

Long-Term Effects of Early Childhood Programs on Cognitive and School Outcomes

W. Steven Barnett

Abstract

The extent to which early childhood programs produce long-term benefits in children's cognitive development, socialization, and school success is a matter of some controversy. This article reviews 36 studies of both model demonstration projects and large-scale public programs to examine the long-term effects of these programs on children from low-income families. The review carefully considers issues related to research design. It includes studies of preschool education, Head Start, child care, and home visiting programs, and focuses primarily on the effects of program participation on children's cognitive development. Results indicate that early childhood programs can produce large short-term benefits for children on intelligence quotient (IQ) and sizable long-term effects on school achievement, grade retention, placement in special education, and social adjustment. Not all programs produce these benefits, perhaps because of differences in quality and funding across programs. The article concludes with recommendations for future action.

W. Steven Barnett, Ph.D., is a professor at the Graduate School of Education at Rutgers University.

The contribution of early childhood care and education (ECCE) to the healthy development and future well-being of children who are economically and socially disadvantaged has become a vital public issue with important implications for families, business, private philanthropy, and government. It will be shown through a detailed, critical review of research that public investments in quality early childhood care and education can produce important long-term improvements in the intellectual and social development of disadvantaged children. Unfortunately, because the United States underinvests in both the quantity and quality of early care and education, the nation forgoes many of the potential benefits at an annual cost estimated in billions of dollars.

The above conclusions could easily come as a surprise to those who are familiar with the debates that have swirled around child care and other

ECCE programs such as state-sponsored preschool education and the federal Head Start program in the past several years. There is widespread agreement that ECCE programs can produce short-term gains in disadvantaged children's performance on standardized tests of intelligence and academic ability and that some preschool programs have reduced later grade retention and special education placement. However, there has been considerable disagreement about how these gains are produced, what they mean, whether they persist, and what other long-term consequences might be expected.¹⁻⁴

The disagreements regarding long-term effects are so extreme that it is impossible to make public policy recommendations without resolving some of them. The key questions to be addressed for ECCE policy are as follows:

1. What are the effects of ECCE programs on the cognitive development, socialization, and school success of disadvantaged children? How long do they persist?

2. Are some types of ECCE programs more successful than others (for example, home visits versus center-based programs; model interventions versus large-scale programs such as Head Start or traditional child care; programs that start at birth versus those that begin at age three or four years)? Do some children benefit more than others?

3. To what extent can the effects of model programs be generalized to existing public and private programs?

These policy questions are addressed by conducting a critical review of research on the effects of ECCE on disadvantaged children with an emphasis on cognitive development. This review focuses on long-term effects because they are the subject of greatest disagreement, and it includes a variety of ECCE programs—child care, early intervention, preschool education, and Head Start. The article concludes with recommendations for future action.

Research on Immediate and Short-Term Program Effects

Hundreds of studies have examined the immediate and short-term (that is, within a year or two after children exit a program) effects of ECCE programs of various types. These studies are found in two largely separate streams of research, one on the effects of ordinary child care on children from all backgrounds and the other on the effects of ECCE programs specially designed to improve the cognitive development of economically and otherwise disadvantaged children.

Initially, research on child care focused on potential negative effects on the mother-child relationship and the child's socializa-

tion, with less attention to cognitive development. More recently, child care research has begun to examine the effects of variations in both the quality of nonparental care and the child's home environment and family circumstances. Research on programs that served disadvantaged children first emphasized their effects on cognitive development, particularly IQ, but has since expanded to examine the effects of such interventions on other aspects of cognitive development and on socialization.

Short-Term Effects of Child Care

The child care research literature presents no consistent evidence that child care per se is harmful to child development, regardless of the age at which a child begins out-of-home care.⁵⁻⁶ It does, however, indicate that variations in the quality of child care are

important determinants of the impact of child care. Higher quality child care is associated with better cognitive and social development both while children are in child care and during their first few years of school.⁵⁻⁸ (See also the article by Frede in this journal issue for a discussion of the components of quality care.)

A recent investigation found that age at entry to or years of experience in child care during the preschool years influenced the reading and math achievement of children at ages five and six, but differently for children from high- and low-income homes.⁹ For children from impoverished homes, earlier entry and/or more years in care produced a larger effect on reading scores than fewer years. Conversely, effects were negative for children in the highest-income families. The key may be differences in the quality of the children's home environments rather than income per se: children whose home environments were very highly supportive of cognitive development and socialization actually had *lower* scores if they had been in care outside their homes, while children whose home environments were relatively poor gained the most from outside care.

Short-Term Effects of Model Interventions

Several reviews of the intervention research literature have been written over the past decade.¹⁰⁻¹² The authors of those reviews conclude that programs designed for disadvantaged children, including those that are routinely provided on a large scale, can produce immediate boosts in IQ equivalent to about eight IQ points. This is a meaningful improvement in cognitive ability and can have important implications for children in terms of academic performance and placements in special education classes.

Effects of similar magnitude were found on preschool and kindergarten achievement measures. Changes of somewhat smaller magnitude were found for socio-emotional outcomes such as self-esteem, academic motivation, and social behavior immediately after the end of the intervention. On average, these effects declined over time and were negligible several years after children exited the programs. However, some programs produced sizable gains that persisted at least into the first few years of

school for IQ, achievement, and school outcomes such as grade retention and special education placement.

A variety of ECCE intervention approaches (for example, one-to-one tutoring, half-day preschool education, and child care)—some emphasizing direct instruction and others emphasizing child-initiated activities—for disadvantaged children seem to have worked equally well. However, the magnitude of the effects appears to be at least roughly related to the intensity, breadth, and amount of involvement with the children and their families.¹⁰ One specific type of intervention, home visiting (alone or in combination with a center-based program), may be relatively ineffective in directly improving children's development, although it may be more successful in improving maternal and child health, providing social support, or reducing child abuse and neglect.¹³⁻¹⁴

Since most of those reviews were written, four significant research projects have been undertaken to investigate the effects of ECCE for disadvantaged children: Project CARE, the Infant Health and Development Program (IHDP), Even Start, and the Comprehensive Child Development Program (CCDP).¹⁴⁻¹⁵ The programs are all still too new to have generated any long-term results, but their short-term results are fairly consistent with

Programs designed for disadvantaged children can produce immediate boosts in IQ equivalent to about eight IQ points.

those of earlier studies. Project CARE and IHDP, which involved high-quality center-based care, produced substantial immediate increases in IQ and some benefits in child language skills and child behavior. Even Start and CCDP, which offered weaker early childhood services for children but added parenting education or job skills training services for parents, had smaller benefits on child development but positive effects on outcomes such as parental expectations for children's academic success and enhanced utilization of other community social, health, and education services. (For additional

information about these programs, see the articles by Yoshikawa and St. Pierre and colleagues in this journal issue.)

Results of the two research literatures appear to be converging: ECCE has important impacts on cognitive development and socialization of disadvantaged children immediately and in the short term. Effects depend on program quality, and cross-study comparisons indicate that effects are larger for well-designed, intensive ECCE interventions than for ordinary child care. From some studies, it appears that the effects of ECCE programs decline over time once children leave ECCE.

Research on Long-Term Program Effects

The children in many of the studies included in the preceding summary of short-term effects of ECCE have been followed over several years to generate information about the long-term effects of ECCE. This article reviews 36 such studies, identified through computerized and manual searches of the research literature, which meet four criteria: (1) the ECCE program studied began at age four or earlier (thereby excluding stud-

The model ECCE programs were probably of higher quality than the large-scale public programs.

ies of kindergarten programs); (2) the target population for the ECCE program studied was children who were economically disadvantaged; (3) at least one aspect of cognitive development, school progress, or socialization was measured after age eight (third grade or later); and (4) the research design employed a no-treatment comparison group that was reasonably similar to the group of children who participated in the intervention.

The 36 studies were divided into two categories for review based on the nature of the ECCE program and the research design. In 15 studies,^{16–30} researchers developed their own ECCE programs to study the effects of exemplary, or model, programs. In 21 studies,^{31–51} researchers investigated the effects of

ongoing, large-scale public ECCE programs. Five large-scale studies examined state or local programs (including some supported with federal Title 1 funding),^{31–35} five studied children who had attended Head Start and state or local programs,^{36–40} and eleven examined Head Start programs.^{41–51}

Model Programs

The 15 studies of model programs are identified and described in Table 1. Generally, these model ECCE programs were probably of higher quality than the large-scale public programs. They may have had more highly qualified staff, closer supervision of staff by experts, lower child-staff ratios, and smaller group size. These advantages were made possible by much higher levels of funding per child than are available to typical Head Start and public school programs. (See also the article by Frede in this journal issue.)

Services Offered

The model programs varied considerably in the services offered, their onset and duration, and when the programs operated (1962 to 1980). All but one (Verbal Interaction Project) provided classroom services. Most also offered home visits. Programs offered a range of other activities for parents, and, in three instances, these were extensive enough that they might be called parent support and development programs.^{17,19,21}

Study Participants

In all but one study, most of the participating children were African American. The exception, the Houston Parent Child Development Center, served Hispanic families. All but one program served boys and girls; the Harlem Training Project served only boys. All but two studies did not select participants on the basis of IQ: the Perry Preschool study selected children based on low IQ scores (generally below 85), and the Milwaukee program served children whose mothers had low IQs (below 75).

The average level of mother's education was under 12 years in all studies, and under 10 years in five studies.^{17–19,23,26}

Most of the children in comparison or control groups began formal education at kindergarten, but, especially in the studies conducted in later years when alternative

services were more widely available, a significant percentage of children in comparison groups could have attended preschool or child care programs.

Large-Scale Programs

The 21 studies of large-scale public ECCE programs are identified and described in Table 2.

Services Offered

None of the large-scale programs enrolled children before age three, and most served children part day for one school year at age four. Typically, the studies do not describe the programs so that one must depend on general knowledge about public school preschool and Head Start programs to understand the services offered. The Head Start programs had broader missions than most of the other programs; their goals included improving health and nutrition, and providing services to parents and the community.⁵² However, Head Start programs tend to have larger group sizes, pay teachers much more poorly, and may provide classes only part year.^{53–54} Classrooms tend to serve 15 to 20 children with a teacher and an aide, but there is considerable variation in the quality of educational experiences within these classrooms and in the parent involvement and other services provided.^{53–55}

In three large-scale program studies, children who participated in the ECCE programs also participated in other services. In the Cincinnati Title I study, most full-day kindergarten students had attended preschool and most half-day kindergarten students had not. In both Child Parent Center (CPC) studies, services began in preschool and continued to provide enriched educational experiences through third grade. In the Florida Learning-to-Learn and Head Start study, children received intensive services through first grade.

Study Participants

In all the large-scale studies, children and their families were low income. There is considerable ethnic and geographic diversity across studies. Most children are minorities, from single-parent families, and most parents are less educated, but substantial numbers of white children, two-parent families,

and parents who are high school graduates also participated.

Research Design

The best research studies are those that are so tightly designed that one can conclude with confidence that the results obtained are due only to the intervention. In the ECCE literature, as in most, there is considerable variability in the quality of the research design, especially with respect to four key aspects of research design: (1) the ways in

Most of the large-scale programs served children part day for one school year at age four.

which the comparison groups were formed, (2) initial and follow-up sample sizes, (3) attrition, and (4) who was measured and how to assess effects of the program. Each of these aspects of study quality has important implications for the interpretation of study results. These implications are discussed briefly below, and the methodological concerns associated with each of the studies are listed in Tables 1 and 2.

Formation of Comparison Groups

Generally, the strongest research design involves identifying a pool of potential participants and then randomly assigning some children to an experimental group and some to a control or comparison group. This increases confidence that estimated effects in these studies are due to the program rather than to preexisting differences between program and comparison groups.

If random assignment is not employed, then researchers usually attempt either (1) to construct a comparison group, matched as closely as possible on a number of characteristics thought to be relevant (for example, maternal education, family income level, ethnic or racial background), or (2) to construct a comparison group but then also use statistical techniques to control for initial differences on key characteristics. Unfortunately, in neither technique is it possible to know with certainty that one has matched or controlled for all the key characteristics, and that is why random assignment, which presumably equalizes the groups initially, is

Table 1

Model Early Childhood Programs^a			
Program Name/ Related Endnote Number^b (Years of Operation)	Program Description	Ages of Participation	Research Design/ Methodological Concerns
Carolina Abecedarian ¹⁶ (1972–1985)	Preschoolers: full-day child care Schoolage: parent program	Entry: 6 weeks to 3 months Exit: 5 to 8 years	Randomized.
Houston Parent Child Development Center ¹⁷ (1970–1980)	Home visits Full-day child care Center-based program for parents	Entry: 1 to 3 years Exit: 3 to 5 years	Randomized. High attrition. ^f
Florida Parent Education Project ¹⁸ (1966–1970)	Home visits Twice weekly part-day preschool (ages 2 to 3 years)	Entry: 3 to 24 months Exit: 3 years	Initially randomized with one group, and additional control group members added at 24 months. Not randomized. ^g High attrition. School-administered tests. ^h
Milwaukee Project ¹⁹ (1968–1978)	Full-day child care Job and academic training for mothers	Entry: 3 to 6 months Exit: 5 years	Groups of 3 to 4 children assigned alternately to E and C groups. Small sample. ⁱ
Syracuse Family Development Research Program ²⁰ (1969–1975)	Home visits Full-day child care	Entry: 6 months Exit: 5 years	Matched comparison group selected at 36 months. Not randomized.
Yale Child Welfare Research Program ²¹ (1968–1974)	Home visits Full-day child care Pediatric care Developmental screenings	Entry: Prenatal Exit: 30 months	Two comparison groups for same neighborhoods for first follow-up. Matched comparison group selected for follow-up at 30 months. Not randomized. School-administered tests.
Curriculum Comparison Study ²² (1965–1967)	Part-day preschool program Kindergarten program	Entry: 4 years Exit: 5 or 6 years	Post hoc comparison group from original pool. Not randomized. School-administered tests.

Notes

^a Programs are grouped such that those enrolling children younger than three years old appear first, followed by those enrolling children after age three.

^b See the related endnotes at the end of this article for complete citations of the reports and/or studies in which program methods and outcomes are described.

^c Throughout Table 1, E refers to the experimental or intervention group, and C refers to the control or comparison group.

^d IQs were measured using the WISC or WISC-R, unless otherwise noted.

^e Outcomes listed as E > C or E < C were statistically significant at the p < .05 level, at least (that is, likely to have occurred by chance no more than 5 times in 100). In some instances, the difference between the E and C groups was fairly large but not statistically significant, perhaps because of small sample sizes. Such outcomes are indicated as "E = C, but positive trend."

^f Results may be biased because of high attrition rates.

^g Results may be biased because children were not randomly assigned to experimental and control or comparison groups.

^h Results may be biased because school-administered tests were used to measure achievement.

ⁱ The small initial sample makes it difficult to demonstrate statistically significant effects of the program.

Initial Sample Size ^c	Follow-up Sample Size	Time of Follow-up	IQ ^{d,e}	School Outcomes ^e
E = 57 C = 54	Age 8 E = 48 C = 42 Age 15 E = 48 C = 44	8, 12, and 15 years	Age 12: E > C E = 93.7 C = 88.4 Age 15: E = C E = 95.0 C = 90.3	Achievement tests: E > C at age 15 Special education: E < C at age 15: E = 24%, C = 48% Grade retention: E < C at age 15: E = 39%, C = 59%
E = 97 C = 119	School data E = 50 C = 87 IQ data E = 39 C = 78	Grades 2 to 5	Not measured	Achievement tests: E = C, but positive trend Grades: E = C Bilingual education: E < C E = 16%, C = 36% Special education: E = C in grades 2 to 5 E = 27%, C = 31% Grade retention: E = C in grades 2 to 5 E = 16%, C = 29%
E = 288 C = 109	E = 83 C = 24	Grades 4 to 7	E = C (grades 4 to 7) E = 83.1 C = 79.8	Math achievement: E > C Reading achievement: E = C Special education: E < C, grade 7 E = 23%, C = 54% Grade retention: E = C, grade 7 E = 28%, C = 29%
E = 20 C = 20	E = 17 C = 18	Grade 4 Grade 8	Grade 8: E > C E = 101 C = 91	Achievement tests: E = C, but positive trend Grades: E = C Special education: E = C E = 41%, C = 89% Grade retention: E = C, grade 4 E = 29%, C = 56%
E = 82 C = 72	Parents E = 52 C = 42 Children E = 49 C = 39	Grades 7 to 8	E = C, age 5 on Stanford-Binet	Teacher ratings: E > C, but for girls only Grades: E > C, but for girls only Attendance: E > C, but for girls only
E = 18 C = 18 only	Age 7 to 8 E = 17 C1 = 33 C2 = 31 Age 10 E = 16 C = 16	Age 7 to 8 and age 10	E = C at age 10	Achievement tests: E = C Attendance: E > C Teacher ratings: E = C, but positive trend for boys Special education: E = C, but positive trend for boys only E = 25%, C = 50%
E = 244 C = 68	E = 168 C = 51	Post high school	Not measured	Special education: E = C, grade 12 E = 32%, C = 63% Grade retention: E = C, grade 12 E = 26%, C = 58% High school graduation: E = C

Table 1 (continued)

Model Early Childhood Programs^a			
Program Name/ Related Endnote Number^b (Years of Operation)	Program Description	Ages of Participation	Research Design/ Methodological Concerns
Early Training Project ²³ (1962–1967)	Home visits Summer part-day preschool program	Entry: 4 to 5 years Exit: 6 years	Randomized. School-administered tests.
Experimental Variation of Head Start ²⁴ (1968–1969)	Preschool program	Entry: 4 years Exit: 5 years	Post hoc comparison group from same communities. Not randomized. High attrition. School-administered tests.
Harlem Training Project ²⁵ (1966–1967)	One-to-one tutoring or child-directed play	Entry: 2 to 3 years Exit: 4 years	Comparison group recruited from children born 1 to 2 months later. Not randomized. School- administered tests.
High/Scope Perry Preschool Project ²⁶ (1962–1967)	Home visits Preschool program	Entry: 3 to 4 years Exit: 5 years	Randomized.
Howard University Project ²⁷ (1964–1966)	Preschool program	Entry: 3 years Exit: 5 years	Comparison group from neighboring tracts. Not randomized.
Institute for Developmental Studies ²⁸ (1963–1967)	Home visits Part-day preschool program Parent center school (K-3)	Entry: 4 years Exit: 9 years	Randomized. High attrition. School- administered tests.
Philadelphia Project ²⁹ (1963–1964)	Home visits Part-day preschool program	Entry: 4 years Exit: 5 years	Matched comparison group from same kindergarten classes. Not randomized. School- administered tests.
Verbal Interaction Project ³⁰ (1967–1972)	Home visits	Entry: 2 to 3 years Exit: 4 years	Six groups with three matched comparison groups. Not randomized.

Notes

^a Programs are grouped such that those enrolling children younger than three years old appear first, followed by those enrolling children after age three.

^b See the related endnotes at the end of this article for complete citations of the reports and/or studies in which program methods and outcomes are described.

^c Throughout Table 1, E refers to the experimental or intervention group, and C refers to the control or comparison group.

^d IQs were measured using the WISC or WISC-R, unless otherwise noted.

^e Outcomes listed as E > C or E < C were statistically significant at the p < .05 level, at least (that is, likely to have occurred by chance no more than 5 times in 100).

In some instances, the difference between the E and C groups was fairly large but not statistically significant, perhaps because of small sample sizes. Such outcomes are indicated as "E = C, but positive trend."

Initial Sample Size ^c	Follow-up Sample Size	Time of Follow-up	IQ ^{d,e}	School Outcomes ^e
E = 44 C = 21	E = 36 C = 16	Post high school	E = C at age 17 E = 78.7 C = 76.4	Achievement tests: E = C Special education: E < C, grade 12 E = 5%, C = 29% Grade retention: E = C E = 58%, C = 61% High school graduation: E = C E = 68%, C = 52%
E = 116 C = 24	E = 102 C = 19	Post high school	E > C at age 13 E = 85.0 C = 91.0	Achievement tests: E = C, but positive trend Special Education: E = C, grade 7 E = 13%, C = 15% Grade retention: E = C, grade 7 E = 10%, C = 16%
E = 244 C = 68	E = 168 C = 51	Grade 7	E = C at age 12 E = 92.1 C = 88.9	Math achievement: E > C Reading achievement: E < C Grade retention: E < C, grade 7 E = 30%, C = 52%
E = 58 C = 65	E = 58 C = 65	Post high school	E = C at age 14 E = 81.0 C = 81.0	Achievement tests: E > C Grades: E > C Special education: E = C, grade 12 E = 37%, C = 50% Grade retention: E = C, grade 12 E = 15%, C = 20% High school graduation: E > C E = 67%, C = 49%
E = 38 C = 69	E = 30 C = 69	Grade 4	Not measured	Grade retention: E = C E = 33%, C = 47%
E = 312 C = 191	E = 63 C = 34	Grade 7	Not measured	Special education: E = C E = 0%, C = 13% Grade retention: E = C E = 23%, C = 43%
E = 60 C = 53	E = 44 C = 37	Post high school	E > C at age 10 on Stanford-Binet E = 98.4 C = 91.7	Achievement tests: E = C, but positive trend Special education: E = C, grade 12 E = 5%, C = 6% Grade retention: E = C, grade 12 E = 38%, C = 53%
E = 111 C = 51	E = 79 C = 49	Grade 3	E > C at grade 3 E = 101.9 C = 93.6	Achievement tests: E > C Special education: E > C, grade 7 E = 14%, C = 39% Grade retention: E = C, grade 7 E = 13%, C = 52%

usually thought to be the most rigorous methodological approach.

Of the 36 studies included in this review, 7 of the 15 model program studies formed comparison groups by random assignment.⁵⁶ None of the 21 large-scale public program studies used random assignment.

Sample Size

Researchers commonly use statistical tests of differences between groups to estimate the likelihood that findings are due to the intervention rather than to chance. These tests can help determine whether the same effects could be reproduced for the whole target population. A general principle behind all of these tests is that it is much harder to demonstrate a “statistically significant” difference between groups (usually defined as a result that would occur by chance no more than 5 times out of 100) when there are only a few participants than when there are many.

Among the evaluations of model programs included in this review, two experimental studies (Milwaukee and the Early Training Project) began with extremely small sample sizes which provided these studies with very little statistical power to

original target population. If treatment and comparison groups lose comparability, the benefits of random assignment are lost, and the results of a comparison can be totally misleading.

Among the model programs in this review, four had attrition rates so high that initial random assignment could have been invalidated.^{17,18,23,28} Among the large-scale public programs, attrition appears to have been a substantial problem for at least six programs.^{33,37,43–46}

Measurement Issues

Researchers must make sure that the tests they use to measure outcomes are administered accurately and fairly to all participants in the study. In many studies of early childhood programs, especially studies of large-scale programs, standardized tests routinely administered by schools often served as the source of achievement test data for follow-up. Although this strategy provided data at low cost, it had several unfortunate consequences, including (1) less uniformity of test administration and (2) lost data because schools used different tests from year to year, and not all children—especially those who were retained in grade or in special education programs—were tested.

Studies that relied on school-administered tests would, at best, have less reliable test scores and smaller sample sizes. At worst, they would systematically have lost more poorly performing students from each year as the cumulative percentage of children retained in grade and placed in special education increased. Even when studies administered their own achievement tests, other research design flaws sometimes produced a similar distortion of achievement comparisons over time.^{43,51} The effect on these studies would be to gradually “erase” any differences between program and comparison groups with achievement test data as grade level increased.

Among the studies reviewed, measurement problems affect all of the large-scale program studies^{31–51} and at least four model program studies.^{18,21,28,30} It is important to note that measurement problems do not affect the other findings reported in those studies, such as effects

None of the 36 studies reviewed is perfect; however, it is important to look at the overall picture.

detect even fairly large effects. The large-scale studies, just because more children are involved, are at an advantage in having greater statistical power to detect effects of the services offered.

Attrition

Attrition (loss of study participants over time) can be a serious problem for any study. First, because attrition means that fewer participants remain, it reduces a study’s statistical power to detect effects. Second, it reduces confidence that (a) the final sample is comparable to the initial sample and (b) the final program and comparison groups are comparable to each other. If the final sample differs substantially from the original, the results might not generalize to the



© Jeffrey Sylvester/FPG International

on grade retention and special education placement.

In sum, none of the 36 studies reviewed in this article is perfect. However, while it is important to acknowledge their weaknesses and, perhaps, weigh studies of varying quality differently, it is also important to look at the overall picture. Each of these studies is a valuable addition to the literature and should be reviewed with an eye toward what it adds to our overall understanding of the effects of ECCE programs.

Long-Term Study Findings

This section discusses the long-term effects on cognitive development, school success, and socialization reported by each study. The results of each study's longest follow-up are reported in Tables 1 and 2 (for model program and large-scale program studies, respectively) for outcome measures that are easily compared across studies—IQ, achievement, grade retention, special education placement, and high school graduation. After the discussions of each type of outcome, two key issues are discussed across all outcomes: Did effects vary by characteristics of the children served (for example, by age, ethnicity, or gender)? Did effects vary with program characteristics?

Effects on IQ

Although the general public tends to think of intelligence as native cognitive ability

(how smart you are) and of IQ tests as measuring intelligence, there is considerable disagreement among experts about what constitutes intelligence, the extent to which its development is influenced by the environment, and what IQ tests measure.⁵⁷ There are doubts about how completely and accurately IQ tests measure general intellectual ability. Nevertheless, researchers often used IQ scores to gauge the success of programs, and those results are reported in the following section.

Model Programs

All of the model program studies reported IQ gains at some point during or after children's program participation. In most instances, effects were sustained until school entry at age five, at which time 10 studies reported effects between 4 and 11 IQ points,^{16,18,21,28–30,37–40} the Milwaukee study reported a gain of 25 points, and the Syracuse study reported no effect. Three studies did not measure IQ at school entry.^{17,22,27}

IQ effects persisted the longest (into adolescence) in the two experimental studies that enrolled infants in full-day educational child care programs (Milwaukee and Abecedarian). Although two other studies that enrolled infants did not find persistent IQ effects, both were quasi-experimental^{20,21} and one ceased serving children before age three.²¹

Table 2

Large-Scale Public Early Childhood Programs ^a			
Program Name ^b (Years of Operation)	Ages of Participation	Design	Initial Sample Size ^c
Child-Parent Center ³¹ (1965–1977)	Entry: 3 or 4 years Exit: 9 years	Compared former CPC children with non-CPC children from same feeder schools.	E = 684 C = 304
Child-Parent Center II ³² (1983–1985)	Entry: 3 or 4 years Exit: 9 years	Compared former CPC children with several other groups.	Unknown
Cincinnati Title I Preschool ³³ (1969–1970; 1970–1971)	Entry: 4 or 5 years Exit: 6 years	Compared children who attended full-day kindergarten and mostly had preschool with children who attended half-day kindergarten and mostly had no preschool.	E = 688 C = 524
Maryland Extended Elementary Pre-K ³⁴ (1977–1980)	Entry: 4 years Exit: 5 years	Compared attenders to nonattenders, including only children continuously enrolled in school district (kindergarten to grade 5).	Unknown
New York State Experimental Prekindergarten ³⁵ (1975–1976)	Entry: 3 or 4 years Exit: 5 years	Compared attenders with children in same district on waiting list and with children in other districts with no prekindergarten program.	1,800 ^j
Detroit Head Start and Title I Preschool ³⁶ (1972–1973)	Entry: 4 years Exit: 5 years	Compared children who had attended Head Start or Title I preschool with children who were eligible but did not attend.	Unknown
DC Public Schools and Head Start ³⁷ (1986–1987)	Entry: 4 years Exit: 5 years	Compared children who attended public school preschool or Head Start with children in same kindergartens who had not.	E = 372 C = 89
Florida Learn to Learn and Head Start ³⁸ (1986–1987)	Entry: 4 years Exit: 5 years	Compared children who attended LTL preschool or Head Start at age 4 (E) with children who started school in kindergarten (C).	E = 45 C = 45
Philadelphia School District Get Set and Head Start ³⁹ (1969–1970; 1970–1971)	Entry: 4 years Exit: 5 years	Compared children in enriched K-3 program (follow-through) who had and had not attended preschool.	E = 1,082 C = 1,615

Notes

^a Programs are grouped such that public school program studies are listed first, followed by program studies involving both public school programs and Head Start, and then all Head Start studies.

^b See the related endnotes at the end of this article for complete citations of the reports and/or studies in which program methods and outcomes are described.

^c Throughout Table 2, E refers to the experimental or intervention group, and C refers to the control or comparison group.

^d Outcomes listed as E > C or E < C were statistically significant at the p < .05 level, at least (that is, likely to have occurred by chance no more than 5 times in 100).

In some instances, the difference between the E and C groups was fairly large but not statistically significant, perhaps because of small sample sizes. Such outcomes are indicated as "E = C, but positive trend."

^e Results may be biased because children were not randomly assigned to experimental and control or comparison groups.

^f No pretest was given to assess/control for initial differences between groups.

^g Results may be biased because school-administered tests were used to measure achievement.

^h Results may be biased because of high attrition rates.

ⁱ Design flaws bias the estimated effect of the program on children's achievement toward zero.

^j The numbers of children in experimental and comparison groups were not reported separately.

Follow-up Sample Size	Time of Last Follow-up	School Outcomes ^d	Methodological Concerns
E = 513 C = 244	Post high school	Achievement tests: E > C at grade 2 E = C at grade 8 High school graduation: E > C E = 62%, C = 49%	Not randomized. ^e No pretest. ^f School-administered tests. ^g
E = 757 C = 130	Grade 7	Achievement tests: E > C for grades K to 7 Special education: E < C E = 12%, C = 22% Grade retention: E < C E = 24%, C = 34%	Not randomized. No pretest. School-administered tests.
E = 410 C = 141	Grade 8	Achievement tests: E > C for grades 1, 5, and 8 Special education: E = C, grade 8 E = 5%, C = 11% Grade retention: E = C, grade 8 E = 9%, C = 12%	Not randomized. No pretest. School-administered tests.
E = 356 C = 306	Grade 8	Achievement tests: E > C for grades 3, 5, and 8 Special education: E < C, grade 8 E = 15%, C = 22% Grade retention: E < C, grade 8 E = 31%, C = 45%	Not randomized. No pretest. High attrition. ^h School-administered tests.
E = 1,348 C = 258	Grade 3	Achievement tests: E > C in kindergarten E = C in grade 1 Special education: E = C E = 2%, C = 5% Grade retention: E < C E = 16%, C = 21%	Not randomized. High attrition.
Unknown	Grade 4	Achievement tests: E > C in grade 4	Not randomized. No pretest. School-administered tests. Bias toward no effect. ⁱ
E varies C varies	Grades 4 and 5	Achievement tests: E = C in grades 3 to 5 Special education: E = C, grade 4 E = 10%, C = 9% Grade retention: E = C, grade 4 E = 31%, C = 38%	Not randomized. Bias toward no effect. High attrition.
E = 44 C = 39	Grade 6	Achievement tests: E = C Special education: E = C Grade retention: E = C	Not randomized. No pretest.
E = 688 C = 524	Grades 4 to 8, varies by cohort	Achievement tests: E = C Grade retention: E > C	Not randomized. No pretest. Bias toward no effect. High attrition. School-administered tests.

Table 2 (continued)

Large-Scale Public Early Childhood Programs^a			
Program Name^b (Years of Operation)	Ages of Participation	Design	Initial Sample Size^c
Seattle DISTAR and Head Start ⁴⁰ (1970–1971)	Entry: 4 years Exit: 5 years	Compared children who had attended Head Start and DISTAR with matched children from same school and grades.	E = 92 C = unknown
Cincinnati Head Start ⁴¹ (1968–1969)	Entry: 4 years Exit: 5 years	Compared third graders who had attended Head Start with those who had not.	Unknown
Detroit Head Start ⁴² (1969–1970)	Entry: 4 years Exit: 5 years	Compared children who had attended Head Start with children in Title I elementary programs.	Unknown
ETS Longitudinal Study of Head Start ⁴³ (1969–1970; 1970–1971)	Entry: 4 or 5 years Exit: 5 or 6 years	Compared children who went to Head Start with children who went to other preschools or no preschool.	1,875
Hartford Head Start ⁴⁴ (1965–1966)	Entry: 4 years Exit: 5 years	Compared children who had attended Head Start with those who had not.	293
Kanawha County, West Virginia Head Start ⁴⁵ (1973–1974)	Entry: 4 years Exit 5 years	Compared children who had attended Head Start with low-income children who had not.	Unknown
Montgomery County, Maryland Head Start ⁴⁶ (1970–1971; 1974–1975; 1978–1979)	Entry: 4 years Exit 5 years	Compared children who had attended eight or nine months with those who had attended one month or less.	E = 1,915 C = 619
NBER-NLSCM Head Start ⁴⁷ (1979–1989)	Entry: 3 to 5 years Exit: 5 to 6 years	Compared children who had attended Head Start with those who had not.	Unknown
New Haven Head Start ⁴⁸ (1968–1969)	Entry: 4 years Exit: 5 years	Compared children who attended Head Start with those who had not.	E = 61 C = 48
Pennsylvania Head Start ⁴⁹ (1986–1987)	Entry: 3 to 5 years Exit: 5 to 6 years	Compared children who attended Head Start with children who had applied but had not been admitted.	E = 98 C = unknown
Rome, Georgia, Head Start ⁵⁰ (1966)	Entry: 5 years Exit: 6 years	Compared children who attended Head Start with all children in first grade in disadvantaged schools in 1966.	E = 130 C = 88
Westinghouse National Evaluation of Head Start ⁵¹ (1965–1966)	Entry: 4 or 5 years Exit: 5 or 6 years	Compared children who attended Head Start with those who did not (matched within grade).	Unknown

Notes

^a Programs are grouped such that public school program studies are listed first, followed by program studies involving both public school programs and Head Start, and then all Head Start studies.

^b See the related endnotes at the end of this article for complete citations of the reports and/or studies in which program methods and outcomes are described.

^c Throughout Table 2, E refers to the experimental or intervention group, and C refers to the control or comparison group.

^d Outcomes listed as E > C or E < C were statistically significant at the p < .05 level, at least (that is, likely to have occurred by chance no more than 5 times in 100). In some instances, the difference between the E and C groups was fairly large but not statistically significant, perhaps because of small sample sizes. Such outcomes are indicated as "E = C, but positive trend."

Follow-up Sample Size	Time of Last Follow-up	School Outcomes ^d	Methodological Concerns
E = 44 C = 20	Grades 6 and 8	Achievement tests: E = C, but positive trend, in grades 6 and 8	Not randomized. No pretest. High attrition. School-administered tests.
Unknown	Grade 3	Achievement tests: E = C in grade 3	Not randomized. No pretest. Bias toward no effect.
Unknown	Grade 4	Achievement tests: E > C in grade 4	Not randomized. No pretest. School-administered tests. Bias toward no effect.
852	Grade 3	Achievement tests: E > C in grade 1 E = C in grades 2 and 3	Not randomized. High attrition. Bias toward no effect.
E = 148 C = 50	Grade 6	Achievement tests: E = C in grade 6 Special education: E = C E = 5%, C = 10% Grade retention: E < C E = 10%, C = 22%	Not randomized. No pretest. High attrition. School-administered tests.
Unknown	Grade 3	Achievement tests: E = C in grade 3	Not randomized. No pretest. School-administered tests. Bias toward no effect.
E = 186 C = 112	Grade 11	Achievement tests: E = C, but negative trend in most grades E > C in grade 11	Not randomized. Possibly no pretests. High attrition. School achievement tests.
E = 747 C = 1,810	Grade varies	Achievement tests: E = C Grade retention: E > C, whites only	Not randomized. No pretest.
E = 35 C = 26	Grade 3	Achievement tests: E > C in grade 1 E = C in grade 3 Grade retention: E < C E = 18%, C = 35%	Not randomized. No pretest. High attrition. Bias toward no effect.
E = 54 C = 18	Grade 3	Achievement tests: E = C, but positive trend, in grades 2 and 3	Not randomized. No pretest.
E = 94 C = 60	Post high school	Achievement tests: E > C in grade 5 E = C in grades 6 and above Special education: E < C E = 11%, C = 25% Grade retention: E = C E = 51%, C = 63%	Not randomized. No pretest. School-administered tests.
E = 1,988 C = 1,992	Grades 1 to 3	Achievement tests: E > C in grade 1 E = C in grades 2 and 3	Not randomized. No pretest. Bias toward no effect.

Large-Scale Programs

Only one of the large-scale program studies provided IQ data using tests comparable to those used in the model program studies.⁴⁴ A small number of studies^{35,43,48} provided results on a test of language ability, and another⁵¹ administered a test of cognitive ability. In any event, only one large-scale program study found effects on these various tests of linguistic or cognitive ability after children exited ECCE and entered school.⁴⁷

Effects on Achievement

Achievement tests measure ability and knowledge in the subjects of reading and mathematics. Compared with IQ tests, they are more focused on academic accomplishment and the acquisition of what is taught in school.

Model Programs

Estimated effects on standardized achievement tests varied among the model program studies. Five of 11 studies with achievement test data found statistically significant positive effects beyond third grade.^{16,18,25,26,30} Evidence of effects was strongest among the experimental stud-

The variation in findings with respect to achievement could be the result of (1) the basic design weakness of quasi-experimental studies, (2) exceptionally high attrition rates for achievement test data that both reduced sample size and biased comparisons toward finding no effect,^{33,39,44} or (3) some of the measurement problems described in the section above.^{43,48,51}

Effects on School Progress and Placement

School outcomes were also measured by rates of grade retention, special education, and high school graduation.

Grade Retention and Special Education in Model Programs

Across all studies, the findings were relatively uniform and constitute overwhelming evidence that ECCE can produce sizable improvements in school success. All but one of the model program studies reported grade retention and special education rates, and in all of these the rates are lower for the program group. The one model program study that did not report rates (Syracuse) simply reported that there was no statistically significant difference. The estimated effects for the model programs are not always statistically significant given the small sample sizes; but in most instances, they are large enough to be of practical importance. Despite small sample sizes, statistical significance on one or the other was found in five model program studies,^{16,18,21,23,30} and another, the Perry Preschool study, found significant effects on the rate of placement for mild mental retardation and for number of years of special education.

Grade Retention and Special Education in Large-Scale Programs

Statistically significant effects on grade retention or special education were found in 8 of the 10 large-scale program studies that collected relevant data. The failure to find significant effects in two studies appears to be the result of relatively low rates of retention and special education placement in the community as a whole (Cincinnati Title I) and/or initial differences between the groups (Washington, DC). Both of these circumstances would make it harder to demonstrate a difference between the experimental and comparison groups.³⁷

The findings constitute overwhelming evidence that ECCE can produce sizable improvements in school success.

ies that had used random assignment to form comparison groups. Achievement effects were found through second grade (Milwaukee), fourth grade (Florida), and into junior high school (Abecedarian and Perry). In contrast, only one of the quasi-experimental studies of model programs found long-term effects on achievement.³⁰

Large-Scale Programs

The achievement test results of the large-scale program studies were quite variable. Four found no effects at any time.^{37,41,45,47} Five found initial effects that faded and ceased to be statistically significant by the end of third grade.^{35,39,43,48,51} The others found statistically significant effects in third grade or later, though the patterns of effects over time are variable.

High School Graduation

Three model program studies and two large-scale program studies had sufficiently long follow-ups to assess effects on high school graduation rates.^{22,23,26,31,50} All five estimated that ECCE had a large effect on the graduation rate, though only the three studies with larger sample sizes found the effect to be statistically significant. However, added support is provided by the other studies that find effects on achievement, grade retention, or special education placement—all of which are predictive of high school graduation.^{26,58,59}

Effects on Socialization

Although the primary focus of long-term studies of ECCE has been on cognitive development and school success, socialization (the learning and adoption of socially accepted values and behavior) has received some attention, particularly in the model program studies.

Increased aggression at school entry had been found for three studies in which children began child care as infants,^{20,21,60} but there is no evidence that this aggression persisted. Indeed, two of those studies found that program children had better classroom behavior later,^{20,21} and two other studies reported that children were rated by elementary school teachers as better adjusted socially.^{17,49} Two studies found no significant effects on primary grade teacher ratings of classroom behavior.^{18,26}

Long-term positive effects on socialization were evident not only in teacher ratings, but also in parent ratings in one study²⁰ and in data on delinquency and crime in the only two studies that sought these out.^{20,26} In addition, several model ECCE programs were found to increase pride in school achievement.⁶¹ The Perry Preschool study provides the longest and most intensive follow-up study of effects on socialization.²⁶ It found that ECCE was associated with increased commitment to school, better relationships with friends and neighbors, greater adult economic success, and, for girls, increased marriage and fewer out-of-wedlock births. (For further review of this set of outcomes, especially effects on crime and delinquency, see the article by Yoshikawa in this journal issue.)

Child Characteristics and Effects

One of the most important policy questions is whether ECCE programs appear to have different effects on different groups of children. This sort of question usually can be addressed by examining the results within a study (if the researcher actually compared groups of children) or by examining results across studies that served different groups of children.

In general, there do not appear to be large variations in effects for children from low-income families, though this question has not received much attention. Outside this range, family income becomes relevant; the same effects would not be expected for children from higher-income families whose development is not impacted by poverty.

One possible exception to this general rule is gender. Four experimental studies of model programs (Abecedarian, Houston, Perry, Early Training Project) found larger effects on achievement test scores for low-income girls than boys, though the differences were not necessarily statistically sig-

Four experimental studies of model programs found larger effects on achievement test scores for low-income girls than boys.

nificant. Two of these studies found that graduation rates were higher for girls than for boys (Perry, Early Training Project). Results of the quasi-experimental studies of model programs are less consistent with this picture, and none of the large-scale studies which explicitly tested for gender differences found any.

While it is true that these reported gender differences could be statistical flukes, the findings occur with enough consistency in some of the best quality studies that it is reasonable to conclude that the possibility of gender differences warrants further attention.

Program Characteristics and Effects

Another important policy question is whether particular types of programs or constellations of services appear to be more

effective than others. Again, one can try to answer this question by examining results both within and across studies.

Comparison of Model Programs with Community Child Care

Of the 36 studies in the review, only the Abecedarian study investigated the potential effects of the comparison group's participation in other forms of ECCE.⁶² Comparison group children who had attended community ECCE programs that met federal guidelines for quality⁶³ were found to have higher IQ scores than comparison group children with little or no ECCE experience. The estimated effect at school entry was roughly half the size of the effect of the Abecedarian program.

Head Start and Other Early Childhood Programs

Another issue addressed by some within-study comparisons is the relative effectiveness of Head Start compared with other ECCE programs, usually public school preschool programs. Public school programs might be thought to be more effective because they pay much higher salaries than Head Start and can attract better-

To have any effect at all, schoolage services must be more than add-ons to a preschool program.

qualified staff, but Head Start offers a broader range of services. The studies reviewed here all reported smaller effects for Head Start.^{32,36,38,39} Of course, Head Start children tend to be more disadvantaged; therefore, with one exception, these comparisons could be affected by preexisting differences between the two populations. The exception, a study that randomly assigned children to either a model program which continued through first grade or to Head Start, found that the model program produced a larger effect on long-term achievement.³⁸

Age of Entry into the ECCE Program

A number of the older model program studies were designed to investigate the effects of age of entry and duration of services on child development.^{18,23,25,30} None found sig-

nificant effects from earlier entry (for example, from entry at age two rather than three years).⁶⁴ Unfortunately, these studies tended to have such small sample sizes and such high attrition that only very large effects could have been detected, and the results cannot be considered very conclusive. The Child Parent Center II study³² was the only other study to estimate the long-term effects of variations in age of entry, and it found no advantage for children who entered at age three compared with children who entered at age four.

Effectiveness of Add-on Schoolage Services

Intuitively, it makes sense that, if preschool is good for children, then continuing to provide them with enhanced services during their subsequent school years ought to be even better. Two studies provide information about the effects of such extended elementary programs.

In the Abecedarian study, half of the program and control groups were randomly assigned to a special schoolage program at age five, enabling the researchers to compare the effects of ECCE alone, ECCE plus an enriched schoolage program, the schoolage program alone, and no intervention. The schoolage program was provided for the first three years of elementary school and consisted of biweekly home visits in which teachers provided individualized supplemental activities in partnership with parents and social supports for families. By adolescence the results were clear. Substantial effects on IQ, achievement, and school progress were produced by ECCE alone. The schoolage program was largely ineffective and, as an add-on to ECCE, had no effects on IQ and only mixed effects on school success and achievement.

In contrast, the CPC II study found that enriched elementary school services added substantially to the effects of ECCE, with the size of the effect increasing directly with the number of years of enhanced elementary services. One possible explanation for the difference in results between the Abecedarian and the CPC II studies is that the two research teams studied different programs. While the Abecedarian program was a modest supplement to the children's school experience, the CPC II program

changed the elementary school in marked ways: classes were smaller, additional classroom and support staff were added, and parent involvement was emphasized. An alternative explanation is that the parents who sought out and continued participation in CPC II somehow differed from those who did not (that is, they differed from the control group), and it is those differences rather than the intervention that led to the observed benefits.

In any event, it seems clear that, to have any effect at all, schoolage services must be more than add-ons to a preschool program. These services must actually change the learning environment in some significant ways before they can be expected to produce benefits in addition to those produced by ECCE.

Conclusions

Many studies have investigated the long-term effects of preschool programs on disadvantaged children, but they are far from equal in their capacity to inform public policy. One conservative view of the literature would be that only two studies provide sufficiently valid estimates of the effects of ECCE—the Abecedarian and Perry Preschool studies. The other experiments are impaired by various methodological problems such as small sample size, attrition, and selection bias.

Of course, this is much too narrow a view. The Abecedarian and Perry programs each served African-American children in small cities, so focusing on them limits the conclusions that we can draw to those populations. The other studies can add a great deal to our understanding of ECCE programs in terms of types of programs, populations served, and social and historical context. Thus, information from these other studies may and should be used to supplement the information from the stronger studies, especially if their short-term findings, at least, are consistent with those of existing experiments.

It is from this perspective that the concluding section returns to the policy questions posed at the beginning of this article.

What Are the Effects of ECCE and How Long Do They Persist?

The weight of the evidence establishes that ECCE can produce large effects on IQ dur-

ing the early childhood years and sizable persistent effects on achievement, grade retention, special education, high school graduation, and socialization. In particular, the evidence for effects on grade retention and special education is overwhelming. Evidence is weaker for persistent achievement effects, but this weakness is probably the result of flaws in study design and follow-up procedures. Evidence for effects on high school graduation and delinquency is strong but based on a smaller number of studies.

These effects are large enough and persistent enough to make a meaningful difference in the lives of children from low-income families: for many children, preschool programs can mean the difference between failing and passing, regular or special education, staying out of trouble or becoming involved in crime and delinquency, dropping out or graduating from high school.

Do Effects Vary with the Population Served or Type of Program?

Benefits from ECCE programs appear to be produced via a number of different types of programs and across a number of different groups of children. Indeed, the best predictor of the size of program effects may be the size of the gap between the program and

Preschool programs can mean the difference between failing and passing, regular or special education, or staying out of trouble.

home as learning environments, rather than whether a child is a member of a particular group. Thus, effects might be expected to be largest for the most disadvantaged, though there is no evidence that meaningful effects cease if a child's family moves above the poverty line. Indeed, there is even some suggestion at the other end of the income spectrum that children from very well-off families may suffer from ECCE inferior to that provided by their homes.

The most interesting hint with respect to variations in effects with child characteristics is that long-term effects on educational

achievement and attainment might be greater for girls than for boys. The reason is unclear, but because boys from low-income families fare so poorly in the educational system (twice as many boys as girls are in special education), further research on this topic is warranted. Possibly, teaching methods could be altered in ECCE or in elementary schools to better accommodate the needs of these boys.

With respect to program characteristics, evidence about when programs should begin and how long they should last is mixed. The notion that development is more easily influenced earlier suggests that earlier programs should have larger effects. This notion is confirmed by cross-study comparisons but receives little support from within-study comparisons. One possible explanation for the apparent contradiction is that within-study comparisons have tended to look at very limited age differences such as the effect of beginning at three rather than four years of age. The more important difference may be between beginning in infancy versus beginning later. Also, research on brain development indicates that the same effects on brain development can produce different effects on cognitive and social development depending on the age at which they occur.⁶⁵ Thus, ECCE beginning with infants and continuing to kindergarten may be required to produce persistent effects on IQ and may produce larger effects on academic success and, perhaps, on socialization as well.

Guidance with respect to the effects of enriched elementary school programs is limited and mixed. Despite the intuitive appeal of the idea that fade-out in the benefits of ECCE might occur without prolonged intervention, the empirical support for this view is extremely weak. Fade-out is more apparent than real for all measures except IQ: prolonged effects on achievement, school success, and socialization occur without schoolage intervention. The only direct support for the need for prolonged, schoolage intervention comes from a single quasi-experimental study.³² However, improvements in elementary education for children who attend poor quality schools would be expected to contribute independently to child development including IQ, achievement, and school success and might be a way

to improve long-term educational outcomes for boys.⁶⁶

To What Extent Can Findings Be Generalized to Existing Public and Private Programs?

Research supports the view that large-scale public ECCE programs *can* produce long-term cognitive and academic benefits for disadvantaged children. Comparison of estimated long-term effects between model programs and large-scale programs indicates that the latter tend to have smaller effects, perhaps because model programs provided higher quality services than many of the large-scale public programs. Of course, the extent to which the large-scale public programs that were studied accurately reflect today's large-scale public programs generally is unknown. Nevertheless, there is a risk that today's public programs will not produce the desired benefits because they are lower in quality (larger classes, fewer staff members, less educated staff, poorer supervision) than the model programs.

Cross-study and within-study comparisons suggest that Head Start has been less effective than better-funded public school programs, although these comparisons suffer from methodological problems that reduce confidence in the results. Nevertheless, these findings are consistent with the view that quality matters, a view recently endorsed explicitly by a national panel examining the future of Head Start.⁶⁷

Costs, Benefits, and Financing

It should be evident that ECCE can produce substantial improvements in the cognitive development and educational success of disadvantaged children. The best-known source of support for this view, the Perry Preschool study, does not stand alone, and its effects are not unusually large. Much larger effects might be produced by the Abecedarian program model. From this perspective, the benefit-cost analysis of the Perry Preschool program provides a conservative estimate of the potential returns to public investment in ECCE.⁶⁸ Results of this benefit-cost analysis are presented in Table 3.

As can be seen in Table 3, the present value of benefits (the current value of a future stream of costs of benefits)⁶⁹ of the

Table 3

Present Value of Costs and Benefits per Child in 1990 Dollars Discounted at a Real Rate of 3%			
Cost or Benefit	Recipients of Costs and Benefits		
	Whole Society	Preschool Participants	General Public
Preschool Cost^a	-\$ 12,356	\$ 0	-\$ 12,356
Measured Benefits			
Child Care	738	738	0
K - 12 Education	6,872	0	6,872
Adult Education	283	0	283
College ^b	-868	0	-868
Employment ^c	14,498	10,269	4,229
Crime	49,044	0	49,044
Welfare	219	-2,193	2,412
Benefit Subtotal	\$ 70,876	\$ 8,814	\$ 61,972
Projected Benefits			
Earnings	15,833	11,215	4,618
Crime	21,337	0	21,337
Welfare	46	-460	506
Total Benefits	\$108,002	\$ 19,569	\$ 88,433
Net Present Value	\$ 95,646	\$ 19,569	\$ 76,077

^a Costs and cost increases appear as negative numbers.

^b Some small portion of college costs is likely to have been borne by the participants, but this could not be estimated from the available information.

^c The benefits reported for employment include all costs paid by the employer to hire a participant. Allocation to participants and the general public assume that: (1) the marginal tax rate is 25%, (2) the value of fringe benefits received by the employee equals 10% of salary, and (3) the value of other fringe benefits paid by the employer (for example, the employer's share of Social Security payments) equals 10% of salary.

Perry program greatly exceeded costs for both program participants and the general public. This is true even if all benefits from reductions in delinquency and crime were totally omitted. The national cost of failing to provide at least two years of quality ECCE is extremely high, on the order of \$100,000 for each child born into poverty, or \$400 billion for all poor children under five today.^{68,70} An immediate and substantial increase in public support for ECCE is warranted, therefore, on economic grounds alone. However, the appropriate public policy response is more complex than provid-

ing two years of quality Head Start to every poor child.

Thirty years ago, when fewer than 25% of mothers of children under six were in the work force, a two-year half-day preschool program for poor children might have seemed like an appropriate response. Today, it does not. In 1990, nearly half of the children under age three were cared for by someone other than a parent. (See the article by Hernandez in this journal issue.) For poor children, welfare reform that requires mothers to work outside the home will greatly

increase the numbers in the future. Moreover, whether or not children are poor, the quality of the ECCE services they receive is important for their development. Poor quality ECCE could be detrimental to the development of any child at any age. It is no longer just the benefits of quality ECCE for disadvantaged children that are at stake.

Bringing ECCE services to all children who could benefit from them will not be cheap. Realistically, the cost of serving all poor children under age five years in quality part-day or full-day (depending on need) ECCE programs could be as high as \$25 billion or \$30 billion per year. If to this amount were added sizable subsidies to nonpoor families to encourage them to purchase quality ECCE, the total cost could approach 5% of the federal budget (though the cost could be shared by state government, as

well). However, based on the evidence presented above, these costs would be offset over time by reductions in social problems that cost society far more each year.

A more comprehensive strategy is needed to increase the public and private resources devoted to ECCE. Such a strategy might include a public information campaign to explain the importance of ECCE quality to parents, paid parental leave for parents of children under one year of age, and public funding for accredited ECCE on a sliding scale with full funding of quality care for children in poverty and partial funding for many more children.⁷⁰ Other alternatives are available, but the important point is that the nation needs to move ahead with public support for ECCE. Current policies are penny wise and pound foolish, inexcusably costly in human and financial terms.

1. Consortium for Longitudinal Studies, ed. *As the twig is bent . . . lasting effects of preschool programs*. Hillsdale, NJ: Erlbaum, 1983.
2. Haskins, R. Beyond metaphor: The efficacy of early childhood education. *American Psychologist* (1989) 44:274–82.
3. Locurto, C. Beyond IQ in preschool programs? *Intelligence* (1991) 15:295–312.
4. Seitz, V. Intervention programs for impoverished children: A comparison of educational and family support models. *Annals of Child Development* (1990) 7:73–104.
5. Lamb, M., and Sternberg, K. Do we really know how day care affects children? *Journal of Applied Developmental Psychology* (1990) 11:351–79.
6. Zaslow, M. Variation in child care quality and its implications for children. *Journal of Social Issues* (1991) 47,2:125–39.
7. Helburn, S., and Culkun, M.L. *Cost, quality, and child outcomes in child care centers: Executive summary*. Denver: Economics Department, University of Colorado at Denver, 1995.
8. Phillips, D.A., McCartney, K., and Scarr, S. Child-care quality and children's social development. *Developmental Psychology* (1987) 23:537–43.
9. Caughy, M.O., DiPietro, J., and Strobino, M. Day-care participation as a protective factor in the cognitive development of low-income children. *Child Development* (1994) 65:457–71.
10. Ramey, C.T., Bryant, D.M., and Suarez, T.M. Preschool compensatory education and the modifiability of intelligence: A critical review. In *Current topics in human intelligence*. D. Detterman, ed. Norwood, NJ: Ablex, 1985, pp. 247–96.
11. McKey, R., Condelli, L., Ganson, H., et al. *The impact of Head Start on children, families, and communities*. Final report of the Head Start Evaluation, Synthesis, and Utilization Project. Washington, DC: U.S. Department of Health and Human Services, 1985.
12. White, K., and Casto, G. An integrative review of early intervention efficacy studies with at-risk children: Implications for the handicapped. *Analysis and Intervention in Developmental Disabilities* (1985) 5:7–31.
13. Olds, D., and Kitzman, H. Review of research on home visiting for pregnant women and parents of young children. *The Future of Children* (1993) 3,3:53–92.
14. Wasik, B.H., Ramey, C.T., Bryant, D.M., and Sparling, J.J. A longitudinal study of two early intervention strategies: Project CARE. *Child Development* (1990) 61:1682–96.
15. Infant Health and Development Program. Enhancing the outcomes of low-birth-weight premature infants. *Journal of the American Medical Association* (1990) 263,22:3035–42; St. Pierre, R. and Lopez, M. The comprehensive child development program. Presentation to the National

- Research Council, Board on Children and Families. Washington, DC, December 16, 1994; St. Pierre, R., Swartz, J., Murray, S., et al. *National evaluation of the Even Start family literacy program: Report on effectiveness*. Washington, DC: U.S. Department of Education, Office of Policy and Planning, 1993.
16. Campbell, F.A., and Ramey, C.T. Mid-adolescent outcomes for high risk students: An examination of the continuing effects of early intervention. Paper presented at the biennial meeting of the Society for Research in Child Development. New Orleans, March 26, 1993; Campbell, F.A., and Ramey, C.T. Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development* (1994) 65:684–98; F.A. Campbell: Unpublished analyses of Abecedarian data. F.A. Campbell generously provided to the author unpublished analyses of the Abecedarian data reporting means for academic and school success measures by preschool treatment group and gender.
 17. Andrews, S.R., Blumenthal, J.B., Johnson, D.L., et al. The skills of mothering: A study of parent child development centers. *Monographs of the Society for Research in Child Development*. Serial No. 198 (1982) 46,6; Johnson, D., and Walker, T. A follow-up evaluation of the Houston Parent Child Development Center: School performance. *Journal of Early Intervention* (1991) 15,3:226–36.
 18. Jester, R.E., and Guinagh, B.J. The Gordon Parent Education Infant and Toddler Program. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 103–32.
 19. Garber, H.L. *The Milwaukee Project: Prevention of mental retardation in children at risk*. Washington, DC: American Association on Mental Retardation, 1988.
 20. Lally, J.R., Mangione, P., and Honig, A. The Syracuse University Family Development Program: Long-range impact of an early intervention with low-income children and their families. In *Parent education as early childhood intervention: Emerging directions theory research and practice*. D. Powell, ed. Norwood, NJ: Ablex, 1988.
 21. Seitz, V., Rosenbaum, L.K., and Apfel, N.H. Effects of family support intervention: A ten-year follow-up. *Child Development* (1985) 56:376–91; Seitz, V., and Apfel, N.H. Parent-focused intervention: Diffusion effects on siblings. *Child Development* (1994) 65:677–83.
 22. Miller, L.B., and Bizzell, R.P. The Louisville Experiment: A comparison of four programs. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 171–200; Miller, L.B., and Bizzell, R.P. Long-term effects of four preschool programs: Sixth, seventh, and eighth grades. *Child Development* (1983) 54:725–41; Miller, L.B., and Bizzell, R.P. Long-term effects of four preschool programs: Ninth and tenth grade results. *Child Development* (1984) 55,6:1570–87.
 23. Gray, S.W., Ramsey, B., and Klaus, R. *From 3 to 20: The Early Training Project*. Baltimore, MD: University Park Press, 1982; Gray, S., Ramsey, B., and Klaus, R. The Early Training Project, 1962–1980. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 33–70.
 24. Karnes, M.B., Shwedel, A.M., and Williams, M.B. A comparison of five approaches for educating young children from low-income homes. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 133–70.
 25. Palmer, F. The Harlem Study: Effects by type of training, age of training, and social class. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 201–36.
 26. Weikart, D.P., Bond, J.T., and McNeil, J.T. *The Ypsilanti Perry Preschool Project: Preschool years and longitudinal results through fourth grade*. Ypsilanti, MI: High/Scope Press, 1978; Schweinhart, L.J., Barnes, H.V., Weikart, D.P., et al. Significant benefits: The High/Scope Perry Preschool study through age 27. Monographs of the High/Scope Educational Research Foundation. No. 10. Ypsilanti, MI: High/Scope Educational Research Foundation, 1993; Barnett, W.S., Young, J., and Schweinhart, L.J. How preschool education contributes to cognitive development and school success: An empirical model. Paper presented at the Rutgers Invitational Symposium on Education. New Brunswick, NJ, October 28, 1994.
 27. Herzog, E., Newcomb, C.H., and Cisin, I.H. Double deprivation: The less they have, the less they learn. In *A Report on longitudinal evaluations of preschool programs*. Vol. I. S. Ryan, ed. Washington, DC: U.S. Department of Health, Education, and Welfare, 1974.
 28. Deutsch, M., Deutsch, C.P., Jordan, T.J., and Grallo, R. The IDS Program: An experiment in early and sustained enrichment. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 377–410.

29. Beller, K. The Philadelphia Study: The impact of preschool on intellectual and socio-emotional development. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 133–70.
30. Levenstein, P., O'Hara, J., and Madden, J. The Mother-Child Home Program of the Verbal Interaction Project. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983, pp. 237–63.
31. Fuerst, J.S., and Fuerst, D. Chicago experience with an early childhood program: The special case of the Child Parent Center Program. *Urban Education* (1993) 28:69–96.
32. Reynolds, A.J. *Longer-term effects of the Child Parent Center and Expansion Program*. Paper presented at the annual meeting of the Chicago Association for the Education of Young Children. February 4, 1994; Reynolds, A.J. Effects of a preschool plus follow-on intervention for children at risk. *Developmental Psychology* (1994) 30:787–804; Reynolds, A.J. One year of preschool intervention or two: Does it matter? *Early Childhood Research Quarterly* (1993) 10:1–33.
33. Nieman, R.H., and Gaithright, J.F. *The long-term effects of ESEA Title I preschool and all-day kindergarten: An eight-year follow-up*. Cincinnati, OH: Cincinnati Public Schools, 1981.
34. Eckroade, G.A., Salehi, S., and Carter, J.L. *An analysis of the midterm effects of the extended elementary education prekindergarten program*. Baltimore: Maryland State Department of Education, 1988; Eckroade, G., Salehi, S., and Wode, J. An analysis of the long-term effect of the extended elementary education prekindergarten program. Paper presented at the annual meeting of the American Educational Research Association. Chicago, 1991.
35. State Education Department, University of the State of New York. *Evaluation of the New York State experimental prekindergarten program: Final report*. ERIC Document Reproduction Service No. ED 219 123. Albany, NY: New York State Education Department, 1982.
36. Clark, C.M. Effects of the project Head Start and Title I preschool programs on vocabulary and reading achievement measured at the kindergarten and fourth grade levels. Unpublished doctoral dissertation cited by McKey and colleagues 1985. Wayne State University, 1979.
37. Marcon, R.A. *Early learning and early identification: Final report of the three year longitudinal study*. Washington, DC: District of Columbia Public Schools, 1990; Marcon, R.A. *Early learning and early identification follow-up study: Transition from the early to the later childhood grades 1990–93*. Washington, DC: District of Columbia Public Schools, Center for Systemic Change, 1993.
38. Sprigle, J.E., and Schaefer, L. Longitudinal evaluation of the effects of two compensatory preschool programs on fourth- through sixth-grade students. *Developmental Psychology* (1985) 21,4:702–8.
39. Coppie, C.E., Cline, M.G., and Smith, A.N. *Path to the future: Long-term effects of Head Start in the Philadelphia School District*. Washington, DC: U.S. Department of Health and Human Services, 1987.
40. Evans, E. Longitudinal follow-up assessment of differential preschool experience for low income minority group children. *Journal of Educational Research* (1985) 78,4:197–202.
41. Pinkleton, N.B. A comparison of referred Head Start, non-referred Head Start and non-Head Start groups of primary school children on achievement, language processing, and classroom behavior. Unpublished doctoral dissertation cited by McKey and colleagues 1985. University of Cincinnati, 1976.
42. O'Piela, J.M. *Evaluation of the Detroit Public Schools Head Start program, 1975–1976*, 1976.
43. Shipman, V.C. Disadvantaged children and their first school experiences: ETS-Head Start Longitudinal Study. *Preliminary description of the initial sample prior to school enrollment*. ETS Technical Report Series, PR-70–20. Princeton, NJ: Educational Testing Service, 1970; Shipman, V.C. *Stability and change in family status, situational, and process variables and their relationship to children's cognitive performance*. Princeton, NJ: ETS, 1976; Lee, V.E., Brooks-Gunn, J., Schnur, E., and Liaw, F.R. Are Head Start effects sustained? A longitudinal follow-up comparison of disadvantaged children attending Head Start, no preschool, and other preschool programs. *Child Development* (1990) 61:495–507.
44. Goodstein, H.A. The prediction of elementary school failure among high-risk children. Unpublished paper cited by McKey and colleagues 1985. Connecticut University, 1975.
45. Kanawha County Board of Education. *Kanawha County Head Start evaluation study*. Unpublished report. 1978.
46. Hebbeler, K. An old and a new question on the effects of early education for children from low income families. *Educational Evaluation and Policy Analysis* (1985) 7,3:207–16.

47. Currie, J., and Thomas, D. *Does Head Start make a difference?* Working Paper No. 4406. Boston: National Bureau of Economic Research, 1993.
48. Abelson, W.D. Head Start graduates in school: Studies in New Haven, Connecticut. In *A report on longitudinal evaluations of preschool programs*. Vol. I. S. Ryan, ed. Washington, DC: U.S. Department of Health, Education, and Welfare, 1974, pp. 1–14; Abelson, W.D., Zigler, E., and DeBlasi, C.L. Effects of a four-year follow through program on economically disadvantaged children. *Journal of Educational Psychology* (1974) 66,5:756–71.
49. Reedy, Y.B. A comparison of long range effects of participation in Project Head Start and the impact of three differing delivery models. Unpublished paper for the Graduate Program in School Psychology, Pennsylvania State University.
50. McDonald, M.S., and Monroe, E. *A follow-up study of the 1966 Head Start program, Rome City Schools*. Unpublished paper, 1981.
51. Westinghouse Learning Corporation and Ohio University. *The impact of Head Start: An evaluation of the effects of Head Start on children's cognitive and affective development*. Vols. 1 and 2. Report to the Office of Economic Opportunity. Athens, OH: Westinghouse Learning Corporation and Ohio University, 1969.
52. Zigler, E., and Styfco, S.J. Using policy research and theory to justify and inform Head Start expansion. *Social Policy Report* (1993) 8,2.
53. Slaughter, D.T., Washington, V., Oyemade, U.J., and Lindsey, R.W. Head Start: A backward and forward look. *Social Policy Report* (1988) 3,2:1–19.
54. Willer, B., Hofferth, S.L., Kisker, E.E., et al. *The demand and supply of child care in 1990*. Washington, DC: National Association of the Education of Young Children, 1991.
55. Barnett, W.S., Frede, E.C., Mobasher, H., and Mohr, P. The efficacy of public preschool programs and the relationship of program quality to efficacy. *Educational Evaluation and Policy Analysis* (1987) 10,1:37–49.
56. This includes the High/Scope Perry Preschool Project in which two departures from perfect adherence to random assignment were made to keep siblings in the same group and to shift two children of working mothers from the program to the control group. Neither change had a significant effect on the results (see note No. 26, Schweinhart, Barnes, Weikart, et al., 1993).
57. Sternberg, R., and Detterman, D., eds. *What is intelligence?* Norwood, NJ: Ablex, 1986.
58. Ekstron, R., Goertz, M., and Rock, D.A. *Education and American youth*. Philadelphia: Falmer Press, 1988.
59. Roderick, M. Grade retention and school dropout: Investigating the association. *American Educational Research Journal* (1994) 31,4:729–59.
60. Haskins, R. Public school aggression among children with varying day care experience. *Child Development* (1985) 56:689–703.
61. Royce, J.M., Darlington, R.B., and Murray, H.W. Pooled analyses: Findings across studies. In *As the twig is bent . . . lasting effects of preschool programs*. Consortium for Longitudinal Studies, ed. Hillsdale, NJ: Erlbaum, 1983.
62. Burchinal, M., Lee, M., and Ramey, C. Type of day-care and intellectual development in disadvantaged children. *Child Development* (1989) 60:128–37.
63. The Federal Interagency Day Care Requirements (rescinded in 1980) represented expert opinion about program quality and covered group size, staff-child ratio, and professional qualifications of staff.
64. Lazar, I., Darlington, R., Murray, H., Royce, J., and Snipper, A. Lasting effects of early education: A report from the Consortium for Longitudinal Studies. *Monographs of the Society for Research in Child Development*. Series No. 195 (1982) 47,2–3.
65. Kolb, B. Brain development, plasticity, and behavior. *American Psychologist* (1989) 44,9:1203–12.
66. Husen, T., and Tuijnman, A. The contribution of formal schooling to the increase in intellectual capital. *Educational Researcher* (1991) 20,7:17–25.
67. Advisory Committee on Head Start Quality and Expansion. *Creating a 21st century Head Start*. Final Report of the committee. Washington, DC: U.S. Department of Health and Human Services, 1993. See also the article by Frede in this journal issue.
68. Barnett, W.S. Benefit-cost analysis of preschool education: Findings from a 25-year follow-up. *American Journal of Orthopsychiatry* (1993) 63,4:500–508.

69. Present value is calculated by discounting future costs and benefits by an annual real rate of interest according to the formula $PV = \text{Benefit} / (1+r)^n$ where r is the discount rate (in this case 5%), and n is the number of years into the future.
70. Barnett, W.S. New wine in old bottles: Increasing coherence in early childhood care and education policy. *Early Childhood Research Quarterly* (1993) 8,4:519–58.