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**PK-3 EDUCATION: PROGRAMS AND PRACTICES
THAT WORK IN CHILDREN'S FIRST DECADE**

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Introduction

The growing school readiness movement has brought increased attention to identifying educational programs that are most effective for young children. There is increasing empirical evidence that programs to successfully address children's learning needs must be comprehensive, span multiple years, and target key transition points. Preschool to Third Grade (PK-3) programs attempt to incorporate these principles into a broader framework for promoting school success. Although PK-3 is primarily a vision that success is achieved best by promoting learning during all of early childhood development, until recently, systematic inquiry has been limited. The PK-3 perspective has helped the early childhood field move away from a reliance on relatively brief or one-shot programs toward more systematic and comprehensive models that span most of children's first decade (Reynolds, Wang, & Walberg, 2003). Several recent reviews and policy reports (Bogard & Takanishi, 2005; Foundation for Child Development, 2005; Harvard Education Letter, 2005; Reynolds, 2003) have described the strengths of the PK-3 perspective, the emerging evidence of effectiveness, and a variety of new and established school-based efforts to implement the programs and practices.

In this report, we review the knowledge base on the effectiveness of PK-3 intervention programs and practices for young children making the transition to school. Our coverage includes extended early childhood interventions, preschool programs, full-day kindergarten, reduced class sizes in the early grades, parent involvement, instructional practices, and school transitions (mobility). We also document new findings on PK-3 programs and practices from the Early Childhood Longitudinal Study-Kindergarten Cohort of 1998-99. After summarizing the evidence in each of these areas, we review evidence on the cost effectiveness of PK-3 programs and practices with particular attention to findings from a few extensive longitudinal studies. We conclude with a discussion of the implications and policy recommendations from this evidence.

We distinguish between two major PK-3 strategies. PK-3 programs are planned interventions that begin during any of the five years of a child's life before kindergarten and which continue up to third grade. As extended early childhood interventions, PK-3 programs may include center-based education, instructional supports, family services, and community outreach. The most comprehensive programs include all these elements, and serve children from low-income families or who have special needs.

Alternatively, PK-3 practices are defined as specific elements or components of extended early childhood programs that are hypothesized to be associated with children's outcomes. These elements may include preschool education, full-day kindergarten, reduced class sizes, teaching practices, and parent involvement activities.

Given our emphasis on PK-3 education, we do not provide a detailed review of the evidence on preschool education. For reviews of this evidence, see Ramey and Ramey (1998), Reynolds (2000), and Karoly et al. (2001). We also do not consider evidence on multi-year programs beginning in the elementary grades. See Weissberg and Greenberg (1998) for this evidence.

We first turn to a brief history, rationale, and conceptualization of PK-3 programs and practices.

I. Brief History of PK-3 Programs

PK-3 programs have a relatively long but unheralded history in education. While the federal role dates to 1966, the year after Head Start began, most attention has been directed toward Head Start and related preschool programs. Three federal initiatives are especially significant for understanding PK-3 programs. The first was Project Developmental Continuity. As implied by the name, this initiative by the Office of Child Development began in 1966 and was designed to enhance the transition of preschool children into kindergarten and the primary grades thereby promoting more enduring effects. The project was short-lived and had little evaluation of effectiveness.

In combination with Head Start, Project Follow Through has been the most well known PK-3 program. With funding from the U. S. Office of Education and implemented across the nation from 1968 to 1996, the goal of Follow Through was to do what Head Start did not: provide a continuum of intervention services for low-income children from preschool to third grade. Due to funding cuts and difficulties in coordinating services between Head Start and school-based settings, Follow Through became a social experiment on the effects of alternative instructional methods on school achievement. The more recent National Head Start – Public School Transition Demonstration Project revamped the concept behind Head Start – Follow Through to provide a more continuous intervention experience between preschool and third grade. It was implemented from 1991-1998 in 31 sites.

The third key federal initiative for understanding PK-3 programs was Title I of the Elementary and Secondary Education Act of 1965 (now part of the No Child Left Behind Act). Title I provides block grants to school districts that serve relatively high proportions of children from low-income families. Although PK-3 programs were not specifically called for in the legislation, in 1967 the Chicago Board of Education opened four Title I-funded Child-Parent Center preschool programs. In 1968, continuation services were provided in the centers in kindergarten and then up to third grade, leading to the first cohort of graduates in 1971. The program expanded to other sites until 1975. Based on a philosophy similar to

Head Start, the program was unique in that preschool to third grade services were run by a single school site under the direction of a Head Teacher. Despite changes in funding and reductions in services over the years, the Child-Parent Center program continues to this day as the oldest PK-3 program.

In summary, the elements and basic philosophy of PK-3 programs have existed for decades but have not had the high priority afforded to preschool and kindergarten programs. Current PK-3 initiatives attempt to alter the balance of priorities toward a more comprehensive approach to early childhood development.

II. Rationale for PK-3 Initiatives

Many studies of preschool programs have indicated that, for at least some outcomes, effects fade with the passage of time (Barnett, 1995; Bowman et al., 2001). Although there are many reasons for the dissipation of effects, a key rationale for PK-3 is that the continuation of programs into the primary grades will not only promote more successful transitions but also help prevent the fading effects of preschool intervention. Most developmental theories indicate that personal and environmental support during the transition to formal schooling is important for children's continued success (Entwisle, 1995). This process of change is called an ecological transition. An ecological transition is any change in the role, function, setting, or expectations of a developing person. The transition from preschool to kindergarten and the primary grades necessitates changes in the roles, settings, and expectations of an individual child.

Participation in PK-3 programs and elements may lead to greater and longer-lasting effects than less extensive interventions for several reasons. First, longer periods of implementation may be necessary to promote greater and longer-lasting changes in scholastic and psychosocial outcomes. Early interventions are often comprehensive, and they provide many services to children and parents that require significant coordination. They may be more effective if they have more time to work. An increasingly documented element of successful prevention programs is that they provide comprehensive

services for at least two years. Another factor that reinforces the need for longer-lasting interventions is that children in many urban settings are more at risk today than in the past (Wilson, 1996); hence early interventions must be more extensive than before to be equally effective.

Second, PK-3 programs and elements are designed to encourage more stable and predictable learning environments, both of which are key elements in optimal scholastic and social functioning (Garmezy & Rutter, 1988; Masten & Garmezy, 1985). Participation in extended interventions, for example, may promote higher rates of school and home stability than would otherwise be expected. Certainly, environmental forces continue to operate after preschool and kindergarten. One assumption of early interventions that continue into the primary grades is that the post program learning environment at home and in school can reinforce, limit, or neutralize earlier gains in learning, and thus should not be left to chance.

A third rationale for PK-3 programs and elements is that they occur at a time increasingly viewed as a sensitive if not “critical” period in children’s scholastic development. It is expected that the provision of additional educational and social support services to children and families during this key transition would promote greater success, and would help prevent major learning problems by third grade, a primary marker that presages later academic and social development. Many studies provide empirical validation for the strong link between early school adjustment and educational success during the entire schooling process (Alexander & Entwisle, 1988; Entwisle & Alexander, 1993; Reynolds, 1991; Reynolds et al. 1996).

As a result of these features, PK-3 or extended programs may not only promote children’s learning but help prevent the dissipating effects of earlier intervention (Currie & Thomas, 2000; Lee & Loeb, 1995), a pattern that occurs for many kinds of social programs. Figure 1 shows several paths through which early childhood interventions are hypothesized to affect later social competence, the consensus goal of such programs. The literature indicates that five hypotheses of effects can promote effectiveness, and

they are a major focus of PK-3 programs and practices: (a) cognitive advantage hypothesis (as measured by developed cognitive and scholastic abilities), (b) social adjustment hypothesis (prosocial behavior), (c) family support hypothesis (changes in the family behavior), (d) motivational advantage hypothesis (children's motivation or perceived competence), and the (e) school support hypothesis (classroom and school learning environments). To the extent that PK-3 programs strengthen the factors associated with these intervening mechanisms, long-term success is more likely.

PK-3 program elements can support children's transition to school and continuity during the early years of school, and they are expected to be positively associated with child outcomes. This perspective is consistent with the bioecological model of development (Bronfenbrenner & Morris, 1998), in that learning becomes optimal and sustained as the proximal processes of development, including social interactions and experiences, occur on a regular basis over extended periods of time.

III. Conceptualizing PK-3 Programs

The major assumption of PK-3 programs is that better coordination and integration of educational programs and practices between ages 3 and 9 will enhance learning above and beyond the impact of typically organized school experiences. Zigler, Styfco, and Gilman (1993) described the context underlying PK-3 as follows:

“Do we really want to believe that a year of preschool can ultimately shape the course of human life? To do so is to ignore the many, many factors ranging from the quality of schooling to socialization influences from the family and community...Development is a continuous process and, while it is important to give the child a sound beginning, that does not mean the future is secured” (pp. 21-22).

The core attributes of PK-3 programs as an intervention strategy have become increasingly evident in recent years as empirical knowledge is established (Bogard & Takanishi, 2005; Reynolds, 2003). Four key principles/attributes appear critical and they are noted in Table 1. These are programs and practices that (a) support continuity, (b) enhance capacity for organization of services, (c) promote instructional

practices, and (d) encourage family support services. To the extent that PK-3 programs and practices contribute to the principles, positive impacts on child development are expected. Although the quality of implementation will affect the impact of these principles, PK-3 programs such as the Child-Parent Centers and Head Start-Follow Through have tried to incorporate all four elements within a comprehensive model.

Studies have indicated that the quality and duration of developmentally appropriate early childhood experiences are strongly linked to later school performance and performance in society (Barnett, 1995; Campbell et al., 2002; Reynolds, 2004; Reynolds, Temple, Robertson, & Mann, 2001). While research supports the efficacy of early intervention, the “fade-out” phenomenon has been linked to insufficient school support after early intervention (Currie & Thomas, 2000; Lee & Loeb, 1995).

IV. Review of PK-3 Programs (Extended Early Childhood Programs)

A key rationale for extended early childhood intervention is that elementary schools play an important role in sustaining the benefits of early childhood programs, and a continuation of programs into the primary grades will promote successful transitions. PK-3 interventions are the most comprehensive approaches for strengthening the transitions. Several extended early childhood programs have provided preschool and school-age services to children and families at risk due to economic disadvantage. The four best known of these programs are described below: the Carolina Abecedarian Project, Head Start/Follow Through, the Chicago Child-Parent Center and Expansion Program, and the National Head Start/Public School Early Childhood Transition Demonstration Project. Those programs shed light on the efficacy of continuation interventions. Table 2 provides key characteristics of these programs. Table 3 summarizes findings from the available evaluations. In reporting the findings of these programs, the benefits of both (1) participation in the school-age components of the program and (2) the added value of this participation above and beyond participation in earlier preschool intervention are considered. See Reynolds (2003) for more information regarding those programs.

Carolina Abecedarian Project (ABC)

The Carolina Abecedarian Project began in rural North Carolina in 1972 with the aim of improving development and school performance of low-income children. ABC served children from families that met a certain level of socio-demographic risk of cognitive delays or academic problems. ABC employed an experimental design, with random assignment of families to either a program group or a limited program control group (Campbell & Ramey, 1995). Children in the program group received five years of enriched educational day care from age 4 months to 5 years (prior to kindergarten). A systematic curriculum, including learning activities in the cognitive, language, and social emotional development, was used. This program occurred at a single site for yearly cohorts through 1977, followed by a school-age intervention for three years starting in kindergarten and continuing to second grade (age 8). While the day care program emphasized language and literacy skills with very small child-to-teacher ratios, the school-age intervention followed a family-support model of intervention. The school-age program was designed with the aim of supporting children's academic development through increasing and enhancing parent involvement in the educational process (Campbell & Ramey, 1995). The 3-year school-age program provided families a Home School Resource Teacher who offered learning activities and provide materials for mothers to use at home with their children (Campbell, Helms, Sparling & Ramey, 1998). Teachers serve as a home/school liaison on behalf of the student, and work on community outreach. In addition, the school-age program included a six-week summer transition program prior to kindergarten entry.

Children in both groups received social services and nutritional supplements. After completing the early intervention phase, participants in both groups were randomly assigned to either a new program group or a new control group, forming four types of groups. The new program group received intervention through age 8, and the new control group did not receive further intervention. The original sample was 111 children, 57 randomly assigned to the preschool group, and 54 to the control group. Of

the total of four groups at age 5, 25 children participated in extended early childhood intervention for eight years and 24 children participated during only preschool for five years. Ninety-eight percent of the sample was African American.

Research Findings: Evaluations have consistently showed that the 5-year preschool program produced greater intellectual and academic outcomes than does the 3-year school-age program. Nevertheless, an additional dosage-response effect has been found for children who participate in both preschool and school-age programs. These children have the highest levels of intellectual and scholastic performance at the end of the program at age 8; and the extended intervention group surpassed the performance of the preschool-only group by one-third of a standard deviation (Campbell & Ramey, 1995). At the age 15 follow-up, the extended group surpassed the nonextended group only for reading achievement (Ramey, Campbell, Burchinal, Skinner, Gardner, & Ramey, 2000). Although this trend stayed at the age 21 follow-up, the difference was not significant (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002).

Head Start/Follow Through (FT)

Originated in 1967, Head Start/Follow Through offered Head Start-like services in the public schools in an effort to enhance children's transition between preschool and the early elementary grades for low-income children, thereby strengthening long-term success in school. Although the original plan was to serve 200,000 children in the fall of 1968, due to cutbacks in funding plus the observed incompatibilities between the social-service orientation of Head Start centers and the more regimented educational establishment of public schools, FT never achieved its original goal as a coordinated continuum of early childhood intervention (Kennedy, 1993).

The Head Start/Follow Through (FT) programs tested on the effects of alternative instructional methods on children's educational development in kindergarten to third-grade classrooms. It was implemented as a series of "planned variations" of five instructional models and mixtures including (a)

Parent Education Model, (b) Direct Instruction Model, (c) Behavioral Analysis Model, (d) High/Scope

Cognitively Oriented Curriculum Model, and (e) the Bank Street Model of Developmental-Interaction.

Like Head Start, FT Programs included health and social service components, home visits from paraprofessionals that encouraged parents' participation in their child's education, and participation in school advisory councils. Moreover, most classrooms had teacher aides. FT programs were sponsored by entire schools, and were then implemented at the classroom level. Although 50% or more of the students in a FT classroom were required to be graduates of Head Start, participation was not limited to Head Start graduates. The intervention schools were matched with comparison schools.

Research Findings: A national evaluation showed that substantial modifications in the classroom learning environment in kindergarten and the early primary grades can enhance children's early educational success and social and emotional development, thus improving the transition to school. However, the instructional models were not equally associated with student academic achievement. The Direct Instruction and Behavioral Analysis models were most consistently associated with higher achievement test scores across location and time. As shown in Table 3 studies based on the High Scope, Bank Street, and Direct Instruction models found that Head Start with FT was associated with higher school achievement in the short-term, but these effects were reduced over time (Seitz, Apfel, Rosenbaum, & Zigler, 1983). Although it is difficult to know precisely the added value of FT due to sample limitations, this research does generally indicate that enhancements in the quality of schools in the early grades promote children's educational success with or without earlier intervention.

Chicago Child-Parent Center and Expansion Program (CPC)

The Chicago Child-Parent Center and Expansion Program was developed to promote academic success among low-income children and to encourage parents to become involved in their children's education. The CPC program was established in 1967 through funding from Title I of the landmark Elementary and Secondary Education Act of 1965. This program includes three components: a child-

centered focus on the development of reading/language skills, parental involvement, and comprehensive services (Reynolds, 2000). Figure 2 shows the program components.

This program provides a half-day preschool program for three- and four-year-olds, a half-day or an all-day kindergarten program for five-year olds. The center operates on the nine-month school year calendar. An eight-week summer program is also provided. Parents are required to be involved in the center at least one half-day per week. The comprehensive services include (a) attending to children's nutritional and health needs (i.e., free breakfasts and lunches and health screening), (b) coordinated adult supervision, including a CPC head teacher, parent resource teacher, school-community representative, and a teacher aide for each class, (c) funds for centralized in-service teacher training in child development as well as instructional supplies, and (d) emphasis on reading readiness through reduced class size, reading and writing activities in the learning center, and reinforcement and feedback (Reynolds, et al. 1996).

The expansion program provides parents with a parent resource room, a community representative, and encourages parent involvement. The program was designed to enrich the primary-grade classroom experience. In each grade, class sizes were reduced to a maximum of 25 children and each teacher was provided with a teacher aide. Like the Head Teacher, the Curriculum Parent Resource Teacher provided in-service training to classroom teachers and aides in the expansion classrooms.

Research Findings: Participation in the CPC Program has been found to be significantly associated with higher levels of academic achievement and parent involvement in children's education (Reynolds, 2000). Children participating in the preschool plus follow-on services were found to have higher academic achievement when compared with children receiving only the preschool or follow-on programs (Conrad & Eash, 1983). Children with extended program participation (4 or more years of services) had higher achievement in the eighth grade and better high school graduation rates than children with no intervention (Fuerst & Fuerst, 1993). In addition, CPC participation through second grade was associated with a seven-month advantage in reading and math achievement, lower rates of grade retention,

and lower rates of special education placement (Reynolds, 1994). Students participating through the third grade fared even better, and the benefits persisted up to age 15. Extended program participation was also associated with lower rates of school remedial services (grade retention by age 15 and special education placement by age 18), and with lower rates of delinquency infractions (Reynolds, Temple, Robertson, & Mann, 2002). At the age 24 follow-up, extended program participation was associated with higher rates of high school completion and full-time employment, and lower rates of receiving 1 year or more Medicaid and violent arrest (Reynolds, Temple, Ou, Robertson, Mersky & Topitzes, 2005).

National Head Start/Public School Early Childhood Transition Demonstration Project

In 1991, the U.S. Department of Health and Human Services sponsored the National Head Start/Public School Early Childhood Transition Demonstration Project (HST) in school districts around the country; the HST Project revamped the concept behind Head Start/Follow Through. Approximately 12,000 children and families in 31 sites participated in the demonstration program. The study design involved random assignment of schools to a Transition Demonstration group, which received additional supports and staff funded by this project, or to a comparison group. There were differences across the 31 sites in whether schools or school districts were randomly assigned.

HST was launched to test the value of extending comprehensive, Head Start-like supports through the first four years of elementary school. This program provides a range of Head Start-like family services to assist in the transition from Head Start to public schools, help families with health issues, and improve children's school performance.

A total of 7,515 former Head Start children and families were recruited at 31 sites to participate in the National Study in 1992/93 and 1993/94. Thousands of other children and families, however, participated in the Transition Demonstration Program, since supports and educational enhancements were offered to all children and families in the classrooms.

There were 4 key features of the HST program (Ramey, Ramey, Phillips, Lanzi, Brezausek, Katholi et al., 2000). First, families participating in the HST were encouraged to participate in their children's schooling, and were provided with additional educational resources. Second was educational enhancement, especially to promote use of developmentally appropriate curricula and practices and continuity in children's educational experiences. Third, family social support services were provided to help facilitate positive family-school interactions and to assist in securing and coordinating social services across agencies. Finally, health and nutrition services and activities were provided to ensure the physical and mental health of the entire family.

Most local sites had plans for promoting the inclusion of children with disabilities into regular classrooms, addressing cultural and linguistic diversity and appreciation, and developing individualized transition plans for each child.

Research Findings: To date, evaluations of HST indicated no overall program effect (Ramey, Ramey, & Lanzi, 2004). There was no difference on academic achievement or social development between children in the HST schools and children in the control groups. The lack of effects was attributed to the implementation of the programs. Only about 20% of the sites implemented high quality programs. Moreover, many comparison schools adopted HST program features and were supported through other resources or funding.

Nevertheless, the findings indicate these former Head Start children entered school below other children nationally, but they showed significant gains in reading and math in early elementary school, and their performance quickly improved to close to the national averages by third grade. Furthermore, HST participants demonstrated typical levels of growth in social skills and were rated by their teachers and parents as socially and behaviorally well adjusted to school. The majority of HST children also reported positive experiences at schools (Ramey et al., 2000). Analysis found that participation in the HST was associated with lower rates of mental retardation and emotional disturbance, but perhaps higher rates of

speech or language impairment (Redden, Forness, Ramey, Ramey, Brezaussek & Kavale, 2001).

Collectively, these schools, Head Start Programs, and communities strongly endorsed the value of outreach efforts to families and the need to address young children's needs during their early years of transition to school.

Characteristics of Successful Programs

The evidence described in this section shows that extended early childhood programs can promote more successful transitions to school than preschool interventions alone. Although additional research is needed, several characteristics of successful programs can be identified from this review. First, programs that focus on language-based school readiness skills appear to be more beneficial to children. Second, multiple years of services are associated with successful transition to schools. Third, using schools as the single delivery system for early and extended childhood interventions can strengthen the continuity of services to children and avoid the disjointedness between preschool and school-age programs. Fourth, it is crucial for programs to have an intensive family support component which facilitates parental involvement and commitment to the child's education and promotes parents' personal growth. Finally, it is beneficial to add teacher aides and, reduce class sizes or student-teacher ratios so that children can receive individualized attention and more individual learning opportunities. Programs should be tailored to the needs of children across the entire first decade of life. Nowadays many children are entering schools at a higher risk than students entering 10 years ago, continuous services across the first decade of children's lives provide the optimal level of support for their learning and development and does not presume that intervention at any stage of development (infancy, preschool, school-age) alone can prevent children from future underachievement.

V. Key Features of the CPC Model of PK-3 Education

As the most established PK-3 program and most closely aligned to key PK-3 principles, the CPC program is given further attention in our review. The CPC program (Sullivan, 1971) is a center-based

early intervention that provides comprehensive educational and family-support services to economically disadvantaged children and their parents from preschool to early elementary school. It began in 1967 through funding from Title I of the Elementary and Secondary Education Act of 1965. By the mid 1980s, 25 centers were in operation. In this public-school model spanning 4 decades, each CPC site provides comprehensive services under the direction of the Head Teacher and in collaboration with the elementary school principal. Other primary staff in each center are the parent resource teacher, the school-community representative, bachelor's level classroom teachers, aides, nurses, speech therapists, and school psychologists (see Figure 2). The major rationale of the program is that the foundation for school success is facilitated by the presence of a stable and enriched learning environment during the entire early childhood period (ages 3 to 9) and when parents are active participants in their children's education. Sullivan (1971) described the philosophy of the Child-Parent Centers as strengthening the family-school relationship: "In a success-oriented environment in which young children can see themselves as important, they are 'turned on' for learning...Parents are increasingly aware of the role of the home in preparing children for school" (p. 70).

Five program features are emphasized: early intervention, parent involvement, a structured language/basic skills learning approach, health and social services, and program continuity between the preschool and early school-age years. The program theory is that children's readiness for school entry and beyond can be enriched through systematic language learning activities and opportunities for family support experiences through direct parent involvement in the centers. Classroom teachers in preschool and kindergarten use a mix of teacher-directed and child-initiated instructional approaches, which varied across centers (Graue, Clements, Reynolds, & Niles, 2004). Class sizes in preschool are limited to 17 children taught by 2 staff (teacher and an aide). In kindergarten through third grades, the ratios are 25 to 2. The typical class sizes in first to third grade in Chicago is 35-40 with no aide.

The unique feature of the parent program is the parent resource room, which is physically located in the center adjacent to the classrooms. The full-time parent-resource teacher organizes the parent room in order to implement parent educational activities, initiate interactions among parents, and foster parent-child interactions. With funds for materials, supplies, and speakers, areas of training include consumer education, nutrition, personal development, health and safety, and homemaking arts. Parents may also attend GED classes at the centers. Staff also assess the service needs of parents and children and provide referrals to health, mental health, vocational, and social services.

The main strength of the CPC model is that it provides a unified system of PK-3 education within a public-school framework. Consequently, the key principles of continuity, organization, instruction, and family services are more integrated than in other PK-3 models, such as Head Start/Follow Through and the Abecedarian Project. A major element of both continuity and organization is the close proximity between the preschool/kindergarten and school-age components, either within a block or in a wing of the elementary school. This enables better communication and stronger collaboration among the program components and reduces mobility among children. Program implementation by bachelors' level teachers also helps ensure adequate compensation and professional development opportunities. Stability of the teaching staff is a by-product of these characteristics. Given this public-school structure, wide-scale implementation of the CPC model is possible and does not require a specific funding mechanism.

The CPC preschool model has been successfully replicated in Glendale Elementary School in Madison, Wisconsin (Reynolds & Graue, 2004). Begun in the fall of 2003 and now in its third year, the replication project is a collaboration between the Madison Metropolitan School District, the Waisman Center at the University of Wisconsin-Madison, and the local Head Start program administered by the Dane County Parent Council. The program is funded by Title I and the Waisman Center. Investigators found that the program and its components were implemented well and that children's learning gains during the year paralleled those found in the CPC program in Chicago. This is notable given that the

population served in Madison, Wisconsin is more economically and ethnically diverse than in Chicago's inner-city neighborhoods. Although Glendale Elementary School receives Title I funding, it has relatively low levels of concentrated poverty. Two thirds of the program participants are from low-income families. The racial and ethnic composition is 38% Caucasian, 36% African American, 16% Latino, and 10% Native American, Hmong, and Asian. Findings are suggestive of the generalizability of the model.

The major limitation of the CPC model is that as a school-administered program, successful implementation is dependent in large part on the support of the elementary school principal who supervises the program and the support of the school district administration, which has sole budgetary authority. Like other programs, the CPC program has been under perpetual competition for resources within a school district that has many priorities. Among these have been high school reform, test-based grade promotion/retention, and remedial summer school programs. These and other priorities have drained resources from prevention programs including early education. Consequently, several changes to the CPC model have occurred over the years. In the mid 1970s, funding for the program changed from complete Title I financing for PK-3 to split financing whereby federal Title I was used to fund preschool and kindergarten and state board of education funds (Chapter I) were used for the school-age program. Notably, the state funds allocated to CPC were used at the discretion of the elementary school principal. A second major change to the CPC model was a reduction in health and family services. Beginning in the late 1980s, the positions of school nurse and speech therapist were subsumed by the elementary school, thereby reducing coverage in the program. These changes have adversely affected the continuity and comprehensiveness of services.

VI. Findings on PK-3 Programs and Practices from ECLS-K

We utilize data from the Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K) to provide additional descriptive information about the differing dimensions of PK-3 programs. Unlike the extended early childhood interventions reviewed above, the ECLS-K is a national probability sample of

approximately 22,000 children who began their schooling within the past decade. Given the scope of the study it is possible to consider links between PK-3 program components and children's school success. We first use these data to first explore the prevalence of PK-3 program components for public school children in combination with other sources of national data. Second, we offer a descriptive analysis of how some of these program components are associated with children's academic success. However, we caution that any described associations should not be interpreted as causal effects, but rather as descriptive patterns.

The study sample consists of a nationally representative cohort of children who attended kindergarten in the fall of 1998. Designed and carried out by the U.S. Department of Education, the ECLS-K collected data over children's first four years of school. The study included assessments of children's academic skills, surveys of the children's parents, teachers, and school administrators. Thus the data offer a unique opportunity to explore components of the PK-3 program.

In Table 4, we provide some indication of the experiences in PK-3 programs components among children in the ECLS-K study sample.¹ In doing so we note that although survey data is capable of describing some of the structural dimensions of the PK-3 program, such as preschool attendance or class size, it does not capture many of the important relational and process dimensions of the concept. For example, survey data cannot accurately measure the social dimensions of classroom quality.

Findings from several nationally representative studies suggest that over two-thirds of kindergarten students have experienced some form of early education before they begin their formal schooling (Magnuson & Waldfogel, 2005). In the ECLS-K, preschool attendance in the year before kindergarten, which includes all types of structured childcare and early education programs, is close to 70%. Rates of preschool attendance are, however, about 10% lower for disadvantaged children (defined as having a parent who dropped out of High School or living in poverty), which are also found in other studies (Bainbridge et al., in press).

Turning to participation in full-day kindergarten, we find that slightly more than half of public school children attend a full-day kindergarten program, with disadvantaged children even more likely to do so. These numbers are closely aligned to with other studies of the ECLS-K and other data sources (see Walston & West, 2004, for a review). The higher prevalence of full-day kindergarten among disadvantaged children is expected, as schools often initiate these programs in order to better serve children who are “at risk.” Walston and West (2004) find that full-day kindergarten classes spend similar amounts of time focused on learning basic skills and engaged in learning activities as part-day programs, but that some full-day programs differ by including more advanced skills in their curriculums.

Estimating the prevalence of school mobility is complicated because it requires carefully tracking all students over time across schools and neighborhoods. Because such an undertaking is complicated and costly, the ECLS-K study chose only to follow a portion of children who changed schools during the course of the study. Thus, we know that 82% of children in the ECLS-K attending the same school from kindergarten through third grade is an underestimate of mobility in the U.S. Indeed, a study by the U.S. General Accounting Office (U.S. GAO, 1994) found that in the early 1990s only 59% of children had attended only one school by third grade. An additional quarter of students attended two schools and nearly 17% of students had attended three or more schools by third grade. In addition, the GAO report found that school mobility was considerably higher among disadvantaged children than their more advantaged peers.

Well-prepared, high-quality teachers are an important component of the PK-3 program, although measuring teacher quality in a survey is challenging. In these analyses, we use teacher certification as an indicator of quality. In the ECLS-K study, each year about 8% of public school children are taught by teachers without full certification (including temporary or probationary certification). Additional data from the National Center of Educational Statistics (Lewis et al., 1999) suggests that 7% of elementary grade school teachers do not have full certification. Certification is an important, but likely imprecise

indicator of a teacher's skill working with young children, and consequently other dimensions of teacher preparation may also be important such as the amount and type of early education classes teachers have completed.

Parents' involvement in their children's schooling may take many forms. In the ECLS-K data, according to parents' self-reports of their activities, most parents have been involved in their child's school by the end of the Kindergarten year. In Table 4, we report the frequency of two indicators of parents' involvement during kindergarten – whether they have attended regular parent-teacher conferences and whether they have volunteered in the school. Most parents reported that they attended a parent-teacher conference (79%), whereas fewer reported volunteering in the school (40%). However, rates of involvement were lower among parents of disadvantaged children. We also find that nearly all parents report being involved in at least one of the six ways we consider (96%), and on average parents reported at least three different types of involvement. The levels of involvement reported in the ECLS-K are closely aligned with national estimates of parental involvement from the late 1990s (National Center for Education Statistics, 2001).

Children's exposure to high-quality instruction and learning activities varies widely during the early years of school. Nearly all teachers (96%) report that they engage their students in reading and language arts lessons or projects on a daily basis. Yet, the amount of time per day devoted to this work is far from uniform as data in Table 4 indicates. Time spent on instruction is only one indicator of the quality of the learning environment that children experience, and another central tenet of the PK-3 is the alignment of curricula across the early elementary years so that learning experiences are coherent and build on each other in a logical manner.

Classroom sizes in elementary school have been declining over time. In the ECLS-K, the average class size experienced by public school students in kindergarten, first grade, and third grade was 21 students. These statistics are consistent with other national estimates of average class sizes in elementary schools

(National Center for Education Statistics, 2003). Nevertheless, almost 12% of kindergartners were in classes with more than 25 students and fewer than 20% were in classes with 17 or less students.

Table 4 illustrates that many children experience several dimensions of the PK-3 program. Over 50% of children attend preschool before kindergarten and full-day kindergarten once in school. Over 75% of children have fully certified teachers and have parents that are involved in their school in at least some way. However, though many of these experiences are common, they are not necessarily experienced as a package. Indeed, experiencing any one component of the PK-3 program is largely independent of experiencing other components with two exceptions. More involved parents are more likely to have children attend preschool. Finally, children who participate in full-day kindergarten are likely to have larger classes and spend more time on reading and language activities.

We turn to exploring the patterns of children's achievement and school outcomes in the spring of third grade for children experiencing different components of the PK-3 program. We consider six key elements of the PK-3 program: preschool, full-day kindergarten, school stability from kindergarten through third grade, high levels of reading and language arts instruction, high levels of parental involvement, and teacher certification² Table 5 presents the expected means for the average child (panel 1) and for the average disadvantaged child (panel 2) in our sample adjusting for key family background characteristics.³ Results are presented for several important measures of children's academic achievement: one-on-one assessments of children's math and reading skills, teacher reports of children's math and reading skills, teacher reports of children's approaches to learning (positive orientation toward learning), indicators of whether children have been retained in a grade (not progressed to third grade) and if they are receiving special education services.⁴ The first row of estimates indicate the expected outcomes for a child who did not experience any of the selected PK-3 dimensions.⁵ The second row shows the expected score for a child who experienced three selected PK-3 program components (preschool, full-day kindergarten, and school stability from kindergarten to third grade) but did not

experience other dimensions (high reading instruction, high parental involvement, or only certified teachers). Finally, the third row shows the expected outcomes for a child who experienced all of the PK-3 components.

These descriptive findings illustrate that by third grade, children who do not experience the PK-3 program components are further behind their peers on a number of important indicators of school success: math and reading skill assessments, teacher reports of their skill proficiency and positive approach to learning, as well as grade retention and special education. Children who experience half of the PK-3 components perform better than those who do not, but less well than children who experience all components, demonstrating the importance of the accumulation of multiple components of the PK-3 program. For both teacher reports of skills and skills assessments, the effect sizes are between .22 and .36 of a standard deviation. Looking at disadvantaged children, we find that effects are just slightly larger with estimates suggesting effects of .30 to .40 of a standard deviation.

Perhaps most striking are the effects of these program components on children's probability of being retained or placed in special education by third grade, two costly forms of remediation for low achieving students. For example, children who do not experience any of the PK-3 components are over three times more likely than other children to have been held back. This pattern of effects is also apparent among disadvantaged children, who experience grade retention at much higher rates than other children. In the case of special education, the differences are more modest, but still important.

While these short-term effects offer the promise that PK-3 programs will boost children's achievement in important ways, we caution that our analytic techniques fall far short from proving causal associations, or describing what would occur should PK-3 interventions be implemented widely. Despite our efforts to account for differences in the backgrounds of children who experience different program components, whether there is any remaining bias in our estimates and if so the direction and magnitude of the bias is uncertain. However, we argue that the accumulation of findings from evaluation studies of

high-quality early education and interventions programs, in combination with evidence from rigorous non-experimental studies, points to the wisdom of PK-3 programs.

VII. Review of Evidence on PK-3 Practices

In this section we review the available evidence on the effects of PK-3 practices that are believed to be important elements of PK-3 programs as conceptualized in Table 1.

Full-day Kindergarten

The kindergarten year marks children's transition into formal schooling. Initially designed in the 1960s and 1970s to ease children's transition into school by providing them with opportunities to meet and socialize with children in group settings during a part-day program (Elicker & Mathur, 1997). Although not mandated, today many children attending kindergarten experience more academically oriented curricula. In particular, some research suggests that high-quality kindergarten classrooms may be particularly beneficial for low-income children, and may at least in part compensate for less enriching home environments. Nearly 55% of children in the U.S. now attend full-day programs up from 25% in the 1980s (Burris, 2000; West, Denten & Reaney, 2001). However, there is wide variation across states and school districts in what constitutes full-day kindergarten (Vecchiotti, 2003). The shift to full-day kindergarten has undoubtedly been driven by several important factors, but most prominent has been the potential that greater exposure to enriching learning opportunities during the transition to formal schooling will improve children's academic performance and promote their academic success.

Children who experience full-day kindergarten programs appear to learn more during the course of the school year than other children. When compared to part-day kindergarten, full-day kindergarten has been linked to better performance on tests of reading, math and science (Cryan et al., 1992; Furso, 1997; Votruba-Drzal, 2005; Walston & West, 2004). However, longitudinal studies that follow children through their first few years of school find that the positive benefits of full-day kindergarten fade overtime, as their counterparts who attended part-day programs catch up. For example, using data from

the Early Childhood Study, both Votruba-Drzal (2005) and Rathburn and West (2004) found that the modest positive effects of full-day kindergarten had faded by the spring of first grade. In considering the magnitude and persistence of effects, it is important to consider how the additional classroom time is being spent. It is not necessarily the case that additional time in the classroom translates into greater exposure to enriching opportunities (Karweit, 1992). Indeed, to fully understand the effects of full-day kindergarten it is also important to know how programs structure children's "extra" time (Elicker & Mathur, 1997).

Class Size

Reductions in class size have become an important goal for many educators and policymakers. Lowering class sizes, particularly in the early elementary school years, in order to improve children's achievement has become a common remedy to low student achievement. Smaller classes are thought to improve classroom environments by increasing the amount of individual attention that students receive and perhaps also improving the overall quality of instruction by, for example, reducing the amount of time teachers must spend on discipline and classroom management (Ehrenberg et al, 2001; NICHD Early Child Care Research Network, 2004).

Much of the impetus for small class sizes have come from well-designed evaluations of two state initiatives – Tennessee's Student-Teacher Achievement Ratio (STAR) experiment and Wisconsin's Student Achievement Guarantee in Education (SAGE) quasi-experiment. Tennessee's experiment randomly assigned children (and teachers) to small classes defined as 13-17 students and larger classes defined as over 23 students. Evaluations of the program find that children who consistently attended small classes from first through third grade, had higher test scores than children who did not. Estimated effects of small classes were large enough to be meaningful, with average effects of .13 for white and .26 for black students at the end of third grade (Finn & Achilles, 1999; also summarized in Ehrenberg et al., 2001). These average effects do not take into account the fact that many students, who were initially

assigned to smaller classes, may have changed classes (and thus experienced larger classes). Subsequent analyses find that students that experienced small classes for all three years had slightly larger effects (Nye, Hedges, & Konstantopoulos, 2001). After the experiment ended in fourth grade all students experienced large classes and the effects of class-size reduction declined. Estimated effects four years after program completion were about .15 of a standard deviation (Finn & Achilles, 1999; also summarized in Ehrenberg et al., 2001).

In Wisconsin, a quasi-experimental evaluation of the SAGE initiative also provides evidence that class size reductions have positive benefits for student's learning. The SAGE program lowered class sizes among schools serving a sizable population of low-income students. Molnar and colleague's (1999) evaluation finds that students in small classes performed better on mathematics and reading tests than other children, with effect sizes ranging from .12 to .35 depending on the grade and outcome being considered (Molnar et al., 1999). As was the case in the STAR study, results from the SAGE evaluation suggest larger effects for black students than for white students.

The findings from experimental studies, which provide some of the best evidence, taken together with a host of non-experimental studies, are a strong basis from which to conclude that smaller classes in the early elementary school years are an important avenue for improving children's school outcomes.

Preschool

Scholars have long hailed the potential for early education programs to improve disadvantaged children's school readiness by providing them with developmentally appropriate and enriching learning opportunities in structured settings. Early education experts argue that high-quality early education programs offer some instruction in academic skills, but also encourage self-directed (or child-centered) learning and foster positive relationships between children and their instructors. By exposing children to high-quality teachers who are able to create positive learning environments, their basic skills improve and they may enter school better prepared to learn.

Rigorous research has confirmed the efficacy of early education for disadvantaged children. Results from several experimental evaluations confirm that high-quality compensatory early education programs have large positive effects on disadvantaged children's cognitive development and academic skills at school entry. Although the effects may fade some over time, these programs have lasting effects on children's school careers (for reviews see Barnett, 1995; Karoly et al., 1998; Brooks-Gunn, 2003; Ramey & Ramey, 2000; Vandell & Wolfe 2000).

However, most children do not attend high-quality programs, but rather attend programs of average quality, such as local preschools or Head Start Centers. A growing body of research indicates that these programs also boost children's academic skills at school entry. Most recently, an experimental evaluation of the Head Start program found that four-year olds who attended Head Start performed better on tests of their literacy skills (but not math) after participating in the program during the school year. The estimated effects varied depending on the test administered, but were typically modest and of the same magnitude of estimated short-term effects of other types of preschool and prekindergarten programs from quasi-experimental or non-experimental studies (NICHD & Duncan, 2003; Gormley & Gayer, 2003; Magnuson et al., 2004)⁶. Despite accumulating evidence of short-term effects of average quality programs, the long-term effects of these programs are not well established, and warrant further research attention (Gilliam & Zigler, 2001). Nevertheless, early education is certainly one of the most effective avenues for improving young children's school achievement and as such should serve as the cornerstone of PK-3 programs.

School Mobility

Non-promotional school changes are common (Rumberger, 2003). One study estimates an annual rate of school mobility at 30% (U.S. General Accounting Office, 1994). Studies routinely find that children who experience school mobility, especially frequent mobility, have poor academic outcomes (Heinlein & Shinn, 2000). Their low levels of achievement are thought to be the result of disruptions in

their learning experiences as curricula vary widely across schools in the sequence and progression of material being taught. School mobility might also disrupt children's social relationships and require that they adjust to new expectations, activities, and patterns of interaction. However, as scholars point out, children change schools for many different reasons and different types of school changes are likely to have different effects on children. For example, moving from a regular public school to a magnet school, which is likely to be of a higher quality, may be beneficial for children's achievement rather than harmful (Temple & Reynolds, 2000).

Estimating the effects of school mobility on children's achievement is challenging, because research finds that children who experience school mobility, particularly frequent mobility, are likely to be doing less well than other children before they change schools. Thus, to fully understand the effects of school mobility per se, studies must take into account these pre-existing differences (Heinlein & Shinn, 2000; Temple & Reynolds, 2000). How large are the effects of school mobility? Considering the achievement of a sample of low-income urban students, one study found that for each school move, a student experienced a reduction in their academic skills of about .08 standard deviations (Temple & Reynolds, 2000). With many students experiencing multiple school changes, the cumulative effects of frequent mobility are likely to be substantial, although additional research with nationally representative data are important to better understand the likely effects of school mobility among a more general population of children. In the only published meta-analysis of school mobility, Mehana and Reynolds (2004) found a moderate negative association between mobility and school achievement test scores. School policies to reduce mobility include, among others, PK-3 programs and parent-teacher conferences for children at elevated risk of mobility. Certainly, a variety of strategies warrant further consideration.

Parental Involvement in School

Parents' involvement in their children's schooling is often noted by educators and parents alike as an important influence on children's academic success. Consequently, many school reform initiatives

emphasize increasing parental involvement through outreach efforts. Parents may become involved in their children's schooling in a variety of ways, for example, by communicating with their children or their children's teachers, assisting their children with homework, providing enriched learning opportunities at home, volunteering in their child's classroom, or becoming involved in school governance. However, the research evidence suggests that not all dimensions of school involvement are equally beneficial for children. A recent synthesis of previous studies finds that two aspects of parental involvement appear to be particularly important for children's school success – parents' high expectations and participation in school (Fan & Chen, 2001; Shumow & Miller, 2001). These two dimensions of parental involvement may be interrelated and work in concert to influence children's school success (Englund et al., 2004).

Precisely estimating the magnitude of parental expectations and parental participation effects is complicated by a variety of methodological issues. A synthesis of non-experimental research indicates that correlations between school outcomes and parental expectations and participation are on the order of .39 and .32 standard deviations respectively (Fan & Chen, 2001). However, it's likely that these correlations overstate the size of causal effects, as it may be that parents expectations and school participation are at least in part determined by their children's previous school performance (Englund et al., 2004; Shumow & Miller, 2001). Unfortunately, few studies are designed to parse out the unique effects of parental involvement. Those that have tested effects with attention to model specification do typically find that parent involvement significantly contributes to school achievement above and beyond family background and child factors. Nevertheless, more research is necessary to better understand the benefits that might accrue from increases in parental participation due to school programming and outreach.

Teacher Quality and Classroom Contexts

Teachers vary in their ability to provide high-quality instruction and to facilitate children's learning. What characteristics do high-quality teachers share? The simple answer is that good teachers

know the material they are teaching and how to effectively convey it to their students. Accumulated research suggests that teachers' intelligence, academic abilities, and mastery of the subjects they teach are linked to students' gains in achievement (Darling-Hammond, Berry & Thoreson, 2001; Darling-Hammond & Youngs, 2002; Goldhaber & Brewer, 2000; Hill, Rowan, & Ball, 2005; Wayne & Youngs, 2003). Evidence also suggests that higher levels of preparation, training, and experience in teaching lead to higher-quality instruction and academic performance (Greenwald, Hedges & Laine, 1996). However, research does not find that merely meeting minimum state certification standards of education, knowledge, and experience or even having an advanced teaching degree consistently distinguishes good teachers from bad teachers (Wayne & Youngs, 2003). This finding has raised questions about what type and amount of training produces effective teachers (Darling-Hammond & Youngs, 2002).

Although most research focuses on overall quality of instruction student's experience, an increasing number of studies point to children's "connectedness" to school and the quality of their relationship with teachers, in particular, as a determinant of their school success. Research has found that young children who get along well with their teachers are more engaged in classroom activities and learn more than their peers (Pianta & Stuhlman, 2004). Thus to understand young children's successful adaptation to school, it may be important to consider the social and interpersonal dimensions of classrooms as well as the academic dimensions (Birch & Ladd, 1997; Hamre & Pianta, 2001).

Finally, the type of instruction that preschool and early elementary school teachers use is also linked to children's early learning. Scholars often distinguish between child-centered and didactic instruction (Stipek et al., 2004). Child-centered instruction emphasizes children's exploration and construction of knowledge in a developmentally appropriate way. With guidance from teachers, children engage in problem solving and inquiry-oriented learning activities, which are often child initiated. In contrast, didactic methods utilize teacher-directed instruction of basic skills, often with a standardized and carefully sequenced series of tasks focused largely on acquiring and practicing academic skills. To date,

research suggests that both approaches may boost academic skills, but that child-centered instruction may be more advantageous than didactic instruction for at least some outcomes (Huffman & Speer, 2000; Marcon, 1999; Schweinhart et al., 1986; Stipek et al., 1998). An integrative approach to instruction may also be beneficial. In a recent study of children in the Child-Parent Centers, Graue, Clements, Reynolds, & Niles (2004) found that children exposed to instruction that blended child-initiated and teacher-directed activities within a comprehensive program model had the highest levels of school readiness and early school achievement.

VIII. Economic Analysis of PK-3 Programs and Practices

Over the last decade, there has been a substantial increase in knowledge about the economic returns of investments in early childhood development programs, including several elements of PK-3 programs reviewed in our report. In this section, we summarize the main findings from available cost benefit analyses. Table 6 shows the economic benefits as a ratio of program costs for many PK-3 programs and practices. With the exception of the CPC extended intervention program, all would be classified as PK-3 practices (rather than programs).

To be cost effective, the economic return of a program or practice should, at a minimum, equal the amount invested – a return of at least one dollar per dollar invested. As shown in Table 6, most programs showed economic returns that exceed costs (for details, see the source report referenced in the table). The highest economic returns were from preschool programs, which ranged from \$4-\$10 per dollar invested. For example, the Perry, Abecedarian, and Child-Parent Center programs showed economic returns of preschool into adulthood through government savings in education, justice system, and health expenditures and in increased economic well-being. The values are those reported in the Cost Benefit Analysis (CBAs) for each program. All values are the average economic return per program participant in 2002 dollars. Of course, the assumptions underlying each CBA are not identical. The CPC results show that an established public-school program can generate substantial returns, which has significant

implications for larger scale implementation. Although the costs of the programs are significantly different from each other, the economic returns of each program far exceeded the initial investment. The total economic benefits per participant, both measured and projected over the life course, ranged from about \$60,000 to \$140,000.

The CPC extended intervention program, a PK-3 intervention, had a return of \$6.11 per dollar invested, primarily through reduced need for school remedial services, lower rates of arrest for violent crime, and increased economic well-being from higher educational attainment. We note that the comparison group used to determine this estimate participated in preschool or school-age intervention alone rather than no intervention. Consequently, the cost and benefits are relative to those of the comparison group.

Reduced class sizes in the early elementary grades, WIC, and the CPC school-age program (a combination of reduced class size, family services, and instructional supports) also have returns that exceed costs.

Not surprisingly, grade retention has the lowest economic return by far. It is negative. To determine the economic costs and benefits of grade retention, we multiplied the difference in adjusted rates of high school completion for youth ever retained or not retained in the Chicago Longitudinal Study (-13.5 percentage points; 36.8% vs. 50.3%, respectively) by the projected difference in life-time earnings per participant between high school completers and noncompleters using estimates by the Census Bureau (the same approach used in the cost-benefit analysis of the CPC program; see Temple & Reynolds, in press). The estimate economic return of grade retention was -\$3.32 for every dollar invested. Notably, estimates of the negative link between grade retention and school completion are smaller than in other studies (see Alexander, Entwistle, & Dauber, 2003; Temple, Reynolds, & Ou, 2003).

In summary, the economic benefits of PK-3 programs and practices exceed costs. The highest and most consistent returns were for preschool programs, with increasing evidence for extended interventions,

and reduced class sizes in the early grades. More economic analysis is needed on other elements of PK-3 programs.

IX. Conclusion and Recommendations

Our review of the available evidence indicates growing empirical support for PK-3 programs and practices. Each of the extended early childhood programs showed evidence of positive effects on children's schooling and development, including the large-scale Head Start Transition Project. The strongest evidence is from the Chicago Child-Parent Centers and indicates that compared to those receiving only preschool and kindergarten services, children participating in the program from preschool to second or third grade had higher levels of achievement and lower rates of remedial education. Economic analysis revealed that for every dollar invested in the extended intervention program the return to society at large is \$6.11 in increased economic benefits and in public savings on remedial education and crime. Compared to other programs, this is a high economic return. Nevertheless, preschool programs, a PK-3 practice or program element, showed the highest economic returns.

Evidence from the Early Childhood Longitudinal Study indicates that a national sample of children who received several of the key PK-3 elements had significantly higher levels of school adjustment and achievement in third grade than children who did not receive these program elements. The largest effects were found for economically disadvantaged children who received the five main elements of the CPC program: preschool at age 3 or 4, full-day kindergarten, school stability, high instructional focus, and certified teachers. Moreover, performance advantages also were found for the full sample of children. Although these findings are based on observational data, it is important to note that a national sample of children exposed to several PK-3 program elements have better school performance in third grade. Several PK-3 practices also have growing empirical support.

We also reviewed available evidence on the effects of PK-3 program elements, including preschool, full-day kindergarten, reduced class sizes, teacher and classroom experiences, parent

involvement, and school mobility/stability. All except full-day kindergarten have consistently demonstrated enduring and sizable links to school achievement. We also find evidence that teacher background and training, the quality of the teacher-child relationship, and a significant focus on child-centered instruction is linked to better school performance. The evidence on effects of preschool participation is stronger than that for the other PK-3 elements. Given this evidence, greater organization of PK-3 programs is warranted and our review shows some examples that could be implemented on both smaller and larger scales. The school-based Child-Parent Centers is a prime example of a comprehensive public-school model that includes many of the key principles of effectiveness. Of course, integration of all PK-3 practices and elements may not be possible or realistic in many contexts. In these cases, our analysis reveals that preschool programs, reduced class sizes in the early grades, and the promotion of parent involvement and school stability could be emphasized separately or in combination for positive effects. To promote consistency in learning environments, for example, preschool at age 3 or 4, followed by a kindergarten program and reduced class sizes in grades 1 to 3, all in the same site. We offer four major recommendations:

Disseminate PK-3 programs and practices based on key principles of effectiveness.

The knowledge base on the impact of PK-3 programs has grown significantly over the past decade. Although evidence of the positive effects of early childhood programs has been available for decades, a critical mass of evidence now exists demonstrating the added value of early childhood programs that extend into the primary grades. This includes recent findings from the Child-Parent Center Program, Head Start/Follow Through, the Abecedarian Project, and the Head Start Transition Demonstration as well as new evidence from the Early Childhood Longitudinal Study. In addition preschool programs promoting positive outcomes, long-term benefits of extended interventions have been found for reading achievement, grade retention, special education, and child maltreatment. Taken together, these benefits lead to positive economic returns. Growing evidence also supports PK-3 practices

such as reduced class sizes in the elementary grades, parent involvement, and school stability as research suggests longer-term positive effects will result from these program elements.

Based on this established knowledge base, key principles supported by accumulated knowledge base include (a) length of services matters, especially if the transition to kindergarten and the primary grades is supported, (b) organizational factors such as reduced class sizes, curriculum coordination across ages, integration of program elements within sites, and the provision of adequate staff resources, and (c) family services can be an important context for developing comprehensive PK-3 systems. The effectiveness of PK-3 programs and practices would be strengthened by incorporating these principles.

Use evidence on cost effectiveness to better prioritize funding of PK-3 programs.

In a time of increasingly limited fiscal resources, greater scrutiny of existing programs and services becomes essential. Cost-benefit analyses based on high-quality evaluations are especially important because they can identify the efficient use of taxpayer dollars. Based on our analysis, high-quality preschool programs have shown to be the most cost-effective, with the highest return on investment, followed by reduced class sizes in the elementary grades for disadvantaged children. Evidence on the impact of full-day kindergarten programs is relatively weak as there is no evidence that positive effects endure beyond a year or two. Although economic studies of school stability and parent involvement have not been conducted, the evidence base strongly suggests that each positively contributes to children's development by themselves and as elements in PK-3 programs. Of course, extended early childhood interventions that are implemented well and that include many of these practices are likely to provide an optimal situation for many children, especially those at risk of school failure. Synergistic effects of PK-3 components such as combined preschool and kindergarten programs have not been well researched.

Educate policy makers and administrators about the advantages of PK-3 programs.

A major barrier to expansion of PK-3 programs and practices has been an absence of compelling research on the effects of different models and approaches and a lack of a detailed conceptualization for how PK-3 programs can promote positive child development outcomes. As described in recommendation 2, the evidence base is now relatively strong about the likely impact of differing investment strategies for supporting young children's development. This evidence, especially that of the long-term effects and cost-effectiveness of PK-3 programs, deserves dissemination on a wider scale to school districts, human services systems, community groups, and state and federal policy makers. This evidence base also strengthens the conceptualization for the impact of PK-3 programs as described in Table 1. As reflected in major developmental theories, young children thrive best in consistent, predictable, and enriched learning environments over extended periods of time. No matter how high the quality, one or two years programs are unlikely to address the learning needs of many vulnerable children. PK-3 programs offer a more realistic and comprehensive conception on how to improve children's school success.

Moreover, increased coordination and integration of the usually fragmented services from preschool to third grade will likely lead to smoother transitions to kindergarten and the primary grades. Increased communication is a byproduct of this coordination. All of the extended programs also had staff whose responsibilities were to implement PK-3 programs and services. Our review indicates that school organizational models such as those followed by Child-Parent Centers and Head Start/Follow Through have significant advantages over case management models like Abecedarian and Head Start Transition programs and appear to lead to more enduring effects on child outcomes. For example, in Abecedarian and Head Start Transition programs, most services were organized by outreach staff without the added structural supports such as reduced class sizes, teacher aides, curriculum models, and instructional supports. These added features were reflected most in the CPC program and to a lesser extent in Head Start/Follow Through.

Develop new funding mechanisms for establishing PK-3 programs.

Expansion of PK-3 programs will require significant investments by governments and school systems. Short of rebalancing existing allocations of early childhood and/or school-age investments in favor of extended interventions programs, new sources of revenue for supporting a broad array of programs are needed. We recommend the following mechanisms for funding to be considered, some of which are provided or have been offered in other states:

- Form a state- or county-level commission on early childhood development that would invest in PK-3 programs. Each agency within the government would annually contribute funds to be invested in effective or promising programs. The investments would be overseen by the commission. Roughly 2 to 3 percent of the total funds could be reserved for research and evaluation. Through funding from tax revenues on tobacco sales, Commissions are administered at the county level and invest in early education and prevention programs.

- Create a public/private endowment for funding evidence based and promising programs. Similar to investment strategies in biotechnology, states would provide base levels of funding for programs, which could then be matched by local communities, schools, and the private sector. Minnesota has developed a public/private endowment plan to fund scholarships to increase children's participation in preschool programs.

- Issue state bonds to finance early childhood initiatives that are likely to provide high returns. Given the increasing evidence on cost-effectiveness, early childhood programs could be a major recipient of this financing. The Child-Parent Center model of PK-3 education would be a good candidate for piloting the use of this revenue source. Each component of the program — preschool, kindergarten, and school-age — could be implemented sequentially leading to full-scale testing. While issuing state bonds for specific early childhood programs is unprecedented, many states currently issue bonds for general revenue outlays.

- Develop a check-off box on state income tax returns for voluntary contributions to program funding in early childhood development, such as preschool or more comprehensive PK-3 programs. Implemented in several states, taxpayers could contribute any dollar amount to programs areas overseen by the commission or a specified government agency. Among the options for contributions could be preschool education or early childhood intervention.

- Redirect a portion of funds from existing expenditures to PK-3 programs. Current categorical funding for many education and human-service programs is heavily weighted toward remediation. Rebalancing allocations even by a small percentage would provide needed funds to implement cost-effective prevention programs. For example, state departments of education and local school districts receive millions of dollars per year in Title I block grants to schools serving low-income students. Nearly 95% of these funds are directed toward remedial education. Less than 5% goes to preschool programs. With the exception of the Child-Parent Center Program, no PK-3 programs of which we are aware have been funded in total by Title I. Joint funding or matching grants between federal and state sources would be one approach to cost sharing that could improve the opportunities for funding.

Endnotes

1. These data are nationally representative of a cohort of approximately 22,000 children who entered Kindergarten in the fall of 1998. However, because of sample attrition, the later waves of data are less likely to be nationally representative. In particular, only half of the children who moved schools were followed. Consequently, limiting our analyses to children for whom we have outcomes measured in third grade, we limit the generalizability of our sample.
2. Preschool in these estimates does not include Head Start participation, as it is likely that our selected set of covariates does not adequately adjust for the very disadvantaged characteristics of Head Start attendees. We do not include experiencing a small class size because of concerns that children that attended small public school classes differed from those who experienced larger classes in ways we were

not able to adjust for with the included covariates. We use median splits to define both high levels of high levels of reading instruction. Teachers' reports of time spent on reading and language work and projects were averaged over the three waves of data (kindergarten, first grade, and third grade). More than an average of 60-90 minutes per day of reading and language activities is considered high instruction.

Having parents who indicated they were involved in their child's school along 3 or more of 6 dimensions (attending a parent-teacher conference, open house, parent advisory group, Parent-Teacher association meeting, participating in a school fundraiser or volunteering at the school) is considered a high level of parent involvement.

3. We arrive at these estimates by regressing the child outcome on the PK-3 program components along with a set of controls for important child and family background characteristics and then predicting an outcome score for the sample varying only the PK-3 program components.

4. The reading assessment tests knowledge of letters and word recognition, beginning and ending sounds, vocabulary, and passage comprehension. The math test evaluated understanding of numbers, geometry, and spatial relations. Teachers' reports of children's reading and math skills are based on ratings of specific knowledge or skills on a scale from 1 (not yet demonstrating skill/knowledge) to 5 (demonstrating skill/knowledge competently and consistently). Teachers were also asked to rate several dimensions of children's classroom behavior, which taken together measure children's "approaches to learning." By measuring children's attentiveness, task persistence, eagerness to learn, learning independence, flexibility and independence, this scale indicates the extent to which children may learn in classroom environments.

5. With many PK-3 components common, only about 2% of children fall into this first category. It is important to note that by estimating regressions and predicting means for the average child in the sample, the means are less likely to be biased by the small sample size of the selected groups.

6. Estimated effects sizes for the 4-year old children ranged from .10 to .34 for all children. See Puma et al., (2005) for additional details on the Head Start Experimental Study.

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Figure 1. Five Hypotheses

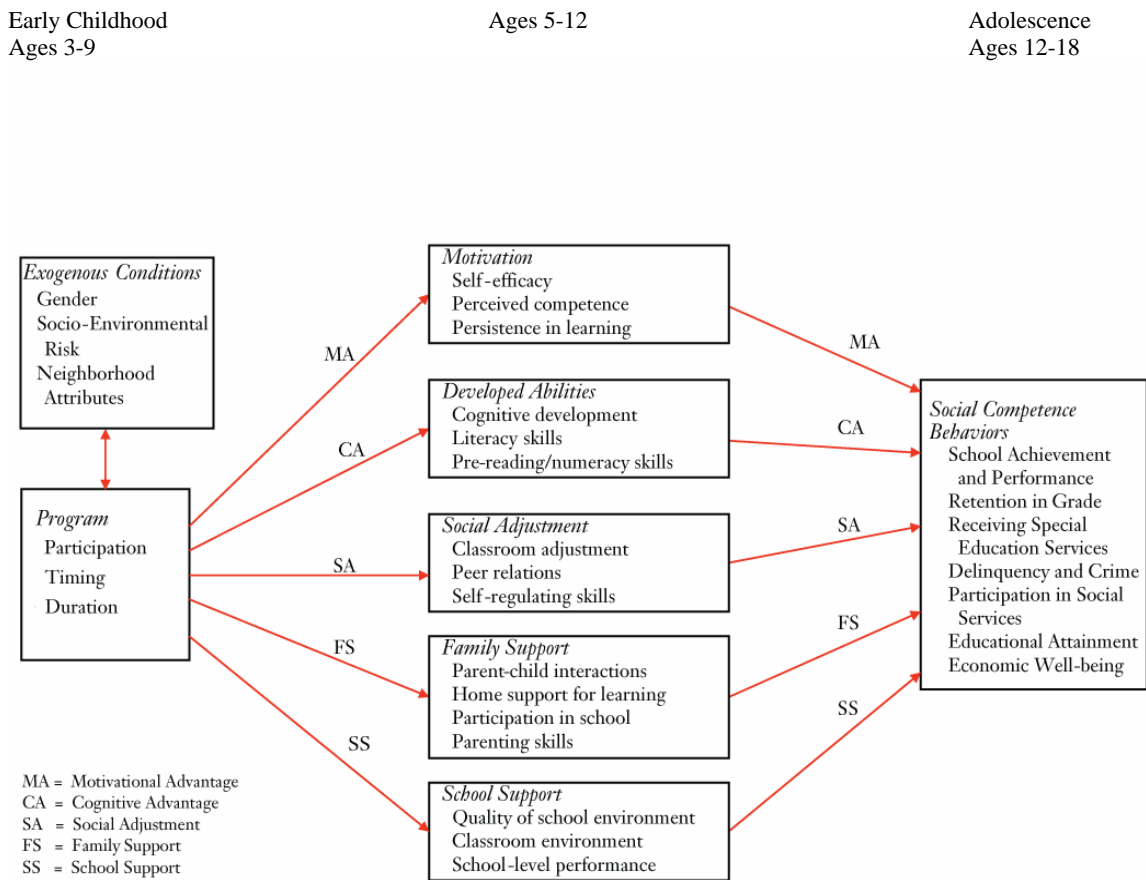


Table 1. Key Principles of PK-3 Programs for Children Ages 3 to 9

- A. Continuity: Consistency and time in learning environments
 - School stability or reducing the negative effects of mobility
 - Increased program length for smooth transitions
 - Peer group consistency
- B. Organization: Structural features to increase intensity, length, and quality
 - Leadership and coordination
 - Integration of program components within a single site
 - Second preschool year and full-day kindergarten
 - Reduced class sizes
 - Low child to staff ratios
 - Additional instructional and support staff
- C. Instruction: Coordination and integration of curriculum & teaching practices
 - School quality
 - Curriculum alignment
 - Setting common goals
 - Increased collaboration among staff
 - Joint staff development
 - Teacher training and professional development
- D. Family Support Services: Comprehensive services to promote smooth transitions
 - Parent involvement in children’s education
 - Resource mobilization

Table 2. Major Characteristics of Four Extended Early Childhood Programs for Low-Income Families

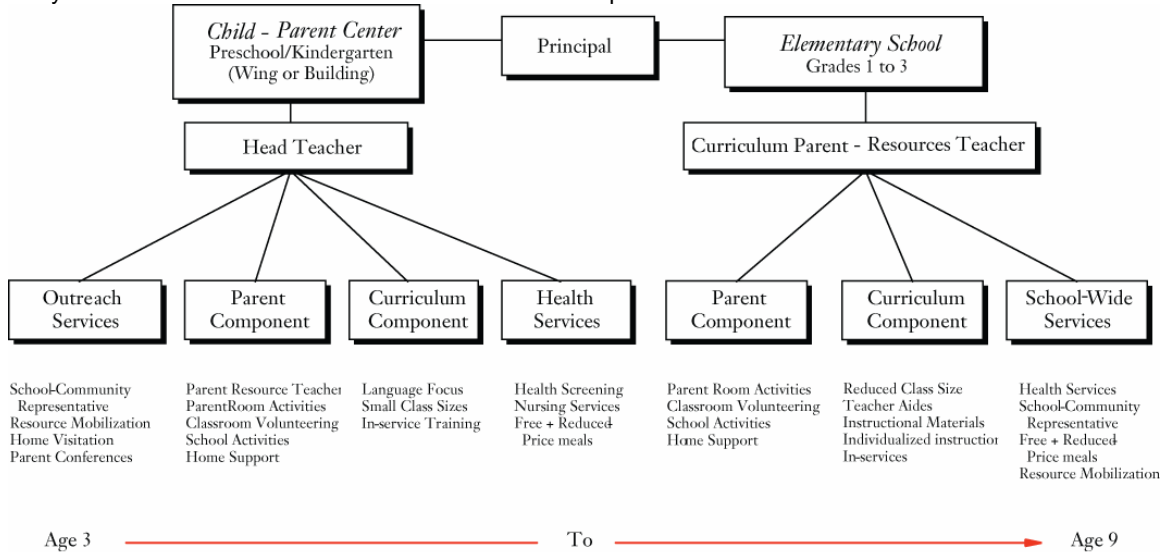
<i>Early Intervention Programs</i>	<i>Age of Entry/Length of Program</i>	<i>Organization</i>	<i>Program Description</i>	<i>Classroom Environment</i>	<i>Parent Component</i>	<i>Other Services</i>
Carolina Abecedarian Project(1972-1985)	6 weeks-5 or 8 years old/ 5 to 8 years	Elementary school Home-school resource teacher	Full-day child care for preschoolers; Parent program for school-age	Limited to activities of home-school teacher	Home visits, school support, outreach	Outreach and referrals
Head Start/Follow Through (1968-1996)	5 years old/ 5 years	Elementary school Program coordinator	Kindergarten to third grade program	Distinct curriculum model Curricular resources Staff in-services	Class volunteers Home visitors Advisory council	Examinations Referrals
Chicago Child-Parent Centers (1967- present)	3 or 4 years old/ 1 to 6 years	One administrative system	Half - day preschool program; Half-day or full-day kindergarten program	Individual instruction in language and math Curricular resources Staff in-services	Parent room at each site Coordinator School and home support activities Advisory council	Services of school community rep Outreach and Referrals
Head Start/Public School Early Childhood Transition Demonstration (1991-1998)	5 years old/ 5 years	Elementary school Family service coordinator	Kindergarten to third grade program	Developmental curricula In-service training and workshops	Parent resources at each site Home visits School involvement Trans gov. board	Nutrition services Family outreach Dental care

Table 3. Selected Effect Sizes on School Competence for Studies of Extended Early Childhood Programs

Program and studies	Program sample and experiences/ Control sample and experiences	Ages of Effects	Effects				
			Reading ¹	Math ¹	Retention	Special Educ.	HS Comp.
<i>Carolina Abecedarian Project</i>							
Campbell & Ramey, 1995	25 in daycare (0 to age 5) + kind -	8	.27	.33	--	--	
Ramey, Campbell, et al., 2000;	grade 2	15	.20	.00	.02	.24	
Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002 (up to age 21)	24 in daycare from birth to age 5 only	21 ²	.23	-.20			.03
<i>Head Start/Follow Through</i>							
Abelson, Zigler, & DeBlasi, 1974/ Seitz et al., 1983 (up to age 14)	35 in Bank Street FT in K-3; 91% had HS	8-9	.00	.51	--	--	
	26 other-school controls; 28% had HS	12-15	.00	.13	--	--	
				>boys			
Becker & Gersten, 1982 (up to age 12)	1,097 in Direct Inst. FT in 1-3 907 in non-FT classrooms in same schools	8-9 12-15	>.50 .19	>.50 .26	--	--	
Schweinhart & Wallgren, 1993 (up to age 9)	281 in High/Scope FT in K-3 528 same-school controls;1% had HS	8-9	.39	.29	--	--	
<i>Chicago Child-Parent Centers</i>							
Fuerst & Fuerst, 1993 (up to age 14)	419 with 4 or more years CPC 503 in feeder-school controls;no CPC	12-15	.33	.20	--	--	--
Reynolds, 1994 (up to age 11)	462 in CPC Pre-K and K plus grades 1-3	8-9	.55	.48	-.13	-.03	--
	207 in CPC Pre- K and K only						
Reynolds & Temple, 1998 (up to age 13)	426 in CPC Pre-K and K plus grades 1-3	8-9 12-13	.48 .43	.35 .28	-- -.15	-- -.06	--
	133 in CPC Pre-K and K only						
Reynoldset al., 2002(up to age 21)	599 in CPC Pre-K and K plus grades 1-3	15-18 21			-.32	-.29	.06 ³
	242 in CPC Pre-K and K only						
Reynolds et al., 2005 (up to age 24)	522 in CPC Pre-K and K plus grades 1-3 510 in CPC Pre-K and K only 336 had no participation	23					.24 ³
<i>Head Start/Public School Early Childhood Transition Demonstration</i>							
Ramey, Ramey et al., (2000)	30 sites across the country 3,411 had Head Start and Transition 3,137 had Head Start only	9	-.10	-.07		.18 any -.13 mental retardation -.12 emotional disturbance	
Redden et al., (2001)	3,221 had Head Start and Transition 2,941 had Head Start only						

Notes: 1. Values for reading and math achievement are proportions of standard deviations. Values for grade retention, special education, and high school completion (HS comp) were derived from probit transformation of proportions. In Abelson et al. study, the effect sizes for the cross-sectional sample were .34 and .51, respectively for third-grade reading and math achievement. In Schweinhart & Wallgren, average effect across grades 1 to 3 was .63.
 2. Effect sizes of the Abecedarian Project were obtained for extended intervention compared to preschool only. The effect sizes for extended intervention compared to no intervention at age 21 were .79 for reading and .42 for math. Effect size for high school completion was preschool compared to no preschool.
 3. Effect sizes of the Chicago Child-Parent Centers from Reynolds et al., (2002) were obtained for extended intervention compared to less extended intervention. Participants who had no participation were excluded. Effect sizes from Reynolds et al., (2005) were obtained through comparing extended intervention (4-6 year) with less than 4 years (0-3 years).
 4. Adapted from Reynolds (2003). The added value of continuing early intervention into the primary grades. In A. J. Reynolds, M. C. Wang, & H. J. Walberg (Eds.), Early childhood programs for a new century. Washington, DC: Child Welfare League of America Press. (pp.173-174).

Figure 2. Child-Parent Center Program



School-Community Representative
Resource Mobilization
Home Visitation
Parent Conferences

Parent Resource Teacher
Parent Room Activities
Classroom Volunteering
School Activities
Home Support

Language Focus
Small Class Sizes
In-service Training

Health Screening
Nursing Services
Free + Reduced Price meals

Parent Room Activities
Classroom Volunteering
School Activities
Home Support

Reduced Class Size
Teacher Aides
Instructional Materials
Individualized instruction
In-services

Health Services
School-Community Representative
Free + Reduced Price meals
Resource Mobilization

Table 4: Participation of ECLS-K Public School Children in PK-3 Program Components

<i>Program Components</i>	<i>All Children</i>	<i>Disadvantaged Children</i>
Preschool	67%	58%
Full-Day Kindergarten	51%	58%
No Mobility Kindergarten through 3 rd Grade	82%	79%
Experience Certified Teachers only K-3	84%	80%
<i>Parental Involvement in Child's School</i>		
Volunteer in School	41%	23%
Attend Parent -Teacher Conference	79%	70%
<i>Daily Time for Reading and Language Arts Instruction in Kindergarten</i>		
0-30 Minutes	9%	8%
31- 60 Minutes	36%	34%
61-90 Minutes	32 %	33%
More than 90 Minutes	21%	25%
Average Kindergarten Class Size	21	21

Notes: Preschool attendance includes Head Start enrollment, prekindergarten, daycare or Nursery School. No mobility is defined by attending the same school. Disadvantage is defined as having a mother or father with less than a high school diploma or living in poverty at kindergarten entry.

Table 5. Regression Adjusted Means for Average Sample Child, by Participation in PK-3 Program Components

	<i>Reading</i>	<i>Math</i>	<i>Teacher Report Reading</i>	<i>Teacher Report Math</i>	<i>Teacher Report Approaches to Learning</i>	<i>Held Back</i>	<i>Special Education</i>
<i>Full Sample</i>							
Group 1 (No PK-3 Components)	49.08	48.88	-.92	-.98	-1.56	.15	.08
Group 2 (Pre + FullK + School Stability K-3)	49.90	50.59	.85	.59	-.95	.07	.07
Group 3 (Group 2 + High Involvement + High Instruction + Teacher Certification)	52.12	52.53	1.28	1.33	.63	.04	.05
<i>Disadvantaged Sample</i>							
Group 1 (No PK-3 Components)	43.88	44.20	-4.73	-4.32	-3.68	.22	.11
Group 2 (Pre + FullK + School Stability K-3)	44.76	46.03	-2.19	-1.51	-3.02	.11	.07
Group 3 (Group 2 + High Involvement + High Instruction + Teacher Certification)	47.55	48.38	-1.74	-1.08	-2.01	.09	.07

Notes: Sample includes only first-time kindergarten public school children. Full Sample size for this study is 6,761. Disadvantage is defined as having a mother or father with less than a high school diploma or living in poverty in kindergarten entry. Disadvantaged sample size is 2,013. The means represent the score for the average child in the described group holding constant: household income, race, parental education, family structure, family size, non-English language spoken in the home, child’s height and weight, region of the country, urbanicity, and child’s race. Reading and Math test scores have means of 50 and standard deviation of 10. Teacher reports of reading, math and approaches to learning have full sample means of 0 and standard deviations of 10. Held Back and Special education are dichotomous measures (1=yes, 0=no).

Table 6. Economic Costs and Benefits for Alternative Investments in Children and Youth in 2002 dollars

<i>Program and Source</i>	<i>Per Participant Cost (\$)</i>	<i>Estimated Benefits (\$)</i>	<i>Benefit-Cost Ratio</i>
High/Scope Perry Preschool (Barnett, 1996)	15,844	138,486	8.74
Child-Parent Center Preschool Program (Reynolds et al., 2002)	7,384	52,722	7.14
Child-Parent Center Extended Program (PK-3) (Reynolds et al., 2002)	4,478	27,361	6.11
Abecedarian Project (Masse & Barnett, 2002)	35,864	135,546	3.78
Women, Infants, and Children (WIC, Avruch & Cackley, 1995)	958	2,941	3.07
Tennessee STAR Class Size Reduction in K -3 (Krueger, 2003)	8,454	23,913	2.83
Child-Parent Center School-Age Program (Reynolds et al., 2002)	3,290	5,457	1.66
Grade Retention (Temple et al. , 2003)	7,959	-26,434	-3.32

Note: Values were converted to 2002 dollars using the Consumer Price Index. Costs for WIC are for 2 years of services. In the other programs, costs are for the average length of participation. CPC Extended Program (PK-3) findings are relative to less extensive program participation (0 to 3 years).