



## Preschool-to-third grade programs and practices: A review of research

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### ABSTRACT

The preschool-to-third grade 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. We review the knowledge base on the effectiveness of preschool-to-third grade 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 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. 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. Overall, we find growing evidence for the positive effects of PK-3 programs and practices. The strongest evidence supporting enduring effects into adulthood is from center-based preschool programs followed by small classes in the early grades. Additional longitudinal studies are needed into adulthood to fully document the effects of different PK-3 programs and to verify the extent to which PK-3 practices (e.g., parent involvement, school mobility) have long-term effects into adulthood.

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### Contents

1.	Introduction . . . . .	1122
1.1.	Brief history of PK-3 programs . . . . .	1122
1.2.	Rationale and conceptualization for PK-3 initiatives . . . . .	1122
2.	Review of PK-3 programs (extended early childhood programs) . . . . .	1123
2.1.	Carolina Abecedarian Project (ABC) . . . . .	1123
2.1.1.	Research findings . . . . .	1124
2.2.	Head Start/Follow Through (FT) . . . . .	1124
2.2.1.	Research findings . . . . .	1124
2.3.	Chicago Child-Parent Center and Expansion Program (CPC) . . . . .	1125
2.3.1.	Research findings . . . . .	1125
2.4.	National Head Start/Public-School Early Childhood Transition Demonstration Project . . . . .	1125
2.4.1.	Research findings . . . . .	1126
2.5.	Characteristics of successful programs . . . . .	1126
3.	Review of evidence on PK-3 practices . . . . .	1126
3.1.	Preschool . . . . .	1126
3.2.	Full-day kindergarten . . . . .	1126
3.3.	Class size . . . . .	1126
3.4.	School mobility . . . . .	1126
3.5.	Teacher quality and instructional practices . . . . .	1127
3.6.	Parental involvement in school. . . . .	1127

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4. Findings on PK-3 programs and practices from ECLS-K . . . . .	1127
5. Economic analysis of PK-3 programs and practices . . . . .	1129
6. Conclusion and recommendations . . . . .	1129
6.1. Disseminate PK-3 programs and practices based on key principles of effectiveness . . . . .	1129
6.2. Use evidence on cost effectiveness to better prioritize funding of PK-3 programs . . . . .	1129
6.3. Develop new funding mechanisms for establishing PK-3 programs . . . . .	1129
Acknowledgements . . . . .	1130
References . . . . .	1130

## 1. 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. 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 reviews and policy reports (Bogard & Takanishi, 2005; Foundation for Child Development, 2005; Reynolds & Temple, 2008; Takanishi & Kauerz, 2008; 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.

We distinguish between two major PK-3 strategies: PK-3 programs and PK-3 practices. PK-3 programs are planned interventions that begin during any year 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. 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 include preschool, full-day kindergarten, reduced class sizes, teaching practices, parent involvement activities, and school transitions (mobility).

In this report, we first turn to a brief history, rationale, and conceptualization of PK-3 programs and practices. Second, we review the knowledge base on the effectiveness of PK-3 programs and practices. Third, we document findings on PK-3 programs and practices from the Early Childhood Longitudinal Study—Kindergarten Cohort (ECLS-K) of 1998–99. Fourth, we review evidence on the cost effectiveness of PK-3 programs and practices. Finally, we conclude with a discussion of the implications and policy recommendations.

### 1.1. 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. 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 to 1998 in 31 sites.

The third key federal initiative 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 (CPC) 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. By the mid 1980s, 25 centers were in operation. 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 CPC 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.

### 1.2. Rationale and conceptualization for PK-3 initiatives

Participation in PK-3 programs and elements may lead to greater and longer-lasting effects than less extensive interventions for three reasons. First, longer periods of implementation may be necessary to promote greater and longer-lasting changes in scholastic and psychosocial outcomes. An increasingly documented element of successful prevention programs is that they provide comprehensive services for at least two years (Nation, Crusto, Wasserman et al., 2003). Second, PK-3 programs and elements are designed to encourage stable and predictable learning environments, both of which are key elements in optimal scholastic and social functioning (Garmezy & Rutter, 1988). 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. Third, PK-3 programs and elements 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.

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. The literature indicates that effectiveness can be promoted through five hypotheses (Reynolds, 2000, 2004, 2005), and they are a major focus of PK-3 programs and practices. The five hypotheses are: 1) cognitive

advantage hypothesis (as measured by developed cognitive and scholastic abilities), 2) social adjustment hypothesis (prosocial behavior), 3) family-support hypothesis (changes in the family behavior), 4) motivational advantage hypothesis (children's motivation or perceived competence), and 5) 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. 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. 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 (Campbell, Ramey, Pungello, Sparling & Miller-Johnson, 2002; Reynolds, Temple, Ou et al., 2007; Reynolds, Temple, Robertson, & Mann, 2001).

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; Reynolds & Temple, 2008). There are four key principles/attributes of PK-3 programs and practices: continuity, organization, instruction, and family-support services. First, continuity means programs and practices support consistency and time in learning environments, such as school stability, reducing the negative effects of mobility, increased program length for smooth transitions, and peer group consistency. Second, programs and practices enhance capacity for organization of services, such as integration of program components within a single site, coordination, second preschool year, full-day kindergarten, reduced class sizes, low child-to-staff ratios, and additional instructional and support staff. Third, programs and practices promote instructional practices, such as school quality, curriculum alignment, increased collaboration among staff, and joint staff development. Finally, programs and practices encourage family-support services, such as parent involvement in children's education, resource mobilization, and health services. To the extent that PK-3 programs and practices contribute to the principles, positive impacts on child development are expected.

## 2. Review of PK-3 programs (extended early childhood programs)

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 programs are

described: 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 1 provides key characteristics of these programs. Table 2 summarizes available findings of the 4 programs. 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, Magnuson, and Ou (2006) and Reynolds (2003) for more information on these programs.

### 2.1. 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).

The original sample was 111 children (98% African American, 57 in the preschool group, and 54 in the control group). Children in the preschool group received five years of enriched educational day care from age 4 months to 5 years (prior to kindergarten). 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, 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. Teachers serve as a home/school liaison on behalf of the student, and work on community outreach. 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.

**Table 1**

Major characteristics of four extended early childhood programs for low-income families.

Early intervention programs	Age of entry and length	Organization	Program description	Classroom environment	Parent component	Other services
Carolina Abecedarian Project (1972–1985)	6 weeks–5 or 8/5 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/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/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/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 2**  
Selected effect sizes on school competence for studies of extended early childhood programs.

Program and studies	Program sample and experiences/ control sample and experiences	Age	Effect sizes in standard deviations				
			Reading <sup>1</sup>	Math <sup>1</sup>	Retention	Special edu	HS Com.
<i>Carolina Abecedarian Project</i>							
Campbell and Ramey (1995)	25 in daycare (0 to age 5) + kind-grade 2	8	.27	.33	—	—	
Ramey, Campbell, et al. (2000); Campbell et al. (2002) (up to age 21)	24 in daycare from birth to age 5 only	15	.20	.00	.02	.24	
		21 <sup>2</sup>	.23	-.20			.03
<i>Head Start/Follow Through</i>							
Abelson, Zigler, and DeBlasi, (1974)/ Seitz et al. (1983) (up to age 14)	35 in Bank Street FT in K-3; 91% had HS 26 other-school controls; 28% had HS	8–9 12–15	.00 .00	.51 .13	— —	— —	
Becker and Gersten (1982) (up to age 12)	1097 in direct inst. FT in 1-3 907 in non-FT classrooms in same schools	8–9 12–15	>.50 .19	>.50 .26	— —	— —	
Schweinhart and 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 and 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 1-3 207 in CPC Pre-K and K only	8–9	.55	.48	-.13	-.03	—
Reynolds and Temple (1998) (up to age 13)	426 in CPC Pre-K and K plus grades 1-3 133 in CPC Pre-K and K only	8–9 12–13	.48 .43	.35 .28	— -.15	— -.06	—
Reynolds et al. (2001) (up to age 21)	599 in CPC Pre-K and K plus grades 1-3 242 in CPC Pre-K and K only	15–18 21			-.32	-.29	.06 <sup>3</sup>
Reynolds et al. (2007) (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 <sup>3</sup>
<i>Head Start/Public-School Early Childhood Transition Demonstration</i>							
Ramey, Ramey et al. (2000)	30 sites across the country 3411 had Head Start and Transition 3137 had Head Start only	9	-.10	-.07		.18 -.13 (MR) -.12 (ED)	
Redden et al. (2001)	3221 had Head Start and Transition 2941 had Head Start only						

Note. 1. Values for reading and math achievement are proportions of standard deviations. Values for grade retention, special education, and high school completion (Hs com) 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 and 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. (2007) were obtained through comparing extended intervention (4–6 years) with less than 4 years (0–3 years).

MR: mental retardation, ED: emotional disturbance.

Table is adapted from Reynolds (2003) and Reynolds et al. (2006).

### 2.1.1. 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; 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 on reading achievement (Ramey, Campbell, Burchinal, Skinner, Gardner, & Ramey, 2000). This trend stayed at age 21, but the difference was not significant (Campbell et al., 2002).

### 2.2. Head Start/Follow Through (FT)

Head Start/Follow Through offered Head Start-like services in the public schools in an effort to enhance low-income children's transition between preschool and the early elementary grades, thereby promote school success. However, FT never achieved its original goal as a coordinated continuum of early childhood intervention (Kennedy, 1993). Instead, FT programs tested on the effects of alternative instructional methods on children's achievement from kindergarten to

third grade. 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, and home visits from paraprofessionals that encouraged parents' participation in their child's education and 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.

#### 2.2.1. 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 students' academic achievement. The Direct Instruction and Behavioral Analysis models were most consistently associated with higher achievement across location and time. 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 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.

2.3. Chicago Child-Parent Center and Expansion Program (CPC)

Established in 1967 through Title I funding, 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. 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.

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. Fig. 1 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. Parents are required to be involved in the center at least one half-day per week. Classroom teachers in preschool and kindergarten use a mix of teacher-directed and child-initiated instructional approaches, which varied across centers. 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, compared to the typical class sizes of 35–40 with no aide in first to third grade in Chicago. See Reynolds (2000) and Sullivan (1971) for more information.

2.3.1. 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). Extended program participation (4 or more years of services) was associated with lower rates of school remedial services and delinquency infractions (Reynolds et al., 2001). 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 et al., 2007).

2.4. 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. 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 tested on the effects of extending comprehensive, Head Start-like supports through the first four years of elementary school.

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. In addition, 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.

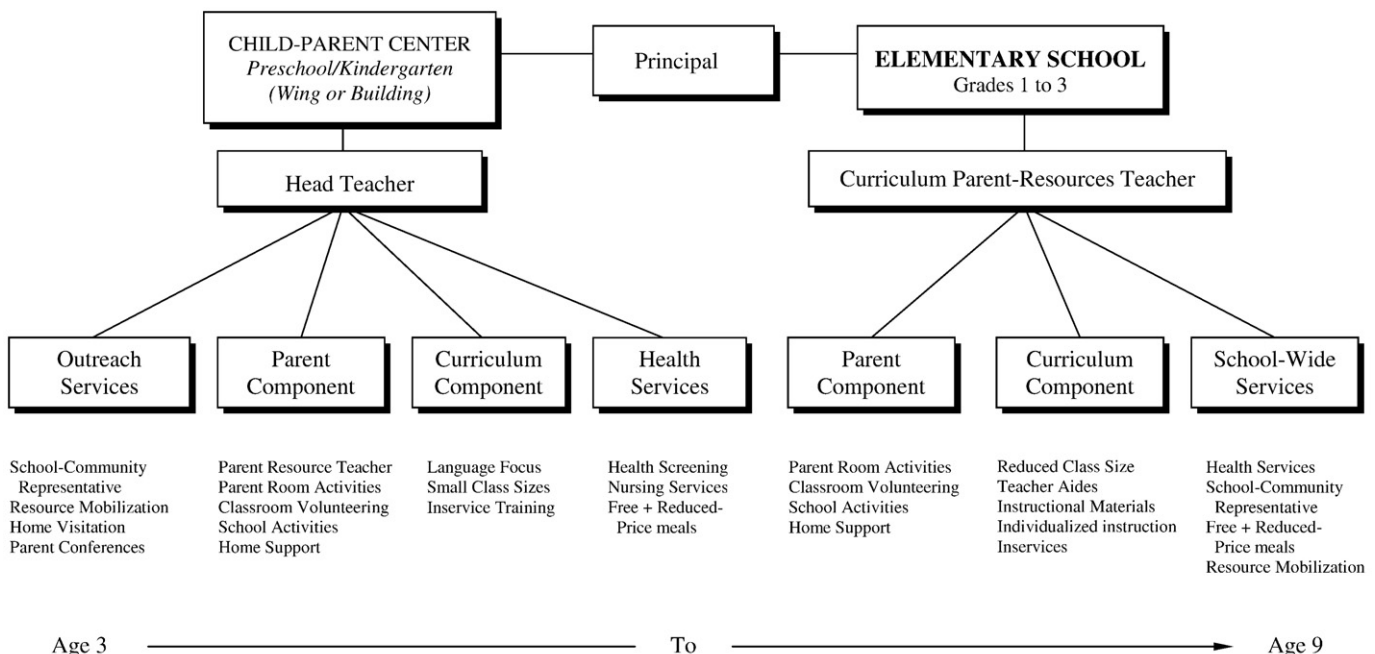


Fig. 1. Child-Parent Center program.

#### 2.4.1. Research findings

To date, evaluations of HST indicated no overall program effect (Ramey, Ramey, & Lanzi, 2004). 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, Campbell et al., 2000; Ramey, 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).

#### 2.5. Characteristics of successful programs

Although additional research is needed, several characteristics of successful programs can be identified based on 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.

### 3. Review of evidence on PK-3 practices

In this section we review the available evidence on the effects of 6 PK-3 practices: preschool, full-day kindergarten, class size, school mobility, teacher quality and instructional practices, and parent involvement in school. Given our emphasis on PK-3 education, we do not consider evidence on multi-year programs beginning in the elementary grades. See Weissberg and Greenberg (1998) and Reynolds and Temple (2008) for this evidence.

#### 3.1. Preschool

Research shows that high-quality compensatory early education programs have large positive effects on disadvantaged children's cognitive development and academic skills at school entry (Barnett, 1995; Gormley, Gayer, Phillips & Dawson, 2005; Karoly, Kilburn & Cannon, 2005). However, most children do not attend high-quality programs, but rather attend programs of varying quality, such as local preschools or Head Start centers. 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; Magnuson, Ruhm, &

Waldfoegel, 2007; U. S. Department of Health and Human Services, 2010). Nevertheless, preschool 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. See Camilli, Vargas, Ryan, and Barnett (2010), Reynolds et al., (2003), and Reynolds and Temple (2008) for reviews on the effects of early childhood programs.

#### 3.2. Full-day kindergarten

Kindergarten was initially designed in the 1960s to ease children's transition into formal school by providing them with opportunities to meet and socialize with children in group settings during a part-day program (Elicker & Mathur, 1997). 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 (West, Denten & Reaney, 2001). The most prominent factor driving the shift to full-day kindergarten is 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 reading, math and science at the end of the kindergarten year (Fusaro, 1997; Votruba-Drzal, Li-Grining, & Maldonado-Carreno, 2008; Walston & West, 2004). However, such positive benefits fade quickly over time (Le et al., 2006; DeCicca, 2007; Votruba-Drzal et al., 2008).

#### 3.3. Class size

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, Brewer, Gamoran & Willms, 2001; NICHD Early Child Care Research Network, 2004). Much of the impetus for small class sizes have come from findings 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 (13–17 students) and larger classes (over 23 students). Children who consistently attended small classes from first through third grade are found to have higher test scores than children who did not (Finn & Achilles, 1999). Estimated effects four years after program completion were about .15 of a standard deviation (Finn & Achilles, 1999). The SAGE program in Wisconsin lowered class sizes among schools serving a sizable population of low-income students. Molnar et al.'s (1999) evaluation finds that students in small classes performed better on mathematics and reading tests than other children. Similar to the STAR study, results from the SAGE evaluation suggest larger effects for black students than for white students. The findings from experimental studies and a host of nonexperimental studies (Aos, Miller, & Mayfield, 2007; Milesi & Gamoran, 2006) provide a basis to conclude that smaller classes in the early elementary school years are an important avenue for improving children's school outcomes (see Aos, Miller, & Mayfield, 2007). However, variability in the strength of effects across studies warrants further investigation.

#### 3.4. School mobility

Non-promotional school changes are common (Rumberger, 2003). Studies routinely find that children who experience school mobility,

especially frequent mobility, have poor academic outcomes (Temple and Reynolds, 1999). 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, children change schools for 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, 1999).

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, these pre-existing differences need to be taken into account to fully understand the effects of school mobility. Mehana and Reynolds (2004) found a moderate negative association between mobility and school achievement in a meta-analysis of school mobility. Temple and Reynolds (1999) found a student experiences a reduction in their academic skills of about .08 standard deviations for each school move in a sample of low-income urban students. A meta-analysis of 15 recent studies by Reynolds, Chen, & Herbers (2009) corroborates these findings. The effect of frequent mobility on school dropout was found to be particularly strong. With many students experiencing multiple school changes, the cumulative effects of frequent mobility are likely to be substantial. School policies to reduce mobility include, among others, PK-3 programs and parent-teacher conferences for children at elevated risk of mobility.

### 3.5. Teacher quality and instructional practices

Teachers vary in their ability to provide instruction and to facilitate children's learning. Research suggests that teachers' intelligence, academic abilities, and mastery of the subjects they teach are linked to students' gains in achievement (Darling-Hammond & Youngs, 2002; Early et al, 2006; 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). 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 as a determinant of their school success. Young children who get along well with their teachers are found to be more engaged in classroom activities and learn more than their peers (Pianta & Stuhlman, 2004).

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, 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. 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; Schweinhart, Weikart & Larner, 1986). An integrative approach to instruction may also be beneficial. Children exposed to instruction that blended child-initiated and teacher-directed activities within a comprehensive program model are found to have the highest levels of school readiness and early school achievement (Graue, Clements, Reynolds, & Niles, 2004).

Individualized reading instruction with professional development support for teachers is also found to promote children's reading skills (Connor, Morrison, Fishman, Schatschneider & Underwood, 2007).

### 3.6. Parental involvement in school

Parents' involvement in their children's schooling is often noted as an important influence on children's academic success. Parents may become involved in their children's schooling in various ways, for example, by providing enriched learning opportunities at home or volunteering in their child's classroom. 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).

Precisely estimating the magnitude of parental expectations and parental participation effects is complicated by various methodological issues. For example, 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, these correlations may overstate the size of causal effects, as parents' expectations and school participation may be in part determined by their children's previous school performance (Englund, Luckner, Whaley & Egeland, 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 (Dearing, Kreider, Simpkins, & Weiss, 2006; Graue et al., 2004).

## 4. Findings on PK-3 programs and practices from ECLS-K

We utilize data from the Early Childhood Longitudinal Study-Kindergarten (ECLS-K) cohort to provide additional descriptive information on the differing dimensions of PK-3 programs and practices. The ECLS-K consists of a nationally representative cohort of children who attended kindergarten in the fall of 1998. For more information, see National Center for Education Statistics (2004). Using the data, we first explore the prevalence of PK-3 program components for public-school children, and then examine the associations between program components and children's academic success.

**Table 3**

Participation of ECLS-K public-school children in PK-3 program components.

Program components	All children	Disadvantaged children
Preschool	67%	58%
Full-day kindergarten	51%	58%
No mobility kindergarten through 3rd grade	82%	79%
Experience certified teachers only K-3	84%	80%
Parental involvement in child's school		
Volunteer in school	41%	23%
Attend parent-teacher conference	79%	70%
Daily time for reading and language		
arts reading and language arts		
instruction in kindergarten		
0-30 min	9%	8%
31-60 min	36%	34%
61-90 min	32%	33%
More than 90 min	21%	25%
Average kindergarten class size	21	21

Notes: Preschool attendance includes Head Start enrollment, prekindergarten, day care 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 in kindergarten fall.

Table 3 shows the experiences in PK-3 program components among children in the ECLS-K study. Preschool attendance in the year before kindergarten (including 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 (having a parent who dropped out of High School or living in poverty). Turning to participation in full-day kindergarten, about 50% public-school children attend a full-day kindergarten program, compared to 58% of disadvantaged children. The higher prevalence of full-day kindergarten among disadvantaged children is expected, as schools often initiate these programs to better serve at-risk children. The ECLS-K study only follows a portion of children who changed schools during the course of the study. Thus, 82% of children in the ECLS-K attending the same school from kindergarten through third grade are an underestimate of mobility in the U.S. We use teacher certification as an indicator of teachers' 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). Certification is an important, but likely imprecise indicator of a teacher's skill working with young children.

We report the frequency of two indicators of parents' involvement during kindergarten: attendance of regular parent-teacher conferences and volunteer in the school, from the ECLS-K data. Most parents reported that they attended a parent-teacher conference (79%), whereas fewer reported volunteering in the school (40%). 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 dimensions we consider (96%), and on average parents reported at least three different types of involvement. 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. In the ECLS-K, the average class size experienced by public-school students in kindergarten, first grade, and third grade was 21 students. About 12% of kindergartners were in classes with more than 25 students and fewer than 20% were in classes with 17 or fewer students.

Many children experience several dimensions of the PK-3 programs and practices based on the ECLS-K sample. 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. Although many of these experiences are common, they are not necessarily experienced as a package.

Table 4 presents the adjusted means of school outcomes in the spring of third grade for the average child and for the disadvantaged child experiencing different components of the PK-3 practices in our sample controlling for family background characteristics. Six key elements of the PK-3 practices are considered: 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 certification. Results are presented for several measures of children's academic achievement: math and reading skills by assessment and teacher reports, teacher reports of children's approaches to learning (positive orientation toward learning), grade retention (not progressed to third grade) and placement in special education. Three groups are examined: children who did not experience any of the selected PK-3 dimensions (about 2% of the sample), children who experienced only three selected PK-3 program components (preschool, full-day kindergarten, and school stability), and children who experienced all 6 PK-3 components.

These descriptive findings show that by third grade, children who do not experience the PK-3 program components are further behind their peers on important indicators of school success: math and reading skill assessments, teacher reports of their skill proficiency and positive approach to learning, 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. Effects are slightly larger (.30 to .40 of a standard deviation) for disadvantaged children. 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

**Table 4**  
Regression adjusted means for average sample child, by participation in P-3 program components.

	Reading	Math	Teacher report reading	Teacher report math	Teacher report approaches to learning	Held back	Special education
<i>Full Sample</i>							
Group 1 (No P-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 P-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: 1. Sample includes only first-time kindergarten public-school children. Full Sample size for this study is 6761. Disadvantage is defined as having a mother or father with less than a high school diploma or living in poverty in kindergarten fall. Disadvantaged sample size is 2013. 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).

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 min 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.



**Table 5**  
Economic costs and benefits for alternative investments in children and youth in 2002 dollars.

Program and source	Per participant cost (\$)	Estimated benefits (\$)	Benefit–cost ratio
High/Scope Perry Preschool (Barnett, 1996)	15,844	138,486	8.74
Child–Parent Center Preschool Program (Reynolds et al., 2002)	7384	52,722	7.14
Child–Parent Center Extended Program (Pk-3) (Reynolds et al., 2002)	4478	27,361	6.11
Abecedarian Project (Masse & Barnett, 2002)	35,864	135,546	3.78
Women, Infants, and Children (WIC, Avruch & Cackley, 1995)	958	2941	3.07
Tennessee STAR class size reduction in K-3 (Krueger, 2003)	8454	23,913	2.83
Child–Parent Center school-age program (Reynolds et al., 2002)	3290	5457	1.66
Grade retention (Temple et al., 2004)	7959	–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 (P-3) findings are relative to less extensive program participation (0 to 3 years).

among disadvantaged children. 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 are 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.

## 5. 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. Table 5 summarizes the main findings from available cost–benefit analyses of PK-3 programs and practices. All would be classified as PK-3 practices except the CPC extended intervention program. To be cost effective, the economic return of a program or practice should at least equal the amount invested.

Most programs showed economic returns that exceed costs (for details, see the source report referenced in Table 5). The highest economic returns were from preschool programs, which ranged from \$4 to \$10 per dollar invested. The total economic benefits per participant, both measured and projected over the life course, ranged from about \$60,000 to \$140,000. The CPC results show that an established public-school program can generate substantial returns, which has significant implications for larger scale implementation. 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. 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 (–\$3.32) by far. 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 (See Reynolds & Temple, 2008).

## 6. Conclusion and recommendations

Our review of the available evidence indicates growing empirical support for PK-3 programs and practices. 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. We reviewed available evidence on the effects of PK-3 program elements. All except full-day kindergarten have consistently demonstrated enduring and sizable links to school achievement. Evidence from the ECLS-K Study indicates that 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. Finally, preschool programs, a PK-3 practice or program element, showed the highest economic returns. We offer three recommendations here.

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

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. Based on this established knowledge base, key principles supported 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. As described earlier, the evidence base of PK-3 programs and practices 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.

### 6.2. 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. 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. 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.

### 6.3. 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 five mechanisms for funding to be considered, some of which are provided or have been offered in some states.

First is to 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, administrated at the county level. Roughly 2 to 3% of the total funds could be reserved for research and evaluation. Second is to 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. Third is to issue state bonds to finance early childhood initiatives that are likely to provide high returns. The Child-Parent Center model of PK-3 education would be a good candidate for piloting the use of this revenue source. While issuing state bonds for specific early childhood programs is unprecedented, many states currently issue bonds for general revenue outlays.

Fourth is to develop a check-off box on state income tax returns for voluntary contributions to program funding in early childhood development. Implemented in several states, taxpayers could contribute any dollar amount to programs areas. Among the options for contributions could be preschool education or early childhood intervention. Finally, fifth is to 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. For example, only 3% of Title I block grants (\$300 million of \$14 billion in annual funding) go to preschool (Ewen & Matthews, 2007). Joint funding or matching grants between federal and state sources would be one approach to cost sharing that could improve the opportunities for early childhood funding.

Given this evidence from the review, 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.

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