

# The Effects of Preschool Education: What We Know, How Public Policy Is or Is Not Aligned With the Evidence Base, and What We Need to Know

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## Summary

Early childhood education is at the nexus of basic developmental science, policy research and analysis, and the applied disciplines of education and prevention science. The field has become one of the most vibrant areas of scientific activity in terms of the connections among scientific advances and theory, program design, policy, and classroom practices. But despite the potential links between research and evaluation on the one hand and program development, practices, and public policy on the other, there are too many key areas in which public policy and practice are not well aligned with the knowledge base. These misalignments, as well as a host of questions emerging from new areas of scientific development (e.g., connections between physiological or genetic processes and behavioral development) and practice-based realities (e.g., the need for focused, intensive, and effective professional development of teachers), point to areas in which new research is needed. The aim of this monograph is to provide an analysis of the research evidence in four major domains of work in early childhood education, identifying points at which evidence is not well aligned with public policy or practice, and a set of questions to guide the next wave of research in this rapidly growing field.

Overall features of the preschool landscape, including those tightly regulated by policy (such as entry age or eligibility) and those more directly related to child outcomes (such as quality of classroom interactions), are stunningly variable across settings and across time. Reasonable evidence suggests that these features also vary as a function of family background factors. The resulting picture is one of too many children and families falling through too many cracks and seams at too many levels. Thus, even in a policy and program development environment in which early education is valued and prominent and recognition of the need to close gaps and seal seams is growing, the realities point to a fragile and vulnerable nonsystem through which many of our most fragile and vulnerable citizens pass.

Demographic shifts will place tremendous pressure on early education and child care in the United States in the coming decades—a trend that is well under way in many states. The consequences for preschool program eligibility and enrollment, available slots, preparation and support of staff, and program resources such as curricula are enormous. It is abundantly evident that the features of the preschool landscape—connections among child care, preschool, and schools; links between families and the adults who teach their children; capacities of the “system” for fostering positive development in children who increasingly vary by race, culture, language, and economic background—will undergo tremendous strain. The pressures imposed on this context and these relationships by the sheer variability present in the children and families will itself be a considerable threat to the viability of the capacity of preschool to promote positive developmental change.

Compelling evidence from well-controlled research shows that preschool programs have lasting positive effects on young children’s cognitive and social development. The evidence comes from studies of child care, Head Start, and public school programs using a wide range of research methods, including experiments. Lasting positive impacts have been found for large-scale public programs as well as for intensive programs implemented on a small scale, but even some of the intensive small-scale interventions were public school programs. Some evidence has shown negative effects on social behavior, but the negative effects have not been confirmed by experimental studies. Cost–benefit analyses have shown that

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the value of benefits is very large relative to costs, even for very costly intensive preschool programs—at the high end, starting at age 3, roughly \$300,000 per child enrolled for a program. The estimated economic value of program impacts on child development can be substantial relative to cost, but this depends on adequate levels of program effectiveness. The economic benefits of child care for parental earnings add even more to the return. Children from lower-income families tend to gain more from good preschool education than do more advantaged children. However, the educational achievement gains for nondisadvantaged children are substantial, perhaps 75% as large as the gains for low-income children.

However, there is no evidence whatsoever that the average preschool program produces benefits in line with what the best programs produce. On average, the nonsystem that is preschool in the United States narrows the achievement gap by perhaps only 5% rather than the 30% to 50% that research suggests might be possible on a large scale if we had high-quality programs. From the standpoint of policy alignment with research findings, it is abundantly evident that the wide variation in program design, models, curriculum, staffing, auspices, funding, and level of educational aims plays a major role in the disappointing, albeit statistically significant and in that sense meaningful, impacts of preschool on child development.

Effective teaching in early childhood education requires skillful combinations of explicit instruction, sensitive and warm interactions, responsive feedback, and verbal engagement or stimulation intentionally directed to ensure children's learning while embedding these interactions in a classroom environment that is not overly structured or regimented. This approach to early childhood teaching is endorsed by those who advocate tougher standards and more instruction and by those who argue for child-centered approaches, and it has strong parallels in the types of instruction and teacher-child interactions that have been shown to contribute to student achievement growth in K–12 value-added studies. Furthermore, quality of instruction within a specific content area appears closely linked to improvements in language, math, and reading. These studies suggest that children may achieve larger gains when they receive higher-quality instruction that specifically teaches target skills in a manner that matches children's skill levels and provides instruction through positive, responsive interactions with the teacher.

The best approaches to professional development focus on providing teachers with (a) developmentally relevant information on skill targets and progressions and (b) support for learning to skillfully use instructional interactions and to effectively implement curricula. Such professional development approaches enable teachers to provide children with domain-specific stimulation supports in real-time, dynamic interactions that foster children's developing skills by engaging these children with available instructional materials or activities. Effective professional development supports allow for a direct tracing of the path (and putative effects) of inputs to teachers, to inputs to children, to children's skill gains.

Evidence is very promising that when such targeted, aligned supports are available to teachers, children's skill gains can

be considerable—on the order of a half a standard deviation on average, and as much as a full standard deviation. Unfortunately, preschool teachers are rarely exposed to multiple field-based examples of objectively defined high-quality practice, and they receive few if any opportunities to receive feedback about the extent to which their classroom interactions and instruction promote these skill domains. At present, there is very little evidence that the policy frameworks and resources that should guide and encourage professional development and training of the early childhood workforce are aligned with the most promising, evidence-based forms of effective professional development. Thus, it is not surprising that teachers with a 4-year degree or 2-year degree do not differ from one another substantially in either their practice or their students' learning gains, and it is not surprising that investments in courses and professional development appear to return so little to children's learning.

Our conclusions are fairly straightforward and include four major points. First, preschool, which we have defined as publicly supported programs (child care, Head Start, state-funded pre-K), encompasses such a wide range of funding streams and targets, program models, staffing patterns and qualifications, and even basic aims (maternal employment or education) that it cannot be understood as a uniform or singular aspect of the public system of support for children. Moreover, the fragmentation in this educational space greatly impedes policy levers that could drive improvement and coherence in the actual models that children experience. Second, despite this stunning variability and fragmentation, there is compelling evidence from well-controlled studies that attending preschool can boost development and school readiness skills and can have longer-term benefits to children and communities. Unfortunately, the effects of various program models are quite varied, with some being rather weak and ineffective while other scaled-up programs narrow the achievement gap by almost half. It is quite clear that programs that are more educationally focused and well defined produce larger effects on child development. Third, for children enrolled in preschool, features of their experience in those settings are important—particularly, the ways in which adults interact with them to deliver developmentally stimulating opportunities. The aspects most often discussed as features of program quality regulated by policy (such as teacher qualifications or curriculum) have much less influence on children than is desired. Fourth, teacher-child interaction and teachers' effective implementation of educational and developmental curricula, as features of program quality, are central ingredients responsible for program effects but do not appear to be produced in a reliable manner by typical teacher preparation. It is important to note that such aspects of preschool quality and children's experience can be improved with specific and focused training and support and this will have expected effects on children's learning.

Current public policies for child care, Head Start, and state pre-K fail to ensure that most American children attend highly effective preschool education programs. Some attend no program at all. Others attend educationally weak programs.

*Children in families from the middle of the income distribution have the least access, but coverage is far from universal even for children in poverty. This state of affairs can have marked and deleterious effects on children, families, and communities. It is not easily solved by more subsidies or more of the same types of programs. Increased provision of child care subsidies under current federal and state policies is particularly unlikely to produce any meaningful improvements in children's learning and development and could have mild negative consequences. Increased public investment in effective preschool education programs for all children can produce substantial educational, social, and economic benefits, but only if the investments are in programs in which teaching is highly effective.*

## Introduction

The widespread belief that early childhood education is one of the best mechanisms for providing educational and developmental opportunities for all children regardless of race or social class (Heckman & Masterov, 2007) has transformed research, program development, and policymaking in the field during the past 20 years. As a field of scientific inquiry, early childhood education is at the nexus of basic developmental science, policy research and analysis, and the applied disciplines of education and prevention science. The field has become one of the most vibrant areas of scientific activity in terms of the connections among scientific advances and theory, program design, policy, and classroom practices. Moreover, the quality of scientific inquiry has improved at all levels, and the research now includes descriptive population-level studies and rigorous controlled evaluations of innovative programs, as well as highly controlled analyses of scaled-up interventions and smaller scale laboratory-based work that fuels conceptual advances and new applications. In the process, the field has matured as an area of scientific inquiry that has a direct link to the public interest. Policymaking related to the care and education of young children is extraordinarily active, engaging a wide range of interest groups, foundations, politicians, and professional organizations (Finn, 2009) in debates about program quality, impacts, expansions, and investments of public and private funds. Early care and education programs for young children require evidence about the best strategies for fostering and assessing learning and developmental gains.

Research demonstrating that early childhood education can promote the development of young children (Heckman & Masterov, 2007) has influenced both policy and practice. Perhaps in no context have the connections among public policy, early childhood practices, and research been more evident than in recent presidential and gubernatorial elections; candidates have relied on available evidence to make arguments for expansion and refinement of early education programs as a means of addressing serious concerns about achievement and learning in the early grades and inequities in society at large. In most instances, the argument is based on research on the role of early education in enhancing children's competencies.

The argument made in many circles—including policy-makers at state and federal levels, advocacy, program planning, and development—is that early childhood education is a means to address concerns that an unacceptably large number of children are already, by 5 years of age, lacking in competencies fundamental to their school success—notably in the areas of spoken language and literacy (Duncan et al., 2007), self-regulation (Raver, 2008; Zaslow et al., 2003), social-relational competence (Fantuzzo et al., 2007), and early math (Cross, Woods, & Schweingruber, 2009). The long-term effects of early gaps in achievement and social functioning are so pronounced that effective and efficient interventions targeted toward these gaps in the preschool period are essential, not only to the developmental success of children but also to the economic and social health of communities (Barnett, 2008; Barnett & Masse, 2007; Heckman, 2006; Heckman & Masterov, 2007; Magnuson, Ruhm, & Waldfogel, 2007a, 2007b). Early childhood education is viewed as a means by which policymakers can address these issues, as both small experimental studies and quasi-experimental studies of large-scale programs have shown consistently positive effects of exposure to preschool (Gormley & Phillips, 2003; Howes et al., 2008; Magnuson et al., 2007a, 2007b; C.T. Ramey & Ramey, 2004; Wong, Cook, Barnett, & Jung, 2008).

Because this argument is supported by evidence and has been widely accepted, there has been a rapid expansion of preschool services for young children, mostly at ages 3 and 4 and mostly targeted toward low socioeconomic groups (Barnett, Hustedt, Friedman, Boyd, & Ainsworth, 2007). The most recent information indicates that 22% of all 4-year-olds are enrolled in state-funded pre-kindergarten (pre-K), with 30 states planning to increase enrollment through specific efforts to raise the percentage of low-income children enrolled in preschool (Barnett et al., 2007). Thus, research evidence has been linked to policy.

However, despite significant investments over the past decade in the expansion and improvement of programs, the promise of early education as a scaled-up asset for fostering learning and development of young children in the United States is not yet being realized—too many children, particularly poor children, continue to enter kindergarten educationally far behind their peers (Jacobson-Chernoff, Flanagan, McPhee, & Park, 2007; Johnson, 2002; National Center for Education Statistics, 2000). Jacobson-Chernoff et al. (2007) reported results from the first follow-up of the nationally representative Early Childhood Longitudinal Study–Birth Cohort showing a gap of roughly one standard deviation on school readiness skills for children below the 20th percentile on family socioeconomic status. Because the wide-ranging and diverse set of experiences in preschools are not, in aggregate, producing the level and rate of skill gains required for children to be ready for school (see Howes et al., 2008; Layzer & Price, 2008), some have argued that simply enrolling more children in more programs, although helpful, will not close, or even narrow in noticeable ways, the skills gap at school entry. Instead, investments (in research, program development, and policy

initiatives) are urgently needed to substantially enhance the positive effects of existing and expanding educational offerings on the very child outcomes in which skills gaps are so evident (see Moorehouse, Webb, Wolf, & Knitzer, 2008). We believe that key challenges to heightening the impact of programs are to align policy with research, to identify gaps in the science, and then to close these gaps in the knowledge base while acting on points of alignment.

In short, despite the potential links between research and evaluation on the one hand and program development, practices, and public policy on the other, there are too many key areas in which public policy and practice are not well aligned with the knowledge base. These misalignments, as well as a host of questions emerging from new areas of scientific development (e.g., connections between physiological or genetic processes and behavioral development) and practice-based realities (e.g., the need for focused, intensive, and effective professional development of teachers), point to areas in which new research is needed. The aim of this monograph is to provide (a) an analysis of the research evidence in four major domains of work in early childhood education, identifying points at which evidence is not well aligned with public policy or practice and (b) a set of questions to guide the next wave of research in this rapidly growing field.

The monograph is organized into five sections. In the first four sections, we provide brief summaries of evidence and policy-practice misalignment in four domains in which the greatest amount of research activity has taken place in the past 20 years and about which reasonable conclusions can be drawn: (a) the landscape and architecture of early childhood education programs and experiences; (b) the effects of such programs and associated experiences on children's learning and development; (c) the nature, measurement, and effects of program quality; and (d) improvement of program effects on child outcomes through professional development of the workforce. In the concluding section, we present a set of emerging and compelling questions that require the attention of scholars and investigators to generate knowledge to support greater impacts and sustainability of the type of early childhood programs now being implemented or planned on a widespread basis.

## **The Landscape of Early Childhood Education: What We Know About Programs, Children Served, and Connections to Public Policy and Practice**

Early education serves at least two primary interests: those of parents seeking opportunities for development enhancement for their children or child care to support their own employment and those of society at large in relation to the development of human capital. In many instances, these interests are mutual and overlapping: Society likely benefits when parents enroll their children in early education opportunities that promote learning and development of skills that might not be provided or fostered by parents, and when children are enrolled, parents

might also then engage in employment opportunities. However, in some instances, such as when early education opportunities are scarce or do not provide for learning and development of children in ways that demonstrably add value, the convergence of family and social interests is not as evident. For the past 20 to 30 years, scholars in the United States and across the world have studied the opportunities for the care and education of young children and their implications for the interests of parents, children, and society. These opportunities range from informal care in a relative's home to enrollment in a formal school-like program and span the range of ages from birth to kindergarten. Many advocates believe that early education and care opportunities have effects that extend into the early elementary grades. Overall, preschool in the United States is a stunningly complex, wide-ranging, and highly varied assortment of early care and educational offerings that take place in very diverse settings and with often inadequate resources that are also constrained in how they may be used. For the purposes of our discussion in this monograph, we focus on early education opportunities offered to young children between roughly 3 years of age and entry into formal schooling, whether that takes place at kindergarten or first grade; we call this the *preschool* period.

### **Preschool programs and experiences**

The term *preschool* encompasses a diverse array of programs, under a variety of names, for children who have not yet entered kindergarten. One way of organizing the data on enrollment of children in such programs is to focus on three broad types of programs serving children during the 2 years prior to kindergarten (ages 3 to 5): private nonprofit and for-profit child care centers, Head Start, and pre-K programs linked to public education. We offer three reasons for considering only these three program types (and not others such as family child care homes or informal child care settings). First, although there is some overlap between these categories, they are reasonably distinct and can be discussed as separate subsectors of the policy field. Second, these are settings that serve most of the 3- to 5-year-old children in child care (Magnuson et al., 2007a), and there are far more and better data describing these settings than there are for other settings such as family child care homes. Third, these three sectors receive considerable public financial support and thus are quite relevant to public policy. We recognize that policy development requires a broader view of early care and education prior to age 3 and after kindergarten entry. However, for review purposes, we focus on this one manageable slice of children's early experiences.

Over the past 4 decades, the federal government and most states have invested heavily in providing public preschool programs for 3- and 4-year-old children. The percentage of preschoolers in child care increased from 17% in 1965 to about 80% in 2008 (Barnett & Yarosz, 2007; Barnett, Epstein, Friedman, Boyd, & Hustedt, 2008). A marked increase in publicly funded programs accompanied this overall increase; Head Start was established in 1965 and by 2007–2008 served nearly

900,000 children in this age range (Barnett, Epstein, et al., 2008). State-funded public pre-K programs greatly expanded during the past 20 years. Now, 38 states offer these programs, which served approximately 1.1 million children across the nation in 2007–2008 (Barnett, Epstein, et al., 2008). By 2008, about 75% of American children attended a center-based preschool program in the year prior to kindergarten, many in private programs. Nearly half attended a center-based program in the year before that (at age 3), with two out of three of these in a private program. The combination of increased enrollment, expansion of publicly funded preschool programs, and recognition of the unique role of early education experiences in the establishment of education success has led to the current situation in which, for the vast majority of children in the United States, school essentially starts at age 4, and for many, at age 3 (Pianta, 2005).

Preschool-aged Latino children are the least likely of any ethnic-racial group to enroll in preschool or child care in the United States (Espinosa, 2007). There is evidence that this does not reflect a difference in cultural attitudes or preferences but rather a lack of information and unequal access (Barnett & Yarosz, 2007). Across all racial groups, close to half of California's 3- to 5-year-olds are enrolled in preschool or child care (47%), whereas only 37% of 3- to 5-year-old Latinos are similarly enrolled (Lopez & de Cos, 2004)—if they live in a household where no one over the age of 14 speaks English fluently, the enrollment rate drops further. Not surprisingly, pre-K and kindergarten children are much more likely to be African American or Latino than are their teachers (Clifford et al., 2005; National Center for Education Statistics, 1999), and Latino children are far more likely than are other children to speak a language different than their teachers (Clifford et al., 2005). Thus, although in many ways preschool programs are explicitly intended to foster the early school success of children from highly diverse (culturally, economically, linguistically) backgrounds and reduce the transition stress and strain that children and families experience, such programs are not widely available and often do not reach these constituencies. As we show later in this section, the growth rate of these groups will place considerable pressure on early education programs and is a major challenge to be addressed.

### **Funding, scope, and administrative support structures**

These three major types of center-based preschool programs differ in their governance and administration, funding, and program standards, largely because of differences in the major government programs that fund them. To understand this situation, it is useful to have some sense of the magnitudes of funding involved. Federal funding for child care assistance exceeded \$8 billion in 2008, and states contributed additional funds, making this the largest source of public funds for early care and education. Precise figures are not available, but private child care centers for 3- to 5-year-olds likely received less than half that total because funds support both older and

younger children and because funds may be spent on home-based child care. In 2008, Head Start programs received around \$6 billion from the federal government to serve 3- and 4-year-old children. Public pre-K spent more than \$5 billion in 2008 in funds administered by the states for regular education, exclusive of special education funds for children with disabilities, to serve mostly 4-year-olds in the year before kindergarten. In 2009, the federal government increased annual funding for child care assistance and Head Start by \$1 billion each through the economic stimulus legislation, but efforts to set aside Title I funding for pre-K failed in Congress (Barnett & Frede, 2009).

The most complicated set of major public expenditures for early care and education services is for child care. As noted earlier, child care assistance can support children from birth to 13 years and may go to home-based caregivers, including relatives, as well as to child care centers. The largest public child care assistance efforts are the federal Child Care Development Fund (CCDF), which provides block grants and triggers additional required and optional state spending (about \$12 billion); the Child Care Food Program (\$2.2 billion); and tax credits from the federal and state governments (about \$3.5 billion; all estimates from Barnett & Frede, 2009). The CCDF provides block grants to the states and territories and requires state contributions to obtain federal funds. The CCDF also permits states to transfer up to 30% of Temporary Assistance to Needy Families funds to the CCDF and to spend those funds directly on child care. Funding for CCDF has more than tripled since 1996, and states have great flexibility in its administration. Most CCDF funds are distributed through vouchers, and about 60% of the children funded attend centers, with the remainder in home-based and informal care. In addition, expenditures of private funds (primarily parents paying fees) are substantial and virtually impossible to estimate accurately.

The three major public funding categories—child care, Head Start, and pre-K—have important differences, beginning with their goals. They all share an emphasis on increasing access to services for children from low-income families (only a few states have universal, rather than targeted, pre-K programs). Child care funding tends to emphasize facilitating parental employment, even though it is recognized that child development is also a goal. It is important to note that only about 5% of CCDF funds are set aside for quality enhancements. About a quarter of children receiving child care assistance are in unregulated care, and in any case, state child care regulations tend to focus on ensuring child safety rather than support for optimal learning and development (Zigler, Marsland, & Lord, 2009). Thus, public funds that flow to child care are only very loosely coupled with assets that could improve child development, and when coupled, the linkage is often passive and unintentional. Head Start has a broad array of goals, including child development, family-parent engagement and education, and to some extent community development. Head Start has tended to pay little attention to its potential role as promoting parental employment by providing child care and, in recent years, has focused more strongly on its

role in promoting child development. State-funded public pre-K is most often defined as a part-day program focused on education and school readiness. Recent years have seen some movement toward greater integration of the child care and education aims and functions of these programs, particularly in universal pre-K programs in which children are served by private child care centers or in wrap-around programs that connect part-time public programs with child care subsidies for whole-day enrollment. For the most part, public funding streams have led programs to ignore the reality that, in the preschool years, education and child care are inextricably tied together; attention to one and not the other results in a lost opportunity to optimize and intensify support for children and families and to promote child development and learning.

Efforts to create a more uniform system of early childhood services or even to increase cooperation among child care, Head Start, and pre-K together are hindered by the separate administrative and governance structures for their respective public funding streams. In this way, policy misalignments create serious problems at the program and classroom levels. Child care standards are set through state social services or health departments. Child care centers may be operated by for-profit, nonprofit, or religiously affiliated organizations. Head Start standards and regulations are set by the U.S. Department of Health and Human Services at the federal level, and states have no administrative authority over local Head Start agencies. Local Head Start agencies are private organizations responsible for their own administration, boards, and parent councils. Pre-K is administered at the state and local levels. State education departments solely administer pre-K in 26 of 38 states with programs. Six other states jointly administer pre-K through Education and Human Services, and the rest use a variety of agencies. If operated by the public schools, programs are governed by a local Board of Education as well as the state. However, increasingly, state pre-K programs fund private centers and may do so directly rather than through local Boards of Education. Given the variations in federal, state, and local control, program standards and schedules vary greatly across these major program types, as do monitoring and accountability. The result is a stunning cacophony of regulation; competing aims; blended funds; and lack of coherence in program design, curriculum, and staffing, with many programs spending precious dollars, time, and staff attention on simply managing and processing all the paperwork. There is no question that policy and funding coherence must be a major aim of future efforts to improve access to and quality of effective early education and child care.

### **Children, families, and the preschool workforce**

When examining early education opportunities in the preschool period, one will notice that the features of these opportunities differ as much as children do. Because of discrepant policies, fragmented workforce characteristics, and the resulting uneven quality of early education learning opportunities, there is really no system for the support of early learning and development.

**Fragmented policies create fragmented experience.** A widely understood example of policy fragmentation and its impact on experience is the set of regulations regarding access to kindergarten–Grade 12 (K–12) opportunities. The age for compulsory school attendance in the United States ranges from 5 to 8, and kindergarten attendance is mandatory in some states and optional in others (Vecchiotti, 2003). Kindergarten lasts 2.5 hours in some states and a full day (6–7 hours) in others (Vecchiotti, 2003), and state-funded pre-K programs range from as short as 2.5 hours per day to as long as 10 hours per day (D. Bryant et al., 2004).

Programs for younger children are even more balkanized and fragmented. As we described previously, the term *preschool* encompasses a diverse array of programs under a variety of names and auspices for children who have not yet entered kindergarten. Again, we focus on only three broad types of programs serving children at ages 3 and 4 linked to largely separate public funding streams: private child care centers, Head Start, and pre-K programs in public education. However, the real landscape of preschool is far broader and more complex.

Enrollment of 4-year-olds is split nearly 50/50 between public (including special education) and private programs. Private programs serve about 1.6 million 4-year-olds, including children receiving public supports such as subsidies to attend these private programs. Public programs include approximately 1 million children in pre-K (regular and special education) and 450,000 4-year-olds in Head Start. At age 3, private programs predominate, serving roughly 1.4 million children. State-funded pre-K (regular and special education) serves only about 250,000 children at age 3, and Head Start serves about 320,000 3-year-olds. The point is that even if we focus only on a narrow slice of preschool—in this case, opportunities for 3- and 4-year-olds—we see little to no evidence of consistency in policy or on programmatic initiatives that create the templates for local opportunities for children and families. In thousands of communities across the country, children, particularly the most vulnerable, are funneled into one program at 3 and then shuffled to another at 4, and yet another at 5—or worse, they are among those who lack access to any of these opportunities. In addition, most of these children have some other sort of child care (subsidized or not) at some point in the day or week. To be concrete, if the public schools cannot manage to offer universal full-day kindergarten, then how does one go about conceptualizing and designing a system of early education and care that is aligned with kindergarten?

**Schedules in preschool programs.** Child care programs typically operate for 10–12 hours a day, 250 days a year. Head Start programs vary their schedules at local discretion despite having a uniform federal administration. Some operate less than 5 days per week, and only 40% of children attend for a full school day 5 days per week during the school year (Barnett, Epstein, et al., 2008). Historically, state pre-K programs have provided only part-day programs, but this has been changing, and at least a quarter of children attend a full school day 5 days per week. Ten state pre-K programs offer at least a full school day, 10

offer only a half day, and the rest leave the decision to local discretion (Barnett, Epstein, et al., 2008). State pre-K services are limited to the 180 or so days that public schools are open. However, some state pre-K and Head Start programs coordinate with child care agencies to provide 10 to 12 hours per day, 250 days per year, with the extra hours paid for by public child care assistance or parent fees. Children often shift from one program to another, making it highly unlikely that they are enrolled full-time in the same program through the preschool period.

**Inconsistency in workforce qualifications.** The attributes and skills of the adults who staff elementary school and preschool educational settings tend to be very different. At the kindergarten level, nearly all states require a bachelor's degree and some level of specialized training in education for adults to be certified to teach, and more than 95% of the teachers in kindergarten classrooms meet both criteria. In contrast, preschool teachers vary widely in their level of training and, on average, receive less training and education than do their elementary school counterparts (Early et al., 2007). There are large differences even among teachers in state-funded pre-K programs. Minimum requirements range from a Child Development Associate (CDA) certificate to an associate's degree to a bachelor's degree (D. Bryant et al., 2004). Furthermore, some states require that the 2- or 4-year degree be in early childhood education or child development, whereas others do not specify a field of study. This variability was reflected in findings from the National Center for Early Development and Learning (NCELD) Multi-State Pre-K study (Clifford et al., 2005), showing that only 70% of pre-K teachers had at least a bachelor's degree in their study of six states with mature pre-K programs, whereas 15% had a 2-year degree and 16% had no formal degree past high school. Thus, even in the fairly well-regulated domains of state-funded pre-K programs and kindergarten, there is substantial variance in the preparation and qualifications deemed necessary for the workforce, a reality that seems indefensible given the developmental needs of 4- and 5-year-olds. How could fostering early literacy for a 4-year-old require such different preparation than fostering literacy in a 5-year-old?

Head Start has national standards for program structure, operation, and teacher credentials but does not require all teachers to have college degrees. Head Start is increasing its educational standards for teachers and educational coordinators, with aims that by the 2011 school year all Head Start teachers will have at least an associate's degree specialized in early childhood and all education coordinators will have at least a bachelor's degree specialized in early childhood. At least 50% of the lead teachers in Head Start must have at least a bachelor's degree by 2013. However, salaries are not commensurate with education in Head Start. Head Start teachers with bachelor's degrees were paid less than \$26,000 on average in 2004 (Hamm & Ewen, 2006). With salaries far below those in the public schools, Head Start cannot help but find it difficult to hire and retain the best teachers, and as the program raises

standards for the educational level of its staff, one wonders if funding will be available to match the market.

For children who do not receive early education services in pre-K or Head Start programs but who are enrolled in the less regulated ecology of family- or center-based child care, exposure to credentialed or degreed staff is even lower (Helburn, 1995; Phillipsen, Burchinal, Howes, & Cryer, 1997; National Institute of Child Health and Human Development [NICHD] Early Child Care Research Network [ECCRN], 2002). The 2007 child care licensing study (National Association for Regulatory Administration, 2009) was one of the more recent and comprehensive studies of the child care workforce. Data gathered from 49 states and the District of Columbia showed that, in the vast majority of states (42), directors of child care centers are only required to have some occupational-vocational training, some higher education credit hours in early childhood education, or a CDA credential. Only one state required that directors of child care centers hold a bachelor's degree. Similarly, for individuals considered as teachers in licensed child care centers, 40 states required some combination of a high school degree and experience. Only 10 states required some vocational program, certificate, or CDA, and 13 states had no requisite educational qualification for child care teachers.

Clearly, we have not settled on a set of minimal qualifications for adults serving in the role of teachers of young children, whether this teaching takes places in private child care, Head Start, or public Pre-K. Moreover, there is too little agreement on the performance standards and metrics for those standards that should be applied to this role, and the preparation and support experiences that should align with such performance standards are woefully out of synchrony. In short, to the extent that teachers play an essential role in fostering high-quality learning opportunities for young children, children passing through the preschool period can expect a stunning level of variation from year to year and setting to setting in even the most basic qualifications (e.g., educational level) of these personnel.

**Access to high-quality preschool experiences is varied and minimal.** Children of color or children in poverty have limited access to preschool care, especially higher-quality care. Furthermore, many children from lower-middle-income families have less access to care than do children from low-income families (Barnett & Yarosz, 2007). A recent study of preschool programs across California found that quality of child care was less than good for a majority of children even in families with incomes over 500% of the poverty line (Karoly, Ghosh-Dastidar, Zellman, Perlman, & Fernyhough, 2008). Overall, private child care tends to have the lowest overall quality, with Head Start and pre-K programs providing somewhat higher and more uniform quality (Administration on Children and Families, 2006; Karoly et al., 2008; Zigler et al., 2009), although there is considerable variability between and within all child care, pre-K, and Head Start preschool programs and big differences among the states (D. Bryant et al., 2004).

In summary, the features of the preschool landscape, including those tightly regulated by policy (such as entry age or

eligibility) and those more directly related to child outcomes (such as quality of classroom interactions), are stunningly variable across settings and across time. Moreover, reasonable evidence suggests that these features also vary as a function of family background factors. The resulting picture is one of too many children and families falling through too many cracks and seams at too many levels. Thus, even in a policy and program development environment in which early education is valued and prominent and recognition of the need to close gaps and seal seams is growing, the realities point to a fragile and vulnerable nonsystem through which many of our most fragile and vulnerable citizens pass.

**The changing characteristics of the children and families served by early education.** The landscape of preschool education we have described has arisen by default, not design. This fragmented system is now supposed to serve diverse children from low-income families, to provide them with the experiences that will accelerate development so they can “catch up” to their more well-buffered peers. Furthermore, this nonsystem is being forced to serve more children and families from more linguistically and culturally diverse backgrounds than it presently serves. For these children, the chasms between home, preschool, and elementary school are particularly deep as a result of barriers that arise from cultural and linguistic variation as well as from inadequate family resources. This section outlines just a few of the characteristics of children and families who will soon enter this ecology, raising questions about its capacity to sustain and foster their developmental progress.

Early childhood education is being investigated as a way to address differences in children’s competencies that are linked to growing up in poor families. Children living in households with poverty-level incomes often lack resources for housing, food, clothing, books, educational resources, high-quality child care—early education, and health care and consequently tend to experience a variety of negative developmental outcomes (Duncan & Brooks-Gunn, 1997; Sewell & Hauser, 1975). Hernandez, Denton, and Macartney (2007) presented poverty-rate estimates that were adjusted for inflation and actual cost of living. Such estimates describe even larger gaps between Whites and most other groups and raise poverty estimates considerably. For example, the readjusted rate suggests that about 31% of young native White children are impoverished, taking into account the cost of child care—early childhood education and health care, whereas the rates for most native race—ethnic minority groups and high-poverty immigrant groups are in the range of 48% to 82% (see Hernandez et al., 2007).

Racial or ethnic minorities are rapidly becoming the majority population; this will happen first among young children (see Hernandez et al., 2007, for details); these children are much more likely than Whites to live in poverty and will place even larger demands on the early childhood system. Moreover, young White children are 2 to 4 times less likely to be poor than are other young children. Thus, the very groups that are growing demographically in the United States are those in which achievement gaps are so pronounced and difficult to

ameliorate. In a nationally representative study of more than 22,000 children who entered kindergarten in 1998, the Early Childhood Longitudinal Study of Kindergarten Children, 68% of the children were classified as English speaking and 18.1% were classified as language-minority children (Espinoza, Laffey, Whittaker, & Sheng, 2006), with almost 13% of the total sample speaking Spanish. More recent estimates suggest more rapid growth among language-minority children, especially among those living in poverty (Hernandez et al., 2007). More than half (52%) of language-minority children and 80% of Spanish-speaking children deemed least fluent in English also had socioeconomic status scores that were in the lowest 20% for the nation (Espinoza et al., 2006). This means that Spanish-speaking children who are learning English as a second language during the preschool years are the *most* likely of all preschool children to live in poverty with an adult who did not have a high school education. Similarly, other studies show that non-English-proficient children are about twice as likely to live in poverty as are English-proficient children in kindergarten through fifth grade, and only about 50% have parents with a high school education (Capps, Fix, Ost, Reardon-Anderson, & Passel, 2004). In addition, the proportion of young children who are White, non-Hispanic is projected by the U.S. Census Bureau to fall steadily in the future, dropping below 50% within 25 years. The corresponding rise of the new American majority does not, however, reflect the emergence of a single numerically dominant group but instead reflects a mosaic of diverse racial and ethnic groups from around the world (see Hernandez et al., 2007, for details). These dramatic increases in linguistic diversity during the early childhood years are now intersecting, and will continue to intersect, with the features of the preschool nonsystem described earlier.

Perhaps the most difficult demands on the early childhood education system involve children of immigrants. In 2000, one of every five children lived in an immigrant family, and this proportion is increasing. Immigrant parents often have high educational aspirations for their children (Hernandez & Charney, 1998; Rumbaut, 1999), but they may have little knowledge about the U.S. educational system, particularly if they have themselves completed only a few years of school and have limited English skills. Parents with limited English skills are less likely to find well-paid, full-time, year-round employment than are English-fluent parents, and they may be less able to help their children with school subjects taught in English. High-quality early childhood education might help both the children to acquire school readiness skills and the parents to understand the U.S. educational system, but there are large debates about what constitutes high-quality care for these children.

Clearly, demographic shifts will place tremendous pressure on early education and child care in the United States in the coming decades, a trend that is well under way in many states, such as California and Texas. The consequences for preschool program eligibility and enrollment, available slots, preparation and support of staff, and program resources such as curricula are enormous. As one reviews the data describing contemporary realities and forecasting future circumstances,



it is abundantly evident that the features of the preschool landscape—connections among child care, preschool, and schools; links between families and the adults who teach their children; capacities of the “system” for fostering positive development in children who increasingly vary by race, culture, language, and economic background—will undergo tremendous strain. The pressures imposed on this context and these relationships by the sheer variability present in the children and families will itself be a considerable threat to the viability of the capacity of preschool to promote positive developmental change.

### The Effects of Enrollment in Preschool on Child Development

Over the past few decades, a substantial body of research evidence has accumulated establishing that enrollment in preschool programs (e.g., child care, Head Start, public pre-K) can improve the learning and development of young children. To be clear, in discussing this literature, we attend in this section of the monograph only to results on exposure or enrollment in preschool and its influence on child development, not to whether the quality of a particular program or classroom has an influence. With such a large number of available studies, meta-analysis is a useful tool to summarize findings across this literature. Meta-analysis statistically summarizes findings by accumulating results across studies, with an aim to detect an average across them, and estimating the extent to which features such as study design, program design, and characteristics of the children served may influence the results.

With this in mind, the most recent comprehensive meta-analysis of preschool enrollment effects revealed a substantial positive effect on cognitive development (Camilli, Vargas, Ryan, & Barnett, 2010). The average effect is large enough to close half, or more, of the achievement gap at school entry between lower-income children and their peers. The initial effect of preschool education is the equivalent of 7 points on an IQ test, or a move from the 30th to the 50th percentile for achievement test scores. Moreover, this statistical summary also finds a somewhat smaller, but nevertheless substantive, positive effect on social-emotional development (Camilli et al., 2010).

Dozens of studies have examined preschool education's long-term effects, providing information into elementary school and beyond (Aos, Lieb, Mayfield, Miller, & Pennucci, 2004; Barnett, 1998; Karoly, Kilburn, & Cannon, 2005). Analyses of multiple studies revealed significant lasting benefits in learning, less grade repetition and special education placement, higher rates of high school graduation, and improved social behavior (Aos et al., 2004; Camilli et al., 2010). These effects decline as students move from their immediate experience in preschool to elementary school, to adolescence, and to adulthood follow-up, but they do not disappear. In a comprehensive meta-analysis (Camilli et al., 2010) that controlled for quality of the research design, the estimated effects of preschool

education on children's cognitive development dropped substantially (from about 0.70 standard deviations, *SD*, to 0.35 *SD*) as one moved the outcome assessments from the end of the program through age 10. Cognitive effects were relatively stable thereafter, at about 0.30 *SD* beyond age 10. Interestingly, no significant decline is found for the impact of preschool enrollment on social-emotional outcomes, including delinquency and crime; however, fewer studies have examined these outcomes and many of the measures are by their nature long term. The long-term cognitive effects are large enough to narrow by one third the achievement gap between low-income children and their more advantaged peers.

Although meta-analysis is useful for summarizing findings and can accommodate individual studies that vary in their methodological rigor, representativeness, and sample size, when ethical and feasible, large-scale randomized trials are the preferred method for addressing well-defined questions about the impacts of policy (Feuer, Towne, & Shavelson, 2002). The reason is that the randomization allows causal inference to be made from study findings and the large scale facilitates generalization to a larger population. Even small randomized trials can provide useful estimates, particularly if results can be compiled across multiple small trials with somewhat different programs, populations, and contexts. Such replication is important for understanding how program outcomes depend on what is provided, who is served, and other circumstances (e.g., K–12 policies or economic conditions).

Various quasi-experimental methods have been developed to estimate the effects of policies and programs when randomized trials are not available or may not be possible. Studies using these designs devote considerable effort and attention to the problem of disentangling family influences from program influences. The potential to obtain valid estimates depends to some extent on the richness of the data regarding families and family processes (that operate as selection factors) and of the data regarding out-of-home preschool program experiences, as well as on the extent to which these data and data on child development are available over time (Todd & Wolpin, 2003). At one end of the spectrum, some studies have followed children and families from infancy, collecting intensive data on experiences in the home and centers as well as on child development from year to year. At the other end, some studies have only parental recall about program type and no measures of children's experiences or development prior to kindergarten.

Given the variations in research design and methods, study findings must be carefully weighed. Careful synthesis of findings across studies requires that each study is interpreted in the context of the others and of the rest of the relevant literature, including research on learning, teaching, and development more generally. In general, within the experimental and well-controlled quasi-experimental literatures, for the most rigorous studies, the largest effects are obtained for enrollment in programs that focused directly on educating the child. Further, the literature also suggests that early childhood education effects may vary depending on child and family characteristics

(Barnett, 2002). Thus, to better understand long-term effectiveness, one must closely examine individual studies.

### **Enrollment in child care and effects on child development and learning**

Most careful studies show that enrollment in typical child care (i.e., child care that has the aim of fostering parent employment and not child learning) has small effects on children's learning and development. Child care in centers, particularly at ages 3 and 4, has somewhat larger positive effects on cognitive development than does home-based child care (Bernal & Keane, 2006; NICHD ECCRN, 2002). Studies in the United States and Canada also have shown that center-based child care has small negative effects on social-emotional development and behavior (Baker, Gruber, & Milligan, 2008; Magnuson et al., 2007a; NICHD ECCRN, 2003); that is, children enrolled in more hours of center-based care tend to display somewhat higher levels of disruptive problem behaviors than those enrolled for fewer or no hours. Negative effects may increase with number of years in care and be lower when children attend higher-quality programs (Love et al., 2003; NICHD ECCRN, 2003).

Higher-quality child care is associated with larger learning gains and better social and emotional development (Burchinal & Cryer, 2003; McCartney, Dearing, Taylor, & Bub, 2007; NICHD ECCRN & Duncan, 2003; Peisner-Feinberg & Burchinal, 1997; Ruopp, Travers, Glantz, & Coelen, 1979; Vandell, 2004). In such studies, child care quality is typically assessed via qualities of the caregivers' involvement with children (warmth, language stimulation, responsive care) or aspects of the setting itself (fewer children, stimulating and age-appropriate materials, safety). Some studies have found larger benefits for children from low-income families (Caughy, DiPietro, & Strobino, 1994; NICHD ECCRN & Duncan, 2003). In most of these studies of either child care quantity or quality, children are not assigned randomly to variations; thus, statistical controls are used to isolate the effects of child care features on developmental outcomes.

Finally, child care subsidies increase employment for mothers of young children, although some research suggests that child care subsidy policies also can increase use of poor-quality care and decrease the stability of care arrangements, thereby harming both cognitive and social-emotional development (Blau & Currie, 2006; Blau & Tekin, 2007; Herbst & Tekin, 2008; Lefebvre & Merrigan, 2008; Tekin, 2007). As all these studies have significant methodological limitations, they must be weighed carefully. Because children cannot be randomized to conditions, study results may reflect unobserved differences between children and families rather than program effects (Larzelere, Kuhn, & Johnson, 2004; Shadish, Cook, & Campbell, 2002). For example, if parents are more likely to enroll children with higher levels of behavior problems in child care centers rather than keep them at home or with relatives, then centers would appear to have negative effects when, in fact, that may not be the case.

Child care effects also tend to be small over the long term, with associations between features of care and outcomes declining as the time period extends into school. However, in addition to the direct effects of attending child care, children benefit from long-term increases in family income resulting from increases in maternal employment (although work could lead mothers to reduce time with their young children, perhaps partially offsetting income benefits). The most rigorous long-term studies of child care effects have found that both positive and negative effects tend to be smaller in the long term. For example, in the NICHD Study of Early Child Care and Youth Development, higher child care quality is associated with slightly higher vocabulary scores through fifth grade and academic skills at 15 years of age, more time in child care is associated with slightly more risk taking and impulsivity at 15 years of age, more time in child care beginning at young ages is related to higher ratings of problem behaviors by teachers in preschool through first grade, and more time in center-based care slightly increases teacher-reported behavior problems through elementary school (Belsky et al., 2007). The Early Childhood Longitudinal Study Kindergarten Cohort of 1998 studies, which have somewhat less capacity to eliminate confounds and assessment of care experiences than the NICHD study, revealed that center-based programs have small residual benefits for reading and math test scores until the end of third grade (Magnuson et al., 2007a, 2007b; Magnuson, Meyers, Ruhm, & Waldfogel, 2004). Other studies provide additional evidence that center care has lasting benefits for academic achievement in reading and math. Overall, long-term positive effects appear to be strengthened by higher quality and to be larger for children from low-income families and, in some studies, for boys (Huston, Walker, Dowsett, Imes, & Ware, 2008; Peisner-Feinberg et al., 2001; Sylva et al., 2008).

Experimental studies conducted with very high-quality educationally focused child care indicate that better results can be produced for the time in which children are enrolled in care. The Abecedarian study (Ramey et al., 2000) used a randomized design to evaluate the effects of a full-day (6–8 hours), year-round educational program from about 4 months of age to kindergarten entry. This study followed 111 children from program entry through age 21, with a largely intact sample (Campbell & Ramey, 2007). The Abecedarian program produced large initial gains in IQ that remained statistically significant, albeit smaller, over time. There were significant positive effects on reading and math achievement from ages 8 to 21 that persisted, with only a very slight decrease in magnitude over time. This educationally focused child care intervention reduced grade retention and placement in special education by 23 percentage points each. Attendance at a 4-year college was significantly different: 36% for the program group versus 14% for the control group (Barnett & Masse, 2007; Campbell & Ramey, 1995; Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; McLaughlin, Campbell, Pungello, & Skinner, 2007; C. T. Ramey et al., 2000).

The Abecedarian study also found long-term effects beyond schooling and cognitive skills. At the young adult follow-up,

members of the program group were more likely to have a skilled job, less likely to have become teen parents, and less likely to smoke marijuana. Effects were not found on social development or behavior during the program or in later delinquency and crime. However, control group involvement in crime and delinquency was low, making it difficult to improve on an already relatively good outcome. Finally, the free child care significantly improved mothers' long-term employment opportunities and earnings, a valuable outcome not likely to be produced by part-day, part-year programs.

The Abecedarian study does not stand alone as evidence of the long-term effects of very-high-quality care from the first year of life to age 5. Other randomized trials replicate key findings of the Abecedarian study regarding effects on children (Campbell et al., 2008; Garber, 1988; McCormick et al., 2008; Wasik, Ramey, Bryant, & Sparling, 1990). The Abecedarian program's effects on maternal earnings also are broadly confirmed by the evidence from studies of the effects of child care on employment referred to earlier. Considering all of the studies of child care together, substantially enhanced child care could have large positive effects and economic benefits even though current programs do not.

This gap between "what could be" and "what is" in terms of the nature and impact of child care is an essential take-away message from any review of the literature on child care impacts and policy. With the Abecedarian study having demonstrated marked gains in school readiness and school-age outcomes for high-risk children more than 25 years ago, perhaps the fundamental question facing policy is whether highly effective programs can be scaled up. These experimental, educationally focused programs very clearly indicate that achievement and developmental gaps for poor children can be greatly narrowed, if not eliminated, yet the failure to replicate such effects at larger scale or even in modestly scaled parallels is notable. Interestingly, literature on effects of child care in other countries suggests a somewhat more positive set of benefits for programs operating at scale; in nearly every case, such programs are intensive, full-day opportunities with care providers that focus on promoting learning and development and that operate in a much more coherent policy and funding context.

### **Head Start and its impacts on child development and learning**

The strongest Head Start study to date, in terms of the rigor of the design and depth of assessment, is the National Impact Study (NIS) of a large sample of children across the country randomly assigned to attend Head Start or not at ages 3 and 4. As reported, the estimated positive effects on cognitive learning after 9 months of Head Start were fairly small overall. Positive effects were smallest for broad cognitive measures and somewhat larger (still small overall) for more limited sets of literacy skills easily taught and mastered in a brief time (Puma et al., 2005). No negative effects were found on socioemotional development, and behavior problems and hyperactivity were significantly lower for the Head Start 3-year-olds. Reflecting

the comprehensive services and family-oriented nature of Head Start, access to dental care was improved, and child health, as reported by parents, was modestly improved for 3-year-olds. Subsequent follow-up found that the modest initial cognitive advantages from a year of Head Start disappear by the end of kindergarten, and the control children catch up (U.S. Department of Health and Human Services, Administration for Children and Families, 2010). Although some researchers have expressed concerns related to the study design (specifically the existence of "crossovers," i.e., children whose experience did not actually correlate with the study design because they crossed from one study group to the other), the general pattern and magnitude of effects remain the same when adjustments are made for crossovers (Ludwig & Phillips, 2007).

To put the results of the NIS in a broader context for interpretation, one must first recall that the NIS reflects a national sampling strategy and thus is an evaluation in the broadest sense of Head Start impact across a very wide range of variation in children, communities, and programs. With this in mind, on the broadest measures of cognitive abilities, the largest estimated effects are only 20% to 33% of the average effects in the preschool effects literature. More specifically, programs producing effects of this magnitude would close no more than 10% to 20% of the achievement gap, and as effects decline later, the long-term impact of Head Start enrollment on the achievement gap could be no more than a 5% reduction in the achievement gap, on average.

Studies of specific Head Start programs have found larger impacts. For example, a small, randomized trial of Head Start for 4-year-olds in one program found cognitive gains that were substantially higher than those in the NIS. That study also found a very large effect on dental care, as well as positive effects on health care (Abbott-Shim, Lambert, & McCarty, 2003). A rigorous quasi-experimental study of Head Start's initial effects was conducted in Tulsa, Oklahoma, where Head Start teachers have 4-year college degrees and early childhood teacher certification and are paid public school salaries and benefits (Gormley, Phillips, & Gayer, 2008). This study found effects on literacy and math that were considerably larger than those in other Head Start studies, including comparable estimates from the NIS. By contrasting these results for specific programs with the NIS results, it is possible to shed some light on what factors may account for more and less effective programs. For example, Head Start's national policies that lead to low teacher qualifications and compensation may well limit the program's educational effectiveness, when contrasted with the program in Tulsa, whereas in other circumstances, it could be that more effective programs have stronger, more educationally focused curricula and professional development, all of which are masked in the larger NIS.

A few nonexperimental studies have used approaches designed to reduce or eliminate the kind of selection bias that afflicts studies of Head Start impacts, such as those conducted using the Early Childhood Longitudinal Study of Kindergarten Children sample. These rigorous nonexperimental studies found positive Head Start effects on achievement, with

estimates of initial impacts similar to those from the randomized trials noted earlier (Currie & Thomas, 1995, 1999), and some have also looked at longer term effects. The studies found lasting effects on achievement test scores and grade retention for White and Hispanic children but not for Black children. Grade repetition for Hispanic children age 10 and older was found to be substantially reduced (Currie & Thomas, 1995, 1999). In addition, the studies found that Head Start increased high school graduation rates by 22 percentage points for White children and decreased arrest rates by 12 percentage points for African American children (Garces, Thomas, & Currie, 2002). Note that comparisons to more rigorous studies suggest that the differences in results by ethnicity could reflect limitations of the methods and data rather than real differences in outcomes (Barnett & Camilli, 2002; Ludwig & Phillips, 2008).

One particularly rigorous nonexperimental study relies on variations in historical patterns of Head Start funding across counties to estimate Head Start's effects on child health and educational attainment (Ludwig & Miller, 2007). This study found that Head Start decreased mortality among children ages 5 to 9 from causes plausibly affected by Head Start health services; in addition, Head Start was associated with increased high school graduation and college attendance. Positive effects were found for boys and girls and for Blacks as well as Whites. Although effects were not clearly found on eighth-grade test scores, the estimated range of possible effects on test scores is wide enough to encompass the modest positive effects of Head Start on achievement that have been found in other studies. However, these effects refer to a time prior to the availability of the state children's health programs and other services that are available today.

In summary, controlled evaluations of Head Start impacts generally show modest effects, on average, for child learning and developmental outcomes. Effects are larger for programs that are more educationally intensive and for outcomes more closely tied to the kind of inputs being offered, whether they be access to dental care or learning letters. In some sense, the lesson from this work again reflects the staggering variation in program design and delivery—this variation swamps the impacts of successful programs when aggregated together, but indeed there are pockets of effective programs evident within the broader population of Head Start programs, and the attributes of those programs may be important “concept proofs” for what could be modeled at a larger scale.

### **Effects of preschool programs**

Similar to Head Start and child care, state and local pre-K programs vary tremendously in their funding, structure, and practices, which limits the usefulness of generalizations about their average effectiveness. Also, keep in mind that state and local pre-K programs are not necessarily delivered in the public schools. In fact, most state pre-K programs deliver services through Head Start and private providers in addition to the public schools—thus as a sector of early education and care, state-funded pre-K really represents all three forms of preschool that

have been the focus of this discussion thus far. In New Jersey, for example, most children are served in private child care centers that contract with public schools and operate with the same standards, regulations, and funding as public schools. Nevertheless, it is useful to review the findings of individual studies of preschool programs that were funded by research or public funds and pre-K programs funded by state and local government to determine what is known about them.

Two longitudinal studies of preschool education stand out because they are well-implemented, randomized trials of public school pre-K programs (Consortium for Longitudinal Studies, 1983). Although they were implemented with higher program standards than many state pre-K programs, they also share important characteristics with some of today's better state programs. Both studies employed public school teachers who received intensive coaching and supervision, with regular in-depth discussion and feedback regarding teaching practices. Other preschool programs with strong evidence of effectiveness have also had such teacher support, and it has been suggested that strong teacher support is likely to be important to replicating positive results (Frede, 1998). Teachers in both programs also conducted home visits.

The High/Scope Perry Preschool program randomly assigned 128 disadvantaged minority children to either a half-day preschool program with home visits by the teachers or a control group (Schweinhart et al., 2005). Children attended the preschool program for two school years beginning at age 3 (except for a few who entered at age 4). Ratios were much better than is typical of most public programs: six or seven children to each teacher (assistant teachers were not used). This staffing made the Perry program considerably more expensive than the typical state-funded pre-K program. Initial positive effects on broad cognitive abilities after 2 years for the children attending Perry Preschool were large enough to close the entire Black-White and poor-nonpoor test score gaps at school entry.

The initial cognitive advantage from the Perry program declined over time, in part because public school helped the control group catch up once the children entered kindergarten (Berrueta-Clement, Schweinhart, Barnett, Epstein, & Weikart, 1984). There was no persistent effect on IQ, but the positive effects on achievement tests continued through school and were substantial. For reading at age 14 and at age 19, the effects were equivalent to 40% of the achievement gap. In addition, the preschool group had better classroom and personal behavior as reported by teachers, less involvement in youth misconduct and crime, fewer special education placements, and a higher high school graduation rate (Berrueta-Clement et al., 1984; Schweinhart, Barnes, & Weikart, 1993). Through age 40, the program was associated with increased employment and earnings, decreased welfare dependency, and reduced arrests. High school graduation increased from one half to two thirds, the number of arrests by age 27 fell by half, and employment at age 40 showed an increase of 14 percentage points (Karoly et al., 2005; Schweinhart et al., 2005). The Perry program joins the Abecedarian project as an example of a model program with considerable impact that has yet to be replicated at scale,

with benefits approaching those reported for the initial implementation. Whether this failure to replicate is due to the nature of the participants (it has been argued that poverty is more toxic in 2000 than it was in 1970), the educational focus of the program, or challenges in translating model programs to scale, the pattern of diminished returns of scaling holds.

A study of public school preschool education was conducted by the Institute for Developmental Studies (IDS). The study included 402 children who were randomly assigned to a pre-K program or to a control group (Deutsch, Deutsch, Jordan, & Grallow, 1983; Deutsch, Taleporos, & Victor, 1974). Children attended for 1 year at age 4 and afterward entered an IDS kindergarten program. A teacher and an aide staffed each preschool classroom of 17 children. Estimated positive effects at the end of pre-K were substantial for cognitive abilities. The positive effects on cognition remained at about half that level, closing a quarter of the achievement gap through at least third grade. The IDS study also provided follow-up analyses that indicate persistent effects to adulthood on achievement, educational attainment, and employment. However, the study suffers from severe attrition in its sample, which limits the confidence that can be placed in those very long-term findings (Deutsch et al., 1983; Jordan, Grallo, Deutsch, & Deutsch, 1985).

Another randomized trial studied the effects of attending a half-day, university-based preschool education program at age 4 for 291 children whose parents were mostly students at Brigham Young University. This study had fairly high levels of attrition, with only 196 (67%) of the original group found at second- and third-grade follow-up. Attrition rates in treatment and control groups were unaffected by gender, IQ, or social competence. The average IQ of children in the study was a very high 130, the 97th percentile. No statistically significant program effects were found on IQ, but significant effects were found on measures of social competence and school readiness (Larsen, Hite, & Hart, 1983). In second and third grade, the study found statistically significant gains on achievement tests for boys, but not girls (Larsen & Robinson, 1989).

There are no randomized trials of large-scale, state-funded pre-K programs. However, recent studies have used a rigorous quasi-experimental design that emulates the results of a randomized trial under reasonable assumptions (Cook, 2008; Cook, Shadish, & Wong, 2008; Hahn, Todd, & van der Klaauw, 2001). These studies made use of the birthdate cutoff for school entry to generate two groups of children who both entered the program and who were likely to be identical except for birthdate. One group received the program a full year before the other, despite the fact that at the margin they differed in age by only 1 day (Wong et al., 2008). For example, the study of universal pre-K in Tulsa, Oklahoma, showed substantial positive effects on math and literacy test scores at kindergarten entry (Gormley et al., 2008; Gormley, Gayer, Phillips, & Dawson, 2005). Positive effects were found for boys and girls; for White, Black, Hispanic, and Native American children; and for children who did and did not qualify for free and reduced-price lunches (Gormley et al., 2005; Gormley et al., 2008). Positive effects were somewhat larger for minority children (Gormley

et al., 2005; Gormley et al., 2008). The magnitude of the positive effects reported in this study is quite variable, ranging from about the same size as was reported for the meta-analysis discussed earlier to three times that size, notably for outcomes tied to the specific curriculum used in the program. Several features of the Tulsa pre-K program are important when interpreting these effects, notably teacher qualifications and the educational focus of the program. Both public school pre-K and Head Start classrooms in Tulsa employ fully qualified public school teachers paid public school salaries and produce effects that are two or more times larger than those found by the NIS for Head Start in literacy and math. In addition, the literacy effects of Tulsa's public school pre-K are about double those of Tulsa Head Start, whereas math effects are essentially identical for the two programs, reflecting the use of a standard literacy curriculum accompanied by focused professional development.

The same rigorous quasi-experimental approach has been used to estimate the initial effects of 1 year of state pre-K on children's cognitive abilities statewide in Arkansas, California, Michigan, New Jersey, New Mexico, Oklahoma, South Carolina, and West Virginia (Barnett, Howes, & Jung, 2008; Hustedt, Barnett, Jung, & Figueras, 2008; Hustedt, Barnett, Jung, & Thomas, 2007; Wong et al., 2008). Average effects across these eight states were positive for general cognitive ability, for math, and for print awareness (skills in identifying letters and other forms of print). Effects on general cognitive abilities can be directly compared with those in the Perry and IDS studies. The average initial effects for 1 year in these state pre-K programs is about half that of IDS and one quarter that of Perry. The top-performing state pre-K programs (New Jersey and Oklahoma) approach the size of the IDS effect on general cognitive ability. Although these eight state programs are not representative of all state pre-K programs, they are a broad sample and demonstrate the modest, but positive, effects that state pre-K programs can produce on a large scale when they have reasonably high standards.

The NCEDL evaluated impacts of pre-K in the 11 states with the most mature pre-K programs in 2001–2002. The study tracked changes over the pre-K year in children's language, academic, and social skills and examined the extent to which those changes were related to child care quality. Examining change over time provides some, but not complete, adjustment for potential family and child characteristics that could confound observed associations between child care experiences and child outcomes (NICHD ECCRN & Duncan, 2003). Results demonstrated (a) that children showed moderate-sized gains during their pre-K year in language and academic skills that were larger than would have been expected by age alone (Howes et al., 2008) and (b) that the gains were significantly, albeit modestly, related to both the quality of instruction and time spent in specific types of instructional activities (Howes et al., 2008; Mashburn et al., 2008). These gains relating to the quality of the pre-K experiences (but not quantity of exposure) were maintained through kindergarten (Burchinal, Howes, et al., 2008), the last age at which the children were assessed.

Several studies have estimated the effects of universal pre-K on children from nondisadvantaged families to determine whether children from all socioeconomic backgrounds benefit. Relatively large samples allow for separate estimates of children who qualify for a free lunch (below 130% of the poverty line), reduced-price lunch (below 185% of the poverty line or \$39,220 in 2008–2009), or neither (all families with incomes above 185% of poverty). The Tulsa study found positive effects for all three income groups. Effects for the highest income group were on average 87% as large as those for the lowest income group. A statewide study of Oklahoma pre-K found that effects averaged 74% as large for those who qualified for neither program as those who qualified for at least a reduced-price lunch. A similar study of New Jersey's Abbott pre-K program, which is available to all children in 31 cities with large low-income populations, found that effects averaged 81% as large for those who qualified for neither a free nor a reduced lunch. The NCEDL study also found somewhat larger gains among children from homes with income of 150% or less of the poverty line (Howes et al., 2008).

As with Head Start, we must rely on nonexperimental studies for direct estimates of the long-term effects of state and local pre-K programs on a large scale. Direct comparisons indicate that these less-rigorous designs may have underestimated the initial effects of pre-K, sometimes by as much as half (Camilli et al., 2010; Frede, Jung, Barnett, Lamy, & Figueras, 2007; Hustedt et al., 2007). With this in mind, it is notable that the most rigorous of these studies have found that significant effects persist through second grade, although the effects may decline over time (Frede et al., 2007; Hustedt et al., 2007). Also, gains for broader domains of learning decline through second grade (Frede et al., 2007; Hustedt et al., 2007). The nonexperimental studies with the most serious limitations have yielded results similar to those of the least rigorous Head Start studies, but note that some have found that pre-K reduces grade retention and marginally increases test scores in third grade (Fitzpatrick, 2008; Grissmer, Flanagan, Kawata, & Williamson, 2000; Magnuson et al., 2004; Magnuson et al., 2007a, 2007b). Finally, studies using data from the National Assessment of Educational Progress found small positive impacts of state pre-K on test scores and grade repetition (Fitzpatrick, 2008; Grissmer et al., 2000).

Other longitudinal studies of specific state and local pre-K programs provide additional long-term evidence (Gilliam & Zigler, 2001, 2004). Two of the methodologically stronger state evaluations (New York and South Carolina) showed that positive effects on cognitive abilities persisted into elementary school. The New York study also found that pre-K reduced retention in grade. Studies using quasi-experimental methods showed a mixed pattern of positive and null findings on achievement tests but a more uniform pattern of significant reductions in special education and grade retention (Aos et al., 2004; Barnett, 1998; Gilliam & Zigler, 2001). The substantially lower rates of grade retention and special education for children attending pre-K reported by several studies actually explains some of the null findings for achievement test

scores. Many studies compare children in the control group with children receiving pre-K education within each grade level; such comparisons, however, do not take into account the absence of low-performing children from the control group who were retained in an earlier grade or moved into special education (Barnett, 1998, 2002). Few studies have examined long-term effects of statewide programs on behavior, but two separate evaluations of Florida's targeted pre-K program in the 1990s found that it reduced disciplinary problems in the early grades, as determined from official records (Figlio & Roth, 2007; King, Cappellini, & Gravens, 1995).

The most comprehensive long-term study of large-scale public school pre-K is the Child Parent Center (CPC) study (Reynolds, 2000). Chicago's public schools operated the CPC program beginning in the late 1960s. The CPC provided low-income children with a half-day preschool, kindergarten, and a follow-on elementary school component. Some 55% of CPC study students attended CPC preschool for 2 years beginning at age 3 (the remaining students attended the preschool for 1 year beginning at age 4). The preschool program had a licensed teacher and an assistant in each classroom of 18 children and a relatively strong parent outreach and support component. This program design is similar to the best state programs in terms of basic design (i.e., staffing, qualifications, hours enrolled, educationally focused) and cost. Estimated effects on test scores at kindergarten entry were above the average size reported in the meta-analysis, with effects of just 1 year of CPC attendance equal to between 25% and 85% of the achievement gap at school entry (Reynolds, 2000).

The half-day CPC preschool program is sufficiently similar to the Perry Preschool program that CPC could be viewed as a large-scale, though less intensive, replication. Therefore, the extent to which the CPC study confirms the long-term findings of the Perry Preschool study is important. The CPC study found positive effects on the following outcomes: test scores through at least middle school, arrests for delinquency and crime, special education, and high school graduation. The estimated effects are remarkably similar to those in the Perry Preschool study, although sometimes smaller. In addition, the CPC study revealed a significant reduction in grade retention. This pattern is what one would expect from a somewhat less intense dose of the same "treatment," but note that differences in curriculum, population, and location might also contribute to differences in outcomes. As in the Perry Preschool study, effects on cognitive abilities declined over time, but as late as eighth grade, they were still equal to a third or more of the achievement gap. The effects on schooling outcomes are substantial: a 15 percentage point reduction in grade retention, a 10 percentage point reduction in special education placements, and an 11 percentage point increase in high school graduation.

Studies of the educational effects of pre-K in other countries yield findings that are consistent with findings in the United States. A randomized trial with long-term follow-up of high-quality, half-day pre-K in Mauritius found short-term improvements in children's learning and behavior followed by reduced rates of conduct disorder at age 17 and reduced crime rates at

age 23 (Raine, Mellinger, Liu, Venables, & Mednick, 2003). Rigorous quasi-experimental studies in Latin America showed that preschool education increased test scores; decreased school failure; increased educational attainment; and improved attention, class participation, and discipline (Berlinski, Galiani, & Gertler, 2006; Berlinski, Galiani, & Manacorda, 2008). Studies in the United Kingdom found modest positive effects of early education on cognitive and social development that persisted at least through the primary grades for children from all socioeconomic backgrounds (Melhuish et al., 2008; Osborne & Milbank, 1987; Sammons et al., 2005; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). International comparisons found that more preschool education is associated with higher achievement test scores, and high participation rates are associated with less within-country inequality in test scores (Fuchs & Wossmann, 2006; Rindermann & Ceci, 2008; Schutz, Ursprung, & Wossmann, 2008; Waldfogel & Zhai, 2008). The replication of major findings across countries that differ a great deal in their economic, social, and political circumstances suggests that they are very broadly generalizable.

Perhaps because many preschool education programs have been half day, few studies have estimated their effects on maternal employment. One study found that public preschool programs and less expensive private programs increased employment of single and married mothers of 3- and 4-year-olds and that public kindergarten increased employment of single and married mothers of 5-year-olds (Gelbach, 2002). The estimated increases were 6% to 15% for employment, hours, and earnings for mothers of 5-year-olds and more than 20% for mothers of younger children. Another study of the effects of public kindergarten on maternal employment revealed smaller effects for single mothers and no effects for married mothers (Cascio, 2006). Neither study took into account whether the programs were part day or full day, a potential problem because half-day kindergarten could have little effect on employment. A study of single mothers who had received public assistance in Massachusetts found that both the availability of Head Start and state funding for preschool education for low-income children increased maternal employment (Lemke, Witt, & Witte, 2007). Studies of preschool education in other nations have also found positive effects on maternal employment (Berlinski & Galiani, 2007; Schlosser, 2006).

### **Economic analysis of the effects of preschool**

Three of the studies reviewed earlier provide sufficient methodological rigor, breadth of measurement, and length of follow-up to support comprehensive benefit-cost analyses that compare the economic value of the benefits from investing in preschool programs to their costs. These are the Perry Preschool (Barnett, 1996; Belfield, Nores, Barnett, & Schweinhart, 2006), Abecedarian (Barnett & Masse, 2007), and Chicago CPC (Temple & Reynolds, 2007) studies. Features of these three studies are presented in Table 1. All three studies found that even

with the modest effects noted earlier, benefits exceed costs by a substantial margin, and all three concluded that preschool programs are sound public investments (Barnett, 2007). Important sources of economic benefits in all of the studies are reductions in subsequent schooling costs (as a result of reduced needs for special education and grade repetition) and increases in adult earnings. The two preschool programs also yielded substantial benefits from reductions in costs associated with crime and delinquency. The Abecedarian and Perry Preschool studies also found evidence that the preschool program reduced risky behaviors such as unprotected sex and smoking, which suggests that later health costs might be lowered, but note that this benefit was estimated only for the Abecedarian program. Finally, only the Abecedarian program had substantial child care benefits in the form of long-term increases in earnings for the mothers of children who attended the program.

Comparisons across these three studies can be informative, but they must be done cautiously, particularly because differences in benefits could be due to differences in the programs, populations, or contexts. The two preschool programs are less expensive because they are part day and serve children for only 2 years prior to kindergarten, whereas the Abecedarian program offers full-day, year-round child care beginning in the first year of life. One striking difference in benefits is readily explained. Only the Abecedarian program sought to provide child care that would enable parents to work, and that difference yielded substantial benefits. A case can be made that the extra hours required to turn a preschool program into effective full-time child care essentially pay for themselves in increased maternal earnings.

Another difference in estimated differences raises more perplexing issues. The Perry and Chicago CPC programs reduced crime. The Abecedarian program did not. Differences in population and neighborhoods might explain these results; however, program differences also could be the reason. It is evident that curriculum is important for a program's effects on self-regulation and socioemotional development (Barnett, Jung, et al., 2008; Schweinhart, Weikart, & Larner, 1986)—to improve those outcomes, programs need to have curricular emphases, teacher support, and a focus on those areas. There were early indications that Abecedarian had negative impacts on social and emotional development (Haskins, 1985), and others have suggested that long hours of child care beginning at an early age might harm social and emotional development (Belsky et al., 2007). It is plausible that curriculum and hours in care might interact such that children enrolled for longer hours require the support of a well-delivered curriculum in social development to counter the apparent challenges associated with exposure for longer time periods. These results suggest the value of research on how to secure both child care and socioemotional development benefits.

Rather than rely on these three studies alone, we use them as a kind of Rosetta stone to work with the literature as a whole to draw conclusions about the economic returns of preschool programs and the development of policies that yield large benefits relative to costs. The programs evaluated in these studies are

**Table 1.** Three Benefit–Cost Analyses: Study, Program Design, and Major Findings

Variable	Carolina Abecedarian Project	Chicago Child–Parent Centers	High/Scope Perry Preschool
<b>Demographics</b>			
Year began	1972	1983	1962
Location	Chapel Hill, NC	Chicago, IL	Ypsilanti, MI
Sample size	111	1,539	123
Research design	Randomized	Matched neighborhood	Random assign
Ages	6 weeks to 5 years	3–4 years	3–4 years
Program schedule	Full day, year round	Half day, school year	Half day, school year
<b>Findings</b>			
Increased IQ, short term	Yes	Not collected	Yes
Increased IQ, long term	Yes	Not collected	No
Increased achievement, long term	Yes	Yes	Yes
Special education	25% vs. 48%	14% vs. 25%	37% vs. 50%
Retained in grade	31% vs. 55%	23% vs. 38%	35% vs. 40%
High school graduation	67% vs. 51%	62% vs. 51%	65% vs. 45%
Ever arrested as juvenile	45% vs. 41%	17% vs. 25%	16% vs. 25%
Mean number of adult arrests	1.7 vs. 1.5 (age 21)	Not applicable	2.3 vs. 4.6 (age 27)
Adult smoker	39% vs. 55% (age 21)		42% vs. 55% (age 40)
<b>Cost-benefit results (2008 dollars, discounted at 3%)</b>			
Cost	\$75,568	\$8,830	\$18,481
Child care	\$32,883	\$2,177	\$1,104
Maternal earnings	\$81,821	\$0	\$0
K–12 cost savings	\$10,519	\$6,401	\$9,690
Postsecondary education cost	–\$9,676	–\$732	–\$825
Abuse and neglect cost savings	Not estimated	\$988	Not estimated
Crime cost savings	\$0	\$43,932	\$208,956
Welfare cost savings	\$233	Not estimated	\$897
Health cost savings	\$21,168	Not estimated	Not estimated
Earnings	\$44,681	\$36,475	\$78,631
Second generation earnings	\$6,812	Not estimated	Not estimated
Total benefits	\$188,441	\$89,698	\$298,453
Benefit-cost ratio	2.5	10.2	16.2

hardly typical of those experienced by young children today; they are more intensive and expensive than is common. They had well-paid, highly qualified teachers with strong supervision. Staffing ranged from the Perry Preschool's one teacher for every 6 children to Chicago's teacher and aide for every 16 children. However, all three served disadvantaged children, two of them in the public schools, and the Chicago CPC program is quite similar to the better state pre-K programs in cost, intensity, and design. The initial effects of the Chicago CPC program were of the same size as effects found for state pre-K programs in Oklahoma, New Jersey, and other states with programs.

All three programs served disadvantaged children, and programs serving general populations might be expected to have somewhat smaller benefits. However, the difference is not so large as to suggest that programs serving a broader population would not pass a benefit–cost test. In addition, larger benefits might be expected for some children not included in these studies, particularly children from non-English-speaking backgrounds (Gormley et al., 2005). Conclusions are more difficult to draw about Head Start, which is relatively expensive compared with other programs and yet has been found to have relatively small effects in the national randomized trial. Calculations of likely economic benefits based on the evidence on the very long-term effects of Head Start suggest that its benefits

may exceed costs (Currie & Thomas, 1995; Deming, 2009; Ludwig & Phillips, 2008). However, the lackluster follow-up results from the national randomized trial suggest that little certainty can be attached to this conclusion.

### Summary

Compelling evidence from well-controlled research shows that preschool programs have lasting positive effects on young children's cognitive and social development. The evidence comes from studies of child care, Head Start, and public school programs using a wide range of research methods, including experiments. Lasting positive impacts have been found for large-scale public programs as well as for intensive programs implemented on a small scale, but even some of the intensive small-scale interventions were public school programs. Some evidence has shown negative effects on social behavior, but the negative effects have not been confirmed by experimental studies. Among the three sectors of preschool, subsidized child care today has, at best, small positive effects on early learning and development, and current policies are such that some care has small negative effects on children—reducing school readiness, perhaps largely because some child care may contribute to a rise in problem behavior. To the extent



that there is a potential problem, raising quality and using an appropriate curriculum may avoid it. Findings of long-term effects in the United States have been replicated by studies in a wide range of other countries around the globe, indicating that in broad terms the results are highly generalizable.

Positive long-term effects of preschool education include increased achievement test scores, decreased grade repetition and special education rates, increased educational attainment, higher adult earnings, and improvements in social and emotional development and behavior, including delinquency and crime. Obviously, if programs provide child care, they also benefit parents and can increase earnings in both the short and long term. Increased income that results from providing families with free or subsidized child care also has positive benefits for young children's development, but these are likely small relative to the direct benefits of high-quality preschool programs for children.

How important are long-term effects? One way to address this question is to ask how large the effects are relative to the achievement gap between children in poverty and their more advantaged peers. Programs commonly produce long-term effects equal to 10% to 20% of the achievement gap, with more intensive and longer lasting programs producing larger, at times much larger, effects. Cost-benefit analyses provide an indicator of program impacts that reflect the value of a program across a range of possible outcomes. These analyses have shown that the value of benefits is very large relative to costs, even for very costly intensive preschool programs—at the high end, starting at age 3, roughly \$300,000 per child enrolled for a program. The less costly CPC program was found to have benefits that are an order of magnitude greater than its cost, in the ballpark of \$90,000 per child. Stronger state pre-K programs produce essentially the same size effects as did CPC. Head Start's benefits must be judged uncertain given the latest findings on effects after school entry, but it might still pass a cost-benefit test. In summary, the estimated economic value of program impacts on child development can be substantial relative to cost, but this depends on adequate levels of program effectiveness. The economic benefits of child care for parental earnings add even more to the return.

Who can benefit from educationally effective preschool programs? All children have been found to benefit from high-quality preschool education. Claims that preschool programs only benefit boys or girls, one particular ethnic group, or just children in poverty do not hold across the research literature as a whole. Children from lower-income families tend to gain more from good preschool education than do more advantaged children. However, the educational achievement gains for non-disadvantaged children are substantial, perhaps 75% as large as the gains for low-income children. Some policymakers concerned with reducing the achievement gap between children in poverty and those who are nondisadvantaged might conclude that preschool programs should target only children in poverty. Such an approach ignores evidence that disadvantaged children appear to learn more when they attend preschool programs with more advantaged peers, and they also benefit from peer effects on learning in kindergarten and in the early elementary grades when their classmates have attended high-quality preschool programs.

However, we must be very clear about the magnitude of effects, whether short or long term. Any of the evaluations cited previously indicate preschool programs produce modest effect sizes overall, with somewhat greater effects for low-income children, and some evidence that gains last through the early grades. Typical child care has considerably smaller short- and long-term effects than more educationally focused programs such as selected Head Start programs or higher-quality preschool programs linked to public education. Across studies and program models and/or features, effects range from near zero to almost a standard deviation on achievement tests (the size of the achievement gap for poor children). There is no evidence whatsoever that the average preschool program produces benefits in line with what the best programs produce. Thus, on average, the nonsystem that is preschool in the United States narrows the achievement gap by perhaps only 5% rather than the 30% to 50% that research suggests might be possible on a large scale if we had high-quality programs. From the standpoint of policy alignment with research findings, it is abundantly evident that the wide variation in program design, models, curriculum, staffing, auspices, funding, and level of educational aims plays a major role in the disappointing, albeit statistically significant and in that sense meaningful, impacts of preschool on child development.

### **Impacts of Program Quality on Child Development and Learning**

There are countless features of preschool programs bundled within the concept of "quality," such as who is eligible to attend, group size, adult-child ratios, minimum qualifications of teachers, additional services available to children or families, length of the day, curriculum and approaches to fostering child development, salaries, the amount or type of teacher professional development, and whether and how child learning is assessed. These features vary widely within and across programs or types of programs, as we suggested in the first section. Policymakers, program directors, teachers, teacher educators, and parents each face challenging decisions regarding the selecting of features for programs for children. As we have discussed, despite the very large number of possible combinations of features that, in part, define the preschool experience, enrollment in preschool (and all that it means) appears to provide developmental benefits to children (Cross et al., 2009). As we show in this section, quality matters.

When policymakers look to the research literature to design publicly funded preschool programs, questions about quality are often framed in terms of which features should be regulated and what levels for those features will be considered acceptable. Such questions have implications for the cost of providing programs and the benefits for children who attend, so relying on evidence is important. But the research evidence varies greatly in terms of its quality and ability to provide clear answers to questions about program design and quality. The most definitive answers come from experiments, but these studies often address only questions regarding the efficacy of

a particular treatment, as we have presented earlier in this monograph. Recently, experimental controlled evaluations of treatments to improve preschool have shown that changing specific features of child care or preschool also improve child outcomes. However, most studies of child care quality features tend to be observational, and samples tend to be larger and more diverse, but the ability to draw causal conclusions is more limited. We organize this discussion about effects of various program features on child outcomes within the framework of research on program quality and its impacts; that is, we draw mostly from the large-scale, nonexperimental literature. In this context we are assuming that children already are enrolled in preschool, and the focus of study is the set of program features that could (and do) vary so widely and may have wide-ranging impacts on child development; these features, for purposes of our discussion, are bundled within the concept of quality.

### Defining program quality

As we have discussed, numerous research studies have documented short-term and long-term benefits of attending preschool, and this has led to the creation and expansion of public programs nationwide (Barnett, 1993; Gormley et al., 2005; Lazar, Darlington, Murray, Royce, & Snipper, 1982; Magnuson et al., 2004; Puma et al., 2005; Reynolds, 2000; Reynolds, Temple, Robertson, & Mann, 2002; Schweinhart et al., 2005). Once programs are established, policymakers and program administrators must then establish policies that regulate the design and structure of these programs so they maximize the benefits for children who attend. Nearly every state regulation pertaining to pre-K programs emphasizes the importance of providing high-quality services. However, despite the attention directed toward high-quality pre-K, there is no single or uniform approach to defining or measuring pre-K quality.

Definitions of pre-K program quality generally describe two broad classes of program features: those that pertain to structural elements of a program and those that have to do with processes (Lamb, 1998; Phillips & Howes, 1987; Vandell & Wolfe, 2000). Structural quality concerns those aspects of programs that describe the caregiver's background, curriculum, or easily observed or reported characteristics of the classroom or program. They have typically been targeted by regulation or financing and include the nature and level of teacher training and experience, adoption of certain curricula, class size, child-teacher ratio, and whether the program offers additional services to children and their families. Structural features of programs are typically quite static—they often reflect one-time decisions or features that do not vary within a given exposure. These features are often viewed as necessary for creating the opportunity for the caregiver to create a high-quality preschool classroom, but their provision does not guarantee that children will receive high-quality care.

Process quality refers to children's direct experiences with people and objects in the child care setting, for example, the ways teachers implement activities and lessons, the nature and qualities of interactions between adults and children or between

children and their peers, and the availability of certain types of activities. Features of process quality are inherently dynamic and may in part depend on the needs or preferences of a given child: whether a certain puzzle stimulates cognition depends on whether and how the child interacts with it, whether the teacher is encouraging and able to assist the child if he or she is struggling, and whether the teacher uses the opportunity to engage the child in conversation depends in part on the child's behavior. These direct, dynamic interchanges between the child and resources in the preschool setting are often described as *proximal* processes, and it has been argued that these are the features of programs and aspects of program quality that are the mechanisms responsible for the effects of preschool on child outcomes (Lamb, 1998; NICHD ECCRN, 2002; Vandell, 2004). In a similar vein, Cassidy and colleagues (2005) articulated one clear distinction between definitions of process quality and structural quality: Process quality concerns interactions among individuals (e.g., emotional and instructional), whereas structural quality concerns features of programs that do not directly involve interactions between teachers and children (e.g., teacher qualifications, materials and equipment, class size and ratios).

Policymakers interested in ensuring high levels of preschool quality typically base their decisions about which features of quality to promote on empirical evidence that identifies program attributes that are associated with, or better yet causal to, children's adjustment and learning. With that as the aim, across numerous studies of children's development that included structural quality and/or process quality, there is mixed evidence concerning the extent to which various features of preschool quality are directly associated with, or cause, children's developmental progress, either singularly or in combination. What is clear, however, is that the majority of evidence in favor of positive effects attributes such effects to elements of process quality (e.g., D. Bryant, Burchinal, Lau, & Sparling, 1994; D. Bryant, Peisner-Feinberg, & Clifford, 1993; Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; Burchinal, Ramey, Reid, & Jaccard, 1995; Dunn, 1993; Hagekull & Bohlin, 1995; Howes, 1997; Howes et al., 2008; Mashburn et al., 2008; NICHD ECCRN, 2002; Peisner-Feinberg & Burchinal, 1997; Phillips, Howes, & Whitebook, 1992; Pianta et al., 2005).

In addition to identifying the direct effects of quality on children's outcomes, research has also examined how structural and process quality work together to influence children's development. It is commonly assumed that structural quality may not have a direct effect on children's outcomes; instead, structural features affect the process quality that children directly experience in classes that in turn influences their development (Burchinal, Roberts, et al., 2000; Howes, Phillips, & Whitebook, 1992; NICHD ECCRN, 2002). In fact, regulations that mandate higher standards for features of structural quality (e.g., all teachers must have a bachelor's degree) rest on the likelihood that programs that meet these standards also produce high process quality that will enable children to benefit from enrollment. This proposed mediated path—structural quality influences process quality, which in turn influences children's outcomes—is only modestly supported by evidence in the

literature (NICHD ECCRN, 2002). It is also plausible that structural features of quality moderate effects of process quality, such that the effects of a teacher who is skilled at interacting with children (process quality) are higher when that teacher has a level of training that enables better implementation or works in a classroom with a low ratio. Also, for example, when implementing a literacy curriculum, a teacher's interaction skills (process quality) could be counteracted by the demands of a classroom filled with too many children (e.g., group size, an indicator of structural quality, is too high) or a very large number of children from poor households. Policymakers face pressing decisions about features in which to invest resources, and many rely on recommendations of professional organizations that promote the well-being and appropriate education of young children by describing minimum standards of quality. For example, the American Public Health Association and the American Academy of Pediatrics (1992), the National Association for the Education of Young Children (NAEYC; 2005), and the National Institute for Early Education Research (NIEER; Barnett et al., 2007; Barnett, Hustedt, Robin, & Schulman, 2004) each advance a set of recommended standards for structural and/or process features of preschool programs, and they have informed policymakers' and program administrators' decisions about how to invest program resources to design high-quality programs. The NAEYC recommends a comprehensive set of standards related to both process and structural features of child care and preschool programs. These standards include descriptions of necessary classroom characteristics such as positive relationships in classrooms, a wide repertoire of teaching practices, developmentally appropriate assessment practices, and learning environments rich with physical resources. The NAEYC also recommends minimum standards related to teacher preparation, curricula, class size, and child-teacher ratio. Specifically, attaining accreditation from NAEYC requires all teachers participate in professional development training; assistant teachers have at least a high school diploma or general equivalency diploma; and programs meet increased standards for teachers' levels of education, which is being phased in between 2006 and 2020 (NAEYC, 2005). In addition, for classes serving 3-year-olds, the maximum class size is 18 children and the maximum child-teacher ratio is 9:1, and for classes serving 4-year-olds, the maximum class size is 20 children and the maximum child-teacher ratio is 10:1 (NAEYC, 2005). The view within the profession is that such standards contribute to better experiences and outcomes for children (Shonkoff & Phillips, 2000).

A recent addition to these recommended standards comes from the NIEER, a nonprofit organization with a goal of providing policymakers with information that promotes good education for 3- and 4-year-olds. The NIEER-published *The State of Preschool* yearbooks for 2002 through 2008 (e.g., Barnett, Epstein, et al., 2008; Barnett et al., 2004; Barnett, Hustedt, et al., 2007) provide an overall summary of the status of state pre-K initiatives regarding accessibility, funding, and quality. State policies regarding program structure are rated according to whether they meet 10 structural benchmarks that are

considered by the NIEER to be minimum standards for educationally effective preschool programs (Barnett et al., 2004). The 10 benchmarks for program structure, advanced by the NIEER and based on their synthesis of the available scientific evidence, suggest programs should have the following:

1. Teachers with bachelor's degrees;
2. Teachers who have received specialized training in early childhood education, such as licensure or endorsement in the pre-K area or a degree or credential, such as a CDA, in early childhood;
3. At least 15 hr/year in-service training for teachers;
4. Assistant teachers with a CDA or equivalent;
5. A comprehensive curriculum that covers domains of language and literacy, math, science, social-emotional skills, cognitive development, health, physical development, and social studies;
6. A maximum class size that is less than or equal to 20 children;
7. A child teacher ratio of 10:1 or better;
8. At least one meal served each day;
9. Vision, hearing, and health screening and referral for children; and
10. At least one family support service, which may include parent conferences, home visits, parenting support or training, referral to social services, and information relating to nutrition.

In the 2004 state preschool yearbook published by NIEER (Barnett et al., 2004), the authors combined Benchmarks 9 and 10 into "required screen referral and support services" and added a standard benchmark regarding whether the state monitored program quality. All of these quality benchmarks are supported by a mixture of evidence and professional consensus, and they are often used as policy-shaping tools for state legislatures deciding how to expand or construct a high-quality pre-K educational system. In 2008, Alabama and North Carolina were the only states to meet or exceed each of the 10 benchmarks for quality standards, and Arizona, California, Florida, and Texas met only 4; however, not all policies are of equal importance, so these 4 are not judged to be equally poor (Barnett, Epstein, et al., 2008). The authors concluded that most states lack adequate quality standards for their children and that states need to improve policies that enact higher-quality standards (Barnett, Epstein, et al., 2008; Barnett et al., 2004; Barnett et al., 2007). Recent studies (e.g., Mashburn et al., 2008) have shown only modest empirical support for links between aggregate indices that compile structural features of programs and child outcomes. In the next section, we describe in more detail research conducted on specific structural features of preschool.

### **Structural features of programs as predictors of process quality and child outcomes**

**Teacher education.** Teachers' educational level (degrees, certificates, coursework, formal training, and preparation) is the

structural feature to which policymakers, scholars, and program personnel most commonly attend. This focus is in part due to prior research findings suggesting a correlation between teacher education and improved child outcomes in child care (Vandell, 2004). The recently enacted *Improving Head Start for School Readiness Act of 2007* (see Barnett & Frede, 2009), based mainly on assumptions of a link between teachers' education and processes that improve child outcomes (for which the available evidence is thin), requires that in the near term, at least 50% of Head Start teachers in center-based programs nationwide have a bachelor's degree. As of 2005, 17 of the 38 states with public pre-K programs required that all lead teachers hold a bachelor's degree, and another 12 states required a bachelor's degree of some pre-K teachers. Similarly, states are spending considerable sums to improve the education of child care providers in the hope of improving quality of care. These policy decisions require enormous investments of time and financial capital in educating existing teachers and providing wages that will keep such teachers in the workforce. For the most part there is no strong evidence that education or degrees per se will produce better outcomes for children.

Early evidence suggested that increasing caregiver education could provide a means for increasing quality of care on the basis of associations between education and quality in large child care studies (Burchinal, Peisner-Feinberg, et al., 2000; Howes, Whitebook, & Phillips, 1992; Kontos & Wilcox-Herzog, 1997; NICHD ECCRN, 2000, 2002; Phillipson et al., 1997; Scarr, Eisenberg, & Deater-Deckard, 1994) and in smaller studies (e.g., Burchinal, Peisner-Feinberg et al., 2000). However, more recent evidence questions this link between caregiver education and quality. For example, associations between teacher education and both observed quality and child outcomes were examined, using data from seven large studies of the early care and education of 4-year-olds (Early et al., 2007). The data sets included three studies of public pre-K programs, three studies that either exclusively or primarily examined Head Start classes, and one study that primarily focused on community child care. No consistent pattern of association was found between any index of teacher education and either observed classroom quality (e.g., teacher-child interactions or features of the classroom setting) or child outcomes.

A recent survey of programs providing early childhood degrees provides some insight into why teacher education did not predict either quality or child outcomes (Hyson, Tomlinson, & Morris, 2009). According to this survey of teacher educators, teacher preparation programs are understaffed and overwhelmed by the number of students seeking early childhood education degrees, thus suggesting that the intensity and quality of preparation may be poor, on average. There is some indication that what happens within a degree program might be important, such that teachers with more training in early childhood education tend to interact more effectively with young children (Pianta et al., 2005). However, what is clear is that formal educational training, although it might be a potential avenue for improving program impacts,

is itself stunningly variable and has been largely unevaluated in terms of effectiveness. In short, its potential is unknown and perhaps overestimated. What the data on teachers' education levels do make clear is the compelling need to develop, implement, and evaluate *effective* professional development models for preschool teachers, whether in the context of higher education or in-service training.

**Adult-child ratio.** After teacher education and credentials, the ratio of children to adults in the child care setting is the other structural feature that has been most often studied and regulated. There are studies on group size (i.e., number of children in the setting, number of teachers, presence of aides) as well as the adult-child ratio. Clearly, the rationale for limiting group size or increasing the number of adults involves both concerns for the basic supervision and safety of all the children and concerns that there are enough adults to ensure that all children frequently receive the sophisticated interactions with their teachers necessary to promote social and cognitive development. Therefore, it is not surprising that of all structural features of preschool programs, the adult-child ratio is probably the most consistent predictor of both the quality of the teachers' instruction and their interactions with children, as well as of child outcomes for infants, toddlers, and preschoolers (Blau, 1999; NICHD ECCRN, 2000, 2002, 2004; Phillipson et al., 1997).

Finally, some evidence indicates that applying recommendations offered by professional organizations, such as NAEYC, the American Public Health Association, and the American Academy of Pediatrics, to the full range of child care and early education programs is related to improved developmental outcomes for children. For example, in the NICHD Study of Early Childcare and Youth Development (NICHD ECCRN, 1999), children at 6 months, 15 months, 24 months, and 36 months of age who were enrolled in child care centers that met more standards recommended by the American Public Health Association and the American Academy of Pediatrics (1992) regarding child-staff ratio, group size, caregiver training, and caregiver level of education performed better on cognitive, language, and social competence measures compared with children enrolled in classes that met fewer of these standards. In a similar study, Howes (1990) reported evidence that a composite measure of structural quality in pre-K that included child-staff ratio, group size, caregiver training, and physical space was positively associated with children's adjustment in kindergarten. Thus, structural features of programs can be important components of a regulatory system aimed at providing classroom capacities that contribute to improvement in children's learning and social adjustment. There is some indication that structural features, particularly caregiver and teacher qualifications, could have a greater impact on child outcomes or at least on observed quality of more informal settings, such as child care, and with younger children (D. Bryant & Taylor, 2009).

Clearly, meeting structural standards is not a guarantee of high or even adequate process quality or a guarantee of improved outcomes for children. For example, ample evidence

from observational studies of pre-K, kindergarten, and first-grade classrooms has shown that even when classrooms meet all structural standards for quality, the extent of variation in observed process quality is considerable (NICHD ECCRN, 2002; Pianta et al., 2005; Pianta, La Paro, Payne, Cox, & Bradley, 2002). Furthermore, as discussed earlier, recent research has raised questions about the pathways from structural features to either process quality or child outcomes. At the same time, recognition of the methodological limitations of the existing research suggests that it is too early to conclude that structural features cannot facilitate learning and highly effective teaching, even if they are not sufficient to ensure such practices. As a result, the literature does not give policymakers a clear direction for choosing among the different avenues for designing and structuring programs that will improve child outcomes.

Inconsistencies in findings across studies may, in part, be explained by the different ways that studies have been designed to detect effects, the varying sizes and compositions of the samples, and how preschool quality was defined and measured (Mashburn et al., 2008; NICHD ECCRN & Duncan, 2003). Thus, when the debate has focused on quality, including effects and how to improve and/or ensure it, the level of specificity or precision required to specify the elements of programs (either process or structural) that are either the focus of the discussion or the aim of investments has not been met. The characterization of *quality* as a global, unitary feature of a program is most likely a misnomer or mistake and is not really supported by the evidence. As we demonstrate in the following discussion, it probably makes more sense to focus debate, research, and investment on specific program features.

### **Process quality and child outcomes**

As noted earlier in the section on effects of program enrollment on child outcomes, a cluster of experimental studies has demonstrated that preschool experiences characterized as high quality also produced stronger cognitive and academic skills at entry to school; in turn, these translate into better adolescent and adult outcomes (Campbell et al., 2002; Lazar et al., 1982; Nores, Belfield, & Barnett, 2005; Reynolds et al., 2002). For the purposes of this discussion, it is important to note that the programs included in these studies each represent a package of quality benchmarks, combining the putative best of structural and process features of programs—well-trained staff, favorable ratios, effective curricula, ongoing professional development for positive adult-child interactions; however, these studies do not decompose effects for specific quality parameters. In each of these studies, children were assigned randomly to either the early childhood education program or to a comparison group. Effect sizes, reported in terms of the difference between the means for the treatment and control groups divided by an index of variability, the standard deviation, ranged from small to quite large; in fact, some were large enough to fully close the achievement gap at school entry ( $d = 0.13$  to  $d = 1.23$ ; see Burchinal et al., 2009, for details). The

largest effect sizes were obtained in the most intensive interventions in assessments of children after the age of 2 years. As described earlier, the Abecedarian project, a single-site experimental intervention that delivered 5 years of full-time, high-quality child care, had effect sizes of 125% of an *SD* at 36 months and more modest but long-term effects on employment and schooling outcomes at 21 years of age (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001). However, these effects cannot be attributed to exposures to any specific aspect of the early childhood education program per se. The Perry Preschool Project, a single-site preschool program that included a home-visiting/parenting-education component, yielded effect sizes of almost a standard deviation ( $d = 0.83$ ) on a cognitive test at 3 years of age. In contrast, the less intensive intervention programs resulted in much smaller effects.

Nelson, Westhues, and MacLeod (2003) estimated effect sizes for the 34 preschool intervention programs with at least one follow-up assessment. Moderately large effects for cognitive outcomes during preschool ( $d = 0.52$ ) were still detectable at eighth grade ( $d = 0.30$ ). Similarly, smaller effects for social-emotional outcomes during preschool ( $d = 0.27$ ) were still detected at the end of high school ( $d = 0.33$ ). To the extent that Nelson et al. were able to decompose program attributes and isolate impacts, larger effects on cognition and achievement were observed when programs had an intentional instruction component. Overall, programs that started at younger ages and provided more years of intervention had the largest effects; both starting age and years of intervention are features of quantity of exposure to a high-quality program and not to features of program quality per se.

Descriptive or quasi-experimental studies (i.e., studies that did not involve random assignment to early childhood education conditions) have provided further support for an association between higher-quality early childhood education and positive child outcomes, with these studies involving larger, more representative samples and tending to have a stronger approach to measuring process elements of program experiences (Gormley et al., 2005; Howes et al., 2008; NICHD ECCRN, 2005; Peisner-Feinberg et al., 2001; Reynolds et al., 2002). As described earlier, however, these studies vary widely in terms of the degree to which they account for possible selection biases. Overall, studies have tended to report associations between child care quality and cognitive, language, and academic outcomes and, less consistently, between child care quality and social-emotional outcomes (Vandell, 2004).

Burchinal et al. (2009), drawing from quasi-experimental studies of quality effects in large, contemporary samples, recently conducted a meta-analysis of program quality features and their impacts. In this analysis, which involved only published studies with 10 or more classrooms that reported associations between widely used measures of program quality and child outcomes, associations were converted to partial correlations for the meta-analysis. A partial correlation of .10 is considered modest, .30 is considered moderate, and .50 is considered large (Cohen, 1988), but note that these conventions are somewhat arbitrary. The meta-analysis also estimated the

effect size describing the association between program quality and child outcome overall and by age and type of outcome—language-cognitive, academic, and socioemotional. Children's ages were categorized as 2–3, 3–4, and 4–6 years. In summary, the meta-analysis indicated that widely used broad-aggregate measures of early childhood education quality (i.e., those that mix process and structural features) were statistically related to children's outcomes, but these associations were modest and notably smaller in magnitude than effects derived from random assignment tests of model program impacts. For example, across all associations of quality and outcomes, partial correlations ranged from very low to modest ( $.05 < r_p < .17$ ). Stronger associations were observed for younger children than for older children and for academic and language outcomes than for social outcomes. In other words, these program effects were narrowing somewhat the achievement gap but had only about a quarter of the impact of the experimental studies of model programs.

Because preschool programs play such a prominent role in the policy debate on closing achievement gaps for children from poor families, Burchinal et al. (2009) also examined the association between program quality (again using broad-aggregate indicators that mix structure and process) and child outcomes among low-income children. Again focusing on large, contemporary programs operating at some level of scale, in contrast to specialized model programs, Burchinal and colleagues selected five data sets that included child care quality and child outcome assessments for at least 100 children observed in at least 50 classrooms. The five studies included the NICHD Study of Early Child Care and Youth Development (NICHD ECCRN, 2003); the Cost, Quality, and Outcomes Study (Peisner-Feinberg & Burchinal, 1997); the NCEDL 11-state Pre-Kindergarten Evaluation (Howes et al., 2008); and the Head Start Family and Child Experiences Survey (FACES) from 1997 and 2000. All studies included multiple sites and were designed to reflect variation in preschool program experiences in the United States. Data from five measures of program process quality were collected across the studies, and data from the Early Childhood Environment Rating Scale (Harms & Clifford, 1980) or the Early Childhood Environment Rating Scale—Revised (Harms, Clifford, & Cryer, 1998) were collected in all studies but the Study of Early Child Care and Youth Development.

One set of analyses involved computing partial correlations between measures of process quality and fall-spring gains in child outcomes measured in the spring for each study, using available covariates for family background. The partial correlations for program benefits were again rather modest (ranging from  $r_p = .00$  to  $r_p = .23$ , with most partial correlations less than .10). Some projects and some quality measures appear to have yielded stronger associations, but even those tended to be quite modest. Computing zero-order correlations between program quality and child outcome change scores (the most conservative, because they adjust for prior experiences and the change scores will have more error resulting from the manner in which they are computed) still yielded modest associations.

Average correlations between program quality and child outcomes, as has been summarized above, were modest in magnitude: For language outcomes the average was .14 ( $SD = .06$ , range =  $.02$ – $.26$ ); for academic achievement, .06 ( $SD = .09$ , range =  $-.06$ – $.26$ ); and for social-emotional development, .06 ( $SD = .07$ , range =  $-.08$ – $.16$ ). Thus, these findings indicate that even for children from low-income family backgrounds, benefits of quality in contemporary programs of the type available in a typical community were quite modest, albeit positive. In fact, these results show that contemporary, typical preschool programs consistently show capacity to provide a modest boost to child development.

A particular issue in the estimation of program quality effects is the level of specificity and nature of the process quality metrics being used. Pianta (2003) and others have argued, for example, that some global quality metrics (such as the Early Childhood Environment Rating Scale) may underestimate impacts because these comprehensive assessments not only include aspects of adult-child interaction but also aggregate across a host of attributes of the physical environment. Pianta made the point that process measures should be more narrowly focused on the dynamic features of the classroom setting that are expected to confer benefits for children's learning and development—in this case, actual interactions of adults and children. Moreover, Burchinal and colleagues (2009) raised a different aspect of process quality-outcome associations by examining the extent to which more specific quality measures predict outcomes that should be conceptually aligned with those quality measures. These refinements of the connection between program process inputs and child outcomes, with specific attention to adult-child interactions and input-outcome alignment, were examined in two separate studies (Burchinal et al., 2009; Mashburn et al., 2008).

In Mashburn et al.'s (2008) study, pre-K program quality effects were examined using change scores as the dependent measure for child outcomes at the end of the pre-K year. This study directly contrasted three forms of program quality metrics and features—global metrics based on structural features, global metrics based on observed process and aspects of the physical environment, and domains of observed interactions between adults and children. In these models, using an 11-state database, observed teacher-child interactions—particularly instructionally focused interactions that stimulate cognition and language as assessed by the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008) observational metrics—were consistently significant predictors of change scores in achievement outcomes. Structural indicators, either singly or in combination (such as the NIEER or NAEYC indices), showed no relation to child outcomes, nor were the global metrics based on the physical and process environment. It should be noted that Mashburn et al. estimated the effects of structural features at the classroom level after controlling for state “fixed effects,” which capture state policy differences, including the effects of minimum program standards. Nevertheless, Mashburn et al.'s study is one of the only direct comparisons of various

process metrics in relation to academic and social gains in the preschool year. An additional finding from this study was that instructional features of teachers' interactions were most strongly predictive of achievement gains, whereas emotional features were most strongly related to gains in socioemotional and behavioral outcomes. Finally, it is important to note that the gains in achievement attributable to teachers' instructionally focused interactions on the CLASS measures held throughout the kindergarten year (Burchinal, Howes, et al., 2008) and were larger in terms of magnitude (by more than twofold) than those reported for other measures of quality noted earlier.

The Burchinal et al. (2009) analysis focused on whether stronger associations were obtained when aligned quality and child outcome measures were correlated. Associations were again stronger than those reported using global measures but were still modest. The associations between language and these more specific quality measures ranged from  $-.01$  to  $.21$ , with about half of the partial correlations exceeding  $.10$ .

Finally, in a series of analyses in two separate studies, Burchinal and colleagues (2009; Burchinal, Vandergrift, Pianta, & Mashburn, in press) asked (a) whether the reason that the associations between observed quality and child outcomes were so modest is because the association is nonlinear and (b) whether there may be threshold effects such that features of quality may affect child outcomes only when they exceed a certain level. Burchinal et al. (2009) tested this hypothesis with regression analyses that included quality as both linear and quadratic terms (i.e.,  $\text{Quality} \times \text{Quality}$ ) and site, maternal education, ethnicity, and gender as covariates. Quadratic associations obtained in the analyses of the data provide a hint that process quality may be more strongly related to outcomes when features of process are in the higher range for the specific metric. In one study, FACES 1997, Early Childhood Environment Rating Scale scores were positively related to language scores when quality was in the good to high range. In three studies—the NCEDE, the Study of Early Child Care and Youth Development, and FACES 1997—quality was more strongly related to math skills when quality was in the good to high range. In one study, the NCEDE, the two quality measures were more strongly related to reading skills when they were in the good to high range.

More recently, Burchinal et al. (in press) examined this same question more specifically for observations of adult-child interactions relying on the CLASS (Pianta, Laparo, & Hamre, 2008), using a spline regression technique to determine thresholds. This analysis indicated rather clearly that for the CLASS metric of Instructional Support, effects on achievement gains appear only when the observed quality of teacher-child interaction (in pre-K) exceeds a level of 2 on the 7-point scale, indicating the emergence of a focus on stimulating child cognition. The CLASS Emotional Support scale was related to more positive social-emotional adjustment when the score on that CLASS scale exceeded a 5 on the 7-point scale. In addition, the magnitude of effects observed when interactions exceed these thresholds is greater than that reported across the entire distribution. In short, emerging and rather consistent

evidence shows that growth in child outcomes is stimulated through cognitive- and language-focused interactions with teachers. This growth occurs only when such interactions start to exceed a certain very minimal level of stimulation, and when effects do appear as a result of teacher-child interactions that exceed threshold levels, the effects increase somewhat in magnitude.

### **Summary of quality effects**

We have summarized results from “treatment on the treated” studies (i.e., studies that examine associations between features of preschool programs on children's outcomes for children already enrolled in those programs and not in comparison to non-enrolled control groups) in an effort to examine the extent to which factors associated with the implementation of preschool programs (e.g., structural and process elements) are associated with child outcomes. Meta-analyses and secondary data analysis consistently show that greater teacher-child interaction is clearly and persistently associated with higher language, academic, and social skills and fewer behavior problems, but associations are quite modest. This conclusion seems to contradict the findings from randomized studies in which low-income children were randomly assigned to high-quality, center-based programs like the Abecedarian Project (Campbell et al., 2002), Perry Preschool (Nores et al., 2005), or Infant Health and Development Program (McCormick et al., 2008). Those programs produced moderate to large effects on language, academic, and social outcomes while the children were enrolled, and the findings were maintained, albeit diminished, into early adulthood. Similarly, evaluations of carefully implemented pre-K programs such as the Tulsa (Gormley et al., 2005) and Miami pre-K programs (Winsler et al., 2008) have also yielded large effects. However, the contrast between the nature of the program inputs across these clusters of studies is notable: In most experimental studies, the children were enrolled in a small, model program designed to maximize program impacts, and they were enrolled for more than 1 year (sometimes up to 5 years), rather than attending a program and/or classroom operated as part of a large-scale implementation. In the larger scale Tulsa and Miami studies (which yielded larger impacts), the program had a very highly structured focus on learning and on effective implementation. Thus, the modest estimates for program quality reported earlier, accruing primarily as a result of the nature and quality of adult-child interactions in classroom settings, may reflect a lower bound for impacts of typically operated, loosely regulated preschool. Indeed, evidence suggests that when teachers display features and levels of interactions with children that are above certain threshold levels, benefits accrue in escalating fashion. In summary, quality is important, but it appears that the active ingredient in quality is what a teacher does, and how he or she does it, when interacting with a child.

Effective teaching in early childhood education requires skillful combinations of explicit instruction, sensitive and warm interactions, responsive feedback, and verbal engagement or

stimulation intentionally directed to ensure children's learning while embedding these interactions in a classroom environment that is not overly structured or regimented (Burchinal et al., 2008). This approach to early childhood teaching is endorsed by those who advocate tougher standards and more instruction and by those who argue for child-centered approaches and has strong parallels in the types of instruction and teacher-child interactions that have been shown to contribute to student achievement growth in K–12 value-added studies (see Hart, Stroot, Yinger, & Smith, 2005; National Council on Teacher Quality, 2005). Furthermore, quality of instruction within a specific content area appears closely linked to improvements in language (Dickinson & Caswell, 2007; Justice & Ezell, 2002; Whitehurst & Lonigan, 1998), math (Clements & Sarama, 2008), and reading (National Early Literacy Panel [NELP], 2009). These studies suggest that children may achieve larger gains when they receive higher-quality instruction that specifically teaches target skills in a manner that matches children's skill levels and provides instruction through positive, responsive interactions with the teacher.

### **Improving Preschool Impacts on Child Outcomes Through Professional Development and Workforce Training**

For the early childhood education system to move toward the goal of active and marked advancement of children's skills and competencies, the quality and impacts of programs must be improved through a vertically and horizontally integrated system of focused professional development (Cross et al., 2009) and program designs and models that are educationally focused (as described earlier). In short, programs need to be realigned around educational aims (in key developmental domains and appropriately articulated), and teachers must receive preparation and support to deliver classroom experiences that foster those aims more directly. Teaching would entail providing teacher-student interactions that promote the acquisition of new skills; deliver curricula effectively; and individualize instruction and interaction on the basis of children's current skill level, background, and behavior. Programs require (and policy should encourage the use of) proven-effective professional development supports through which teachers would acquire skills for effective teacher-child interactions and implementation of curricula and assessment in developmentally synchronous ways (Howes et al., 2008; Klein & Gomby, 2008; Raver et al., 2008). Improvement of program impacts in early childhood rests on aligning professional development and classroom practices with desired child outcomes. In particular, the field needs a menu of professional development inputs to teachers (preservice or in-service) that are known conceptually and through empirical evidence to produce classroom practices (e.g., teacher-child interactions) that result in the acquisition of desired skills among children (e.g., literacy skills). Efforts to develop such a system of aligned, focused, and effective professional development for the early childhood workforce are

under way through the auspices of the National Center for Research on Early Childhood Education and through interventions being studied by Landry, Swank, Smith, Assel, and Gunnig (2006) and Powell, Diamond, Burchinal, and Koehler (in press). All these efforts target children's early literacy and language development. Other investigators' work has focused on effective professional development for teachers that improve children's early understanding of and skills in mathematics (Clements & Sarama, 2008; Ginsburg et al., 2005).

### **Workforce needs for professional development**

With enrollment of 3- and 4-year-olds in early education programs approaching 70% of the population and growing (Barnett et al., 2007; West, Denton, & Germino-Hausken, 2000), expansion of early childhood programs is placing notable demands on the supply chain for early childhood educators and for evidence-based in-service training (Hyson et al., 2009). Some surveys estimate that 200,000 teachers are needed to staff universal enrollment programs and 50,000 new teachers will be needed by 2020 (Clifford & Maxwell, 2002). The projected demand on training systems for more teachers is enormous. Many states rely on teachers with elementary grade certifications and teachers with 2-year degrees "grandfathered" into certification (Clifford, Early, & Hills, 1999). Many early childhood teachers take courses while already employed and use worksites for student teaching (Howes, James, & Ritchie, 2003). Several states address the staffing and qualification crisis by improving salaries and benefits for pre-K teachers, whereas others encourage child care and preschool providers to seek additional training without addressing issues of retaining more qualified teachers when salaries tend to be low (see Peters & Bristow, 2005; Pianta, 2005). Thus, it is not surprising that although the overall education level of society is increasing, data from within the early childhood field indicate the qualifications of the workforce are steadily declining (Herzenberg, Price, & Bradley, 2005).

Efforts to meet the demand for trained teachers are moving ahead rapidly without any systematic evaluation of their impact on the nature and quality of instruction in classrooms and on child outcomes (Clifford et al., 1999; Hart et al., 2005; S. L. Ramey & Ramey, 2005). Adding to the urgency, there is little evidence that accumulating course credits, advancing in terms of degree status (e.g., from an associate's degree to a bachelor's degree), or attending workshops improve teaching or child outcomes (e.g., Early et al., 2007; National Council on Teacher Quality, 2005). Accordingly, focus has turned to identifying professional development that effectively imparts to teachers skills that improve children's outcomes. As discussed earlier, a comprehensive analysis of data from seven large child care studies indicated that the teacher's degree, field of study, and certification status were unrelated to classroom quality or child outcomes (Early et al., 2007). Having a degree and credential did not increase the likelihood that children experienced high-quality care in the NCEDE study of six states with mature pre-K programs (Pianta et al., 2005). Similar to nearly every



other form of teacher training, including for K–12, there is virtually no evidence linking preservice or in-service training experiences or teacher credentials per se to child outcomes or to observed classroom quality (National Council on Teacher Quality, 2005; NICHD ECCRN, 2002, 2005; Pianta et al., 2002). In short, the early childhood education system is expanding rapidly in response to great demand, but without any direction based on scientific evidence—a recipe for continued mediocrity and inequity that ultimately undermines the promise of early education to close the achievement gap. If early education programs are going to achieve high quality at scale (Pew Charitable Trusts, 2005), then new mechanisms of training teachers must be developed and tested both in pre-service teacher training and in alternate certification and retraining routes used by large school districts or alternative suppliers (Birman, Desimone, Garet, & Porter, 2000; Borko, 2004; Clifford & Maxwell, 2002; Cochran-Smith & Zeichner, 2005; Hart et al., 2005; Pianta, 2005; Whitebook, Bellm, Lee, & Sakai, 2005).

In-service training is another popular approach to improving quality. A recent meta-analysis suggests that specialized training improves the competency of child care providers ( $d = .45$ ,  $SE = 0.10$ ) and children's outcomes ( $d = 0.55$ ,  $SE = 0.30$ ) but that training is most effective when there is a fixed curriculum content and it is delivered in a single or small number of settings (Fukkink, 2007). Several recent studies provide further indications that some aspects of effective professional development may occur outside of a bachelor's degree program in higher education. Much of the recent work focuses on the provision of feedback on early childhood educators' interactions with children by supplying technical assistance or coaching. A process that involves reviewing videotapes of the teacher interacting with children while delivering a fixed curriculum may be especially promising in helping teachers become both more sensitive and more effective in providing stimulating instruction (Dickinson & Caswell, 2007; Pianta, Mashburn, Downer, Hamre, & Justice, 2008; Whitehurst & Lonigan, 1998, 2002). Providing training to entire preschool programs also seems to be more effective than training selected teachers. Ensuring that everyone, including the administrator, is being trained in the same curricula or approaches increases the likelihood that the training results in real changes in the classroom.

### **Early childhood educator competencies: What do teachers need to know and do?**

Clearly, a host of knowledge domains as well as skills could be included in the lists of competencies needed to effectively educate and care for young children, and often there are multiple layers of organization in such lists. Early childhood educator competencies typically start with broad concepts or domains of knowledge and skill (e.g., knowledge about child development, working with families), and within those broad domains are clusters of specific knowledge areas and skills. For example, the domain of Knowledge About Human Growth and Development could include clusters of knowledge areas

pertaining to cognitive development, social development, or physical growth and development, with each one of these areas then broken down into specific information (e.g., “understands pathways of syntactic development” or “understands role of attachment in emotional development”). Similarly, in broad skill domains (e.g., working with families), one might find a cluster of skills around transition planning with families that could then be defined in terms of “plans and implements effective transition plans with parents.” Thus, a key aspect of competency systems and lists is this multilayer organization of knowledge and skill and the very large range and number of units within each layer. Their very complexity often is an impediment to their utility.

Interestingly, unlike K–12, for which all states have lists of teacher competencies for knowledge and skill, only 26 states have competency standards for early childhood educators. For those states with competencies specified, there is wide variation across states in the number of levels and content of each level. Most states map these competencies onto various forms of certification, licensure, and role within the early childhood education workforce, and again there is considerable variation in this mapping. Some states organize competencies by titles (Director, Teacher, Aide), some by degree (CDA, associate's degree, bachelor's degree, master's degree), and some by levels on a career ladder. For the most part, very little evidence to inform this mapping process exists, and what evidence does exist can seem quite arbitrary. There is little evidence to drive decisions about what a teacher needs to know and do that is distinct from that of a teachers' aide, for example, and there is even less evidence tying specific knowledge or skills to a specific degree, in terms of how that combination of knowledge or skill and degree or role is critical for advancing the quality of the early childhood educator programming offered in a state and child outcomes.

### **Early childhood educator professional development systems (PDSs)**

A PDS can be defined as having several core components, most common of which are higher education programs that prepare teachers, state and local resources that provide in-service support to teachers through workshops or courses, and a system of licensure and certification through which states use higher education programs and in-service training as a means of certifying teachers as qualified to teach in that state. By this definition, administrative data show that in 2008 the vast majority of states had some form of a PDS operating to regulate the workforce in the early education and child care sectors.

However, these same administrative data suggest that there is highly uneven implementation of PDSs across states. Specifically, states differentially regulate different teaching staff and different forms of care; that is, they have different qualifications for these roles. For example, in 2006, 78% of the states had preservice higher education qualifications for center directors, whereas only 25% of states had higher education requirements for center teachers or for large family child care home

providers. In short, states often see these roles as very different, when in fact each of these individuals is likely to be the primary “teacher” in a “classroom” setting serving 3- and 4-year-olds; not surprisingly, these requirements also differ from state to state.

Even when states require some level of preservice preparation in higher education for entry into a professional role as a teacher, there are quite varied requirements for preservice qualification required for licensure or certification in early childhood. For example, CDA certificates are the most common preservice requirement for directors and master teachers in early childhood education programs, whereas experience alone or with a high school diploma is the most common minimum preservice requirement for teachers. Only 40% of state PDSs require a preservice course on working with children with disabilities, and only 10% required a course on working with children learning English as a second language. Thus, apart from the background of variability in entry qualifications into various roles, there is also a rather low level of entry qualifications compared with K–12.

- State PDSs tend to put more emphasis on in-service training rather than preservice qualifications for continued licensure, with 46% of states requiring ongoing training for center teachers, 40% for center directors, and 36% for small family child care providers. Any emphasis on on-the-job training (in contrast to preservice training as noted earlier) places the burden of workforce quality on state and local systems of in-service support rather than on state institutions of higher education and its well-established infrastructure and capacity. However, other factors also influence the workforce and professional development. To a degree, these factors are clearly summarized by the U.S. Census Bureau’s 2008 employment summary (see Barnett, Epstein, et al., 2008): About 42% of all child care workers have a high school degree or less, reflecting the minimal training requirements for most jobs.
- More than a quarter of all employees work part-time, and nearly 18% of full-time employees in the industry work more than 40 hr/week.
- Job openings should be numerous because dissatisfaction with benefits, pay, and stressful working conditions causes many to leave the industry.

For the most part, states do not collect the type of information needed to examine the connection between exposure to features of the PDS and child outcomes. It is widely believed that this is a major reason for the widely noted lack of association between a bachelor’s degree and classroom quality. State administrative data collected as a part of PDSs typically document how many early childhood program staff have participated in various sanctioned training activities (e.g., courses) and at what level (e.g., associate’s or bachelor’s degree). However, we know little about how PDSs are working or what impact they have had on early childhood education systems. Most states do not have information on individuals’ training,

licensure, and certification status and their knowledge and skill in the classroom. Instead, states certify higher education and in-service programs on the basis of mapping coursework and fieldwork onto state competencies, hoping that individuals who progress through these training and preparation experiences have the knowledge and skills required to be effective. Credentialing does not depend on the demonstration of actual skill or effectiveness.

A final and particularly important consideration concerns the type and intensity of professional development that may be necessary to create and sustain changes in teachers’ practice. Thus, although the vast majority of PDSs focus on coursework and workshops as the primary vehicles for preparation and training, we now know that the daily interactions that teachers have with children are critical to children’s social and academic development, and we are just learning how to go about changing these interactions. We need more research in this area to most effectively support teachers and improve student outcomes.

Recent research suggests that targeted intervention to improve teacher interactions with children and instruction in academic skills such as the My Teaching Partner work by Pianta and colleagues (Hamre, Pianta, Downer, & Mashburn, in press; Pianta, Mashburn, et al., 2008) increases effective teaching and children’s social and academic gains. Other research groups have demonstrated similar results—that coaching teachers in interactions linked to instructional supports for learning and good implementation of curriculum can have significant benefits for children (Koh & Neuman, 2009; Landry et al., 2006; Powell et al., in press). Similarly, evidence from a professional development intervention project by D. Bryant and Taylor (2009) suggests that ongoing mentoring and consultation increase effective teaching. Mentoring and training are very difficult to measure and to bring to scale, but they are relatively easy to prescribe as the professional development answer. One critical component of bringing mentoring to scale concerns the ability of systems to prepare and regulate mentors; however, only three states have defined core competencies for technical assistant providers.

### **Quality rating and improvement systems**

Quality rating and improvement systems are fundamentally mechanisms for defining the optimal conditions for caring for and preparing children for school and for encouraging and rewarding improvement to higher levels. They provide a way to open the system of early childhood programs to market-based forces (e.g., consumers of child care have information on quality), and they offer a variety of mechanisms for states to define levels of quality and desirable outcomes for the programs in which they invest, which in turn become markers for monitoring and resource allocation. Mitchell (2009) has written extensively about quality rating and improvement systems, and they are featured in the Pew Early Childhood Accountability framework (Kagan & Garcia, 2007). In many ways, quality rating and improvement systems, in theory, should function as a

mechanism for linking PDSs and states' lists of competencies for early childhood educators. In theory, the quality rating and improvement system would include valid measures of competencies that would also be reflected in the coursework and training offered to teachers through higher education and local and state in-service offerings.

The Maine Roads to Quality Registry is an example of a statewide effort to link teacher qualifications and training to early childhood competencies (Mayfield, Mauzy, Foulkes, Foulkes, & Dean, 2007). Teachers who join the registry receive a registry certificate, registry transcript, career counseling, and eligibility for other programs, including scholarships. The Maine Roads Core Knowledge Training Program is an affiliated 180-hour training program that is aligned with Maine's K–12 Learning Results, with accrediting and legislative requirements, and it prepares teachers to work with children according to the competency priorities of the state. Maine is one of several states including Missouri, Montana, and Wisconsin that joined the National Registry Alliance to develop best practices for data collection systems that are exemplars of designing mechanisms for documenting and encouraging improvement and defining the optimal practices for preparing children for school.

### **Teacher knowledge**

Professional development approaches should optimally be designed for high-priority skill targets, such as preschool language and literacy or math, and they should start by defining these targets and ensuring that there is a curriculum in place that reflects them. Teachers' knowledge of these skills targets and the associated developmental progressions then become a key focus for professional development.

A high-priority target for preschool literacy instruction (Lonigan, 2004) is one that (a) is consistently and at least moderately linked to school-age reading and language achievement, (b) is amenable to change through intervention, and (c) is likely to be underdeveloped among at-risk pupils. Meta-analyses (e.g., Hammill, 2004; NELP, 2004) and longitudinal studies on whether early language and literacy predict later reading and language skills (e.g., P. Bryant, MacLean, & Bradley, 1990; Catts, Fey, Zhang, & Tomblin, 2001; Chaney, 1998; Christensen, 1997; Gallagher, Frith, & Snowling, 2000; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Storch & Whitehurst, 2002) have consistently shown the importance of six skill targets. The first three targets (phonological awareness, alphabet knowledge, print awareness) are literacy skills that consistently predict (average  $r = .40$ ) school-age decoding (NELP, 2004), are amenable to change via interventions (e.g., Justice & Ezell, 2002; Ukrainetz, Cooney, Dyer, Kysar, & Harris, 2000; van Kleeck, Gillam, & McFadden, 1998; Whitehurst, Epstein, Angell, Crone, & Fischel, 1994), and are underdeveloped in at-risk pupils (e.g., Bowey, 1995; Lonigan, Bloomfield, et al., 1999; Snowling, Gallagher, & Frith, 2003). The other targets (vocabulary-linguistic concepts, narrative, social communication-pragmatics) are moderately associated with

school-age decoding (average  $r = .38$ ; NELP, 2004) and reading comprehension (average  $r = .39$ ; NELP, 2004). Vocabulary is an area of language weakness for children reared in poverty (Justice, Meier, & Walpole, 2005; Whitehurst & Lonigan, 1998) that can be accelerated using structured interventions that feature ongoing exposure to new words, as occurs through adult-child shared storybook reading (e.g., Hargrave & Sénéchal, 2000; Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999; Penno, Wilkinson, & Moore, 2002; Reese & Cox, 1999; Whitehurst et al., 1988). For each target, a curriculum can then map ordered instructional objectives and activities (e.g., Bunce, 1995; Lonigan, Anthony, et al., 1999; Lonigan, Bloomfield, et al., 1999; Notari-Syverson, O'Connor, & Vadasy, 1998/2006).

Clements and Sarama (2008) and Ginsburg and colleagues (2005) have also produced evidence for the importance of teacher knowledge in certain facets of mathematics development. Although the evidence base, particularly for the predictive importance of these domains, is not as strong in mathematics as it is in reading, it is clear that increasing teachers' knowledge of developmentally relevant mathematics skill progressions can be a key aspect of improving instruction and child outcomes (Clements & Sarama, 2008).

### **Curriculum, implementation, and improving teacher-child interactions**

Recently, extensive attention has been given to the importance of using proven-effective manualized curricula or instructional approaches as a means of improving program impacts on children's skills (e.g., Preschool Curriculum Evaluation Research Consortium, 2008). Research on these curricula often use measures of procedural fidelity to ensure they are implemented as intended (e.g., Justice & Ezell, 2002; Lonigan, Anthony, et al., 1999; Reid & Lienemann, 2006; Wasik, Bond, & Hindman, 2006); inclusion of procedural fidelity measures is considered an essential quality for intervention research (Gersten et al., 2005). In practice, procedural fidelity measures are increasingly used to determine whether teachers are using adopted programs as intended, particularly those that are considered scientifically based and for which procedural fidelity might be a key moderator of pupil outcomes (see Glenn, 2006).

As important as procedural fidelity is to ensuring that curricula are implemented as intended, it must be distinguished from quality of implementation, which is decidedly more difficult to capture (Sylva et al., 2006) than the teacher's adherence to procedures or scripts; quality of implementation reflects the real-time dynamic and interactive nature of classroom processes and the teacher's ability to work flexibly with students to individualize their instruction and respond sensitively—that is, to exhibit skilled performance within dynamic interactions with children in learning activities that unfold over time in a given instructional episode or “teachable moment.” Note that whereas measurement of procedural aspects of implementation typically examines whether teachers can “go through the motions” in following step-by-step aspects of a novel

curriculum or approach, measurement of quality of instruction looks globally at relational processes between teachers and children across an entire learning episode.

The extent to which measurement of a teacher's procedural fidelity in implementing a structured curriculum may serve as a proxy for his or her instructional quality is a timely question, as the availability and implementation of preschool language and literacy curricula are flourishing in response to national and local initiatives focused on improving the quality of language and literacy instruction in preschool programs. These improvements include both comprehensive curricula that organize classroom activities and experiences for the entire classroom day (e.g., *Opening the World of Learning*; Schickedanz & Dickinson, 2004) and more focal supplements that are embedded into a general curricular framework to provide encapsulated lessons explicitly focused on language and literacy (e.g., *Doors to Discovery*; Wright Group, 2004). Both types of curricula typically provide a detailed scope and sequence for language and literacy instruction for the entire academic year, weekly lesson plans specifying a set of language and literacy objectives and corresponding activities, example scripts (and for some, companion Web sites) illustrating quality implementation of activities, books and other materials (e.g., manipulatives like blocks) needed to implement the curriculum, informal assessments to monitor children's progress in the curriculum, and implementation checklists to monitor teachers' fidelity to the curriculum.

In a recent study, more than 180 pre-K teachers implemented a scripted set of lessons in language and early literacy; the teachers exhibited high levels of procedural fidelity to the prescribed language and literacy curriculum after receiving minimal training in its implementation. Adherence to lesson plans and general guidelines for curriculum implementation exceeded 90% for most aspects of fidelity measured. Although this is an interesting finding, it must be considered in light of additional findings showing that, in large part, exhibiting fidelity to the curriculum was not associated with the quality of language and literacy instruction. Fidelity to specific implementation routines (e.g., calling children's attention to the lesson, preparing all materials needed ahead of time) had no predictive value when considering the quality of instruction (Downer, Pianta, & Fan, 2008).

This finding highlights some of the differences between high-quality language instruction and high-quality literacy instruction. Language instruction that is of high quality requires adults to provide well-tuned, responsive conversational input to children; it needs to feature use of open-ended questions, expansions, advanced linguistic models, and recasts (see Girolametto, Weitzman, & Greenberg, 2003). Because a key characteristic of high-quality language instruction is linguistic responsiveness of adults to children within dynamic exchanges, high-quality language instruction is virtually impossible to script procedurally. That is, one cannot possibly script what children will say or, consequently, how to interact with and respond to children in ways that maximize language-learning opportunities. By contrast, high-quality literacy instruction features

explicit and direct instruction that systematically teaches children about the code-based characteristics of written language and includes both phonological and print structures.

Ratings of the quality of implementation and instructional interactions are low to mid-range for teachers' use of more explicit techniques that may promote children's concept and language development (Girolametto & Weitzman, 2002; Girolametto, Weitzman, van Lieshout, & Duff, 2000; La Paro, Pianta, & Stuhlman, 2004). There is growing evidence on the effectiveness of specific curricula in these learning domains (e.g., Byrne & Fielding-Barnsley, 1993, 1995; Girolametto, Pearce, & Weitzman, 1996; Girolametto, Weitzman, & Clements-Baartman, 1998; Justice & Ezell, 2002; Penno et al., 2002; Wasik & Bond, 2001; Whitehurst et al., 1994). However, observational studies have shown that even these demonstrably effective literacy interventions have no effect on child outcomes when the overall quality of teaching practices is low (Dickinson & Brady, 2005; Howes et al., 2008). In short, the availability of a demonstrably effective curriculum and procedural fidelity with respect to delivery of that curriculum are not likely to be sufficient to ensure student learning.

Given the central role of teacher-child interactions in mediating the effects of professional development on skill gains, one approach to professional development rests on evidence from methodologically rigorous studies demonstrating that objectively assessed teacher-child interactions are active agents of developmental change in preschool classrooms (Domitrovich et al., 2009; Mashburn et al., 2008; S. L. Ramey & Ramey, 2008; Raver et al., 2008). In the sections that follow, we describe approaches to designing and testing professional development interventions that are aligned with interactions that change both teachers' classroom behaviors (Raver et al., 2008) and, in classrooms where teachers participate in these supports, children's school readiness (Downer et al., 2008; Hamre, Pianta, Downer, & Mashburn, 2008; Mashburn et al., 2008). Some recent research has focused on producing effective, high-quality implementation of instruction and interactional support for literacy and language (Landry et al., 2006; Neuman & Cunningham, 2009; Pianta, Mashburn, et al., 2008; Powell et al., in press), whereas other research has focused on math (Clements & Sarama, 2008; Ginsburg et al., 2005). The evidence base is stronger for professional development efforts related to literacy simply because the work has been under way for a longer time.

Because effects of organized curricula on children's skills are mediated and/or moderated by teacher-child interactions (Clements & Sarama, 2008; Domitrovich & Greenberg, 2004; Preschool Curriculum Evaluation Research Consortium, 2008), these interactions must be a central focus of professional development interventions aiming to improve child outcomes (Bierman et al., 2008; Caswell & He, 2008; Fantuzzo et al., 2007; Pianta, Mashburn, et al., 2008; Raver et al., 2008). The average pre-K child experiences teacher-child interactions of mediocre to low quality (Pianta et al., 2005), but small increments in the quality of interactions produce skill gains for children (Burchinal et al., 2008).

The My Teaching Partner consultation (Pianta, Mashburn, et al., 2008) focuses on the three domains of CLASS-defined dimensions of teacher-child interaction. CLASS-assessed interactions uniquely account for child skill gains in preschool (Mashburn et al., 2008; Vu, Jeon, & Howes, 2008), and Gazelle (2006) reported that interactions assessed by CLASS moderated impacts of poor prior performance on school outcomes. Because the majority of teacher interactions fall below the threshold levels identified by Burchinal et al. (in press), most preschool classrooms do not operate in the “active range”; however, small incremental improvements (in any of the three domains) are associated with meaningful changes in children’s skills. In addition, it appears that the My Teaching Partner consultation is capable of moving teacher-child interactions into (and through) the range in which they improve children’s readiness (Burchinal et al., 2008; Hamre et al., 2008; Mashburn, Downer, Hamre, Justice, & Pianta, 2010).

For example, the improvements yielded from the My Teaching Partner program were substantial. For 7 of the 10 CLASS dimensions of teacher-child interaction, effects were between .12 and .97, with an average effect size of .56. Effect sizes for child outcomes were .27 for receptive vocabulary, .32 for emergent literacy skills, and .23–.36 for social skills. Consultation was delivered to teachers entirely via the Web; this is perhaps one of the first completely Web-based professional development approaches that is effective, is individualized, and improves teacher-child interactions across any curriculum. The use of the Web in this and other novel and effective approaches to professional development (see Landry et al., 2006; Powell et al., in press) has the potential for scalability and cost savings for travel, and location is not a precondition to individualized feedback to teachers. For example, the My Teaching Partner consultation is among the least expensive professional development opportunities for which cost has been documented (Odden, Archibald, Fermanich, & Gallagher, 2002), with effects larger than those typically reported in the literature (Raver, 2008). It costs approximately \$3,000 per teacher to deliver the My Teaching Partner consultation, whereas average per-teacher annual cost for professional development ranges between \$2,000 and \$9,000 (Odden et al., 2002). My Teaching Partner consultation and other Web-mediated approaches (Landry et al., 2006) can potentially address the expanding need for effective professional development and can be aligned with training, certification, and degree requirements for preschool teachers.

## Summary

The best approaches to professional development focus on providing teachers with (a) developmentally relevant information on skill targets and progressions and (b) support for learning to skillfully use instructional interactions and to effectively implement curricula. Such professional development approaches enable teachers to provide children with domain-specific stimulation supports in real-time, dynamic interactions that foster children’s developing skills by engaging

these children with available instructional materials or activities (e.g., Burchinal, Roberts, et al., 2000; Howes et al., 2008; Hyson & Biggar, 2005; NICHD ECCRN, 2002). These approaches align (conceptually and empirically) the requisite knowledge of desired skill targets and developmental skill progressions in a particular skill domain (e.g., language development or early literacy) with extensive opportunities for (a) observation of high-quality instructional interaction through analysis and viewing of multiple video examples; (b) skills training in identifying appropriate (or inappropriate) instructional, linguistic, and social responses to children’s cues and how teacher responses can contribute to students’ literacy and growth of their language skills; and (c) repeated opportunities for individualized feedback and support for high quality and effectiveness in one’s own instruction, implementation, and interactions with children. Conceptually, there is a system of professional development supports that allow for a direct tracing of the path (and putative effects) of inputs to teachers, to inputs to children, to children’s skill gains.

Again, evidence is very promising that when such targeted, aligned supports are available to teachers, children’s skill gains can be considerable—on the order of a half a standard deviation on average, and as much as a full standard deviation. Unfortunately, preschool teachers are rarely exposed to multiple field-based examples of objectively defined high-quality practice (Pianta, 2005), and they receive few if any opportunities to receive feedback about the extent to which their classroom interactions and instruction promote these skill domains (Pianta, 2005). At present, there is very little evidence that the policy frameworks and resources that should guide and encourage professional development and training of the early childhood workforce are aligned with the most promising, evidence-based forms of effective professional development. Thus, it is not surprising that teachers with a 4-year degree or 2-year degree do not differ from one another substantially in either their practice or their students’ learning gains, and it is not surprising that investments in courses and professional development appear to return so little to children’s learning. It truly does depend on the nature and type of professional development, and future considerations for policy aimed to improve the quality and effects of preschool must very clearly address this disconnect; investments in professional development need to be made far more contingent on what we know is beneficial to teachers and children, as opposed to on what is convenient or beneficial to professional development providers.

## Directions for Policy and Future Research

Our conclusions are fairly straightforward and include four major points. First, preschool, which we have defined as publicly supported programs (child care, Head Start, state-funded pre-K), encompasses such a wide range of funding streams and targets, program models, staffing patterns and qualifications, and even basic aims (maternal employment or education) that it cannot be understood as a uniform or singular aspect of the

public system of support for children. Moreover, the fragmentation in this educational space greatly impedes policy levers that could drive improvement and coherence in the actual models that children experience. Second, despite this stunning variability and fragmentation, there is compelling evidence from well-controlled studies that attending preschool can boost development and school readiness skills and can have longer term benefits to children and communities over time. Unfortunately, the effects of various program models are quite varied, with some being rather weak and ineffective whereas other scaled-up programs narrow the achievement gap by almost half. It is quite clear that programs that are more educationally focused and well defined produce larger effects on child development. Third, for children enrolled in preschool, features of their experience in those settings are important—particularly, the ways in which adults interact with them to deliver developmentally stimulating opportunities. The aspects most often discussed as features of program quality regulated by policy (such as teacher qualifications or curriculum) have much less influence on children than is desired. Fourth, teacher-child interaction and teachers' effective implementation of educational and developmental curricula, as features of program quality, are central ingredients responsible for program effects but do not appear to be produced in a reliable manner by typical teacher preparation. It is important to note that such aspects of preschool quality and children's experience can be improved with specific and focused training and support and this will have expected effects on children's learning.

The research on preschool has indeed yielded a rich set of results, and both the literature and the field have progressed in the complexity of questions and issues being addressed. As we assess the present state of the research literature as it intersects with policy and look to the future, we see a number of central themes emerging for work needing attention now and into the years beyond:

- (a) Defining and assessing standards for children's learning, for preschool programs, and for the teachers staffing them.
- (b) The amount, nature, and targeting of public investments required to ensure gap-closing gains, including how to reposition funds away from unsuccessful or weak programs and program models and toward those shown to be more effective.
- (c) The basic science of child development, particularly in the areas of neuroscience and genetics, and the implications this work may or may not have for policy and practice in early education.
- (d) How to best align preschool with K–12, which is a very immediate challenge, perhaps best reflected in recent efforts to create a preschool through grade 3 model of schooling.
- (e) The ways in which the somewhat less regulated field of early childhood education provides a testing ground for innovations and ideas relevant to K–12 policy.
- (f) Perhaps most important, how to radically alter the landscape of preschool programs, policies, and funding streams to create a more coherent and uniform platform for these important offerings.

Current public policies for child care, Head Start, and state pre-K fail to ensure that most American children attend highly effective preschool education programs. Some attend no program at all. Others attend educationally weak programs. Children in families from the middle of the income distribution have the least access, but coverage is far from universal even for children in poverty. This state of affairs can have marked and deleterious effects on children, families, and communities. It is not easily solved by more subsidies or more of the same types of programs. Increased provision of child care subsidies under current federal and state policies is particularly unlikely to produce any meaningful improvements in children's learning and development and could have mild negative consequences. Increased public investment in effective preschool education programs for all children can produce substantial educational, social, and economic benefits, but only if the investments are in programs in which teaching is highly effective. Although some state and local pre-K programs appear to have been the most effective, such programs need not be provided by the public schools. Child-care and Head Start programs with similar standards and resources (including professional development focused on teaching practices) operating as part of state pre-K produce similar results. It is also abundantly clear that 1 year of effective preschool education is not a panacea. Even with an earlier start and longer duration, preschool education is not an inoculation that guarantees complete and permanent elimination of the achievement gap for the disadvantaged children who should have priority for such programs because they benefit most.

There are large disagreements within the field about what policies should be implemented. Many advocates, policy-makers, and scholars believe that improving education and wages of teachers is necessary to improve care, because it will professionalize the workforce. Their focus is on improving the quality of preservice training and promoting wide efforts to link teacher qualifications and training to early childhood competencies; Maine's registry is an example of such a program. Others, however, focus on creating professional development programs with demonstrated effectiveness in improving teaching practices and child outcomes. The latter group argues that public funds to improve quality and program impacts should be targeted only to professional development opportunities with known effectiveness. These two positions—one emphasizing improving the amount of training and one emphasizing effective training—are clearly not mutually exclusive, but each will be difficult to implement. For example, ensuring that higher-education courses teach effective practices will require a different approach to preservice training and certification, an area in which there is a considerable need for research and development to drive such a policy. Ensuring there are educational specialists who can provide effective models of professional development to programs will require a different approach to in-service training. Coordinating across preservice

and in-service in achieving these goals and paying close attention to evaluation of impacts will be essential.

Furthermore, balancing between those policies that promote access to care to encourage parental employment and those policies that promote high-quality, educationally focused care to enhance school readiness skills will be the focus of many debates. Although not discussed extensively in this review, most of the public funds for child care are spent on child care subsidies that permit a parent (usually the mother) to work and that often are capped so that it is difficult to purchase high-quality care. Pre-K programs are typically targeted toward low-income children to improve school readiness skills and often are half-day programs so that as many children as possible can have access to them. Such programs do not tend to provide care for the entire time mothers are likely to be employed. More careful discussion of these two somewhat discrepant goals is needed.

There is general agreement that we need more rigorous testing of programs if we are to reach goals of improving practice and child outcomes. For example, too often professional development or instructional programs are adopted on the basis of evidence from studies with limited methodological rigor or that were conducted under less-than-ideal circumstances. Considerably more research money is needed to ensure that we can develop and adequately field test programs before we assume they can be successfully implemented. Before asking systems to implement various models with teachers or with young children, we need to be sure that their purchase is warranted and that we are not wasting opportunities to provide children with much-needed support and instruction.

Policy innovations, such as quality-rating systems, were implemented to assist parents in identifying high-quality child care and in improving the quality of existing programs. These systems could have tremendous potential but are in some ways predicated on somewhat dubious assumptions regarding the role that teacher education and other structural and process quality measures have on promoting child outcomes. Although the programs are well intended, more evaluation is clearly warranted.

Finally, our discussion focused on preschool—programs for children ages 3 and 4. Most of those children received care as infants and toddlers in other, even less well-regulated settings, and many preschoolers themselves receive care in one of these other settings. Less is known about these settings, especially unregulated settings, but existing evidence indicates that quality of care, especially for low-income children, is poor. More broadly, preschool education policy should be developed in the context of public policies and programs to effectively support child development from birth to age 5 and beyond.

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