

## **The Effects of Universal Pre-K in Oklahoma: Research Highlights and Policy Implications**

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*Oklahoma is one of only three states in the nation to offer a free pre-kindergarten (pre-K) program to all students in participating school districts on a voluntary basis. Fortuitous circumstances in Tulsa, Oklahoma, the state's largest school district, permitted an unusually rigorous evaluation of the pre-K program in Tulsa. Because four-year-olds beginning pre-K and five-year-olds beginning kindergarten were administered the same test in September 2001 and because strict eligibility cut-offs were applied, based on date of birth, it was possible to control for selection effects, in addition to gender, race/ethnicity, school lunch eligibility, and precise date of birth. The evaluation showed strong positive effects of the pre-K program on children's language and cognitive test scores. Hispanic children benefited most from the program, and black children also showed sharp gains, especially when they attended full-day programs. The results are discussed in light of contemporary controversies regarding targeted or universal pre-K programs; full-or part-day programming; public school or multiple delivery sites; strategies for ensuring high quality, effective programs; and the need for rigorous program evaluations.*

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Throughout the United States, there is growing interest in pre-K programs that might enhance the school readiness of young children. As of 2002, 40 states had publicly funded pre-K programs for four-year-olds and to a much lesser extent three-year-olds, with total expenditures exceeding \$2.4 billion (Barnett et al., 2003). The typical pattern is to make these programs available to disadvantaged children. Only the District of Columbia and three states—Georgia, Oklahoma, and New York—have programs that are available to all four-year-olds in participating school districts, irrespective of income. In the District of Columbia, every elementary school has a pre-K program, but there are waiting lists at some schools.<sup>1</sup> In Georgia and Oklahoma, the overwhelming majority of school districts have chosen to participate, and a majority of parents of four-year-olds have chosen to enroll their children. In New York, budget difficulties have limited participation so that universality has not been realized.

In this article, we assess Oklahoma's pre-K program by focusing on Tulsa, the largest school district in the state. First, we review the literature on the effects of pre-K programs. Second, we identify some of the distinctive features of Oklahoma's program. Third, we provide a brief introduction to the Tulsa Public Schools and explain why it was feasible to conduct an unusually rigorous evaluation there.

Fourth, we summarize evidence from the Tulsa pre-K program evaluation. And fifth, we consider the public policy implications of these findings, for Oklahoma, for other states, and for the nation.

Although we expect the Oklahoma pre-K program to have positive effects, in light of substantial prior evidence linking developmentally supportive early-childhood programs to improved cognitive and language development, as discussed below, there are reasons to doubt this proposition. First, the program is universal. Given the well-documented challenges facing the early-childhood workforce (Center for the Child Care Work Force, 2002), is it possible for a universal pre-K program to recruit and retain the highly qualified teachers who are needed to make the program a success? Second, the program is run through the public schools. With growing demands that public schools improve the performance of elementary and secondary school students (Hochschild & Scovronick, 2003; Peterson & West, 2003) and with continuing frustration over school desegregation efforts (Clotfelter, Ladd, & Vigdor, 2003; Reed, 2001), can the public schools meet yet another difficult challenge? Third, the program serves a very diverse population, in terms of race, ethnicity, and social class. In meeting the needs of any particular subgroup, can a universal program also meet the needs of the others?

### Literature Review

In theory, pre-K programs should enhance the development of young children, especially disadvantaged children. Outcomes related to school readiness are particularly salient in this literature. Numerous studies of child care have, for example, documented links between higher quality early-childhood environments and children's cognitive and language development (NICHD Early Child Care Research Network [ECCRN], 2000; Peisner-Feinberg et al., 2001). These associations are found most consistently for children who were enrolled postinfancy in center-based arrangements (see also Loeb et al., 2004) and appear to be stronger for children growing up in low-income households who typically receive less support for cognitive and language development (Votruba-Drzal, Coley, & Chase-Lansdale, 2004). Evaluations of Head Start and of model early-intervention programs that focus on this more disadvantaged population of children have documented significant short-term and long-term gains in cognitive functioning and in subsequent academic outcomes (Campbell et al., 2002; Currie & Thomas, 1995; Garces, Thomas, & Currie, 2002; Schweinhart, Barnes, & Weikart, 1997).

It is difficult, however, to extend findings from these two existing strands of research on child care and early intervention to state pre-K programs without a comparison of program features, auspices, staffing, clientele, and costs per child. Prior research has suggested that the typical school-based preschool program is of higher quality than the typical child care program serving low-income children (Layzer, Goodson, & Moss, 1993; Phillips et al., 1994), but today many pre-K programs are not school-based. Model early-intervention programs provide comprehensive packages of services to participating children and their families—features that do not characterize the majority of contemporary pre-K programs.

The emerging literature on developmental outcomes associated with pre-K programs is encouraging but far from definitive. A careful meta-analysis of state-funded preschool programs in 13 states found statistically significant positive impacts on some aspect of child development (cognitive, language, or social) in all of the states, but none of the studies used random assignment and only one used a comparison group that credibly controlled for selection bias (Gilliam & Zigler, 2001). These methodological shortcomings are serious, because children who select into preschool programs (or who are selected into preschool programs) often differ in terms of their observable characteristics (e.g., social class) from those who do not. If they differ in terms of observable characteristics, they probably differ in terms of unobservable characteristics as well.

A recent Michigan study, using a non-experimental research design, reached positive conclusions: in kindergarten, teachers rated students who attended a pre-K program higher in language, literacy, math, music, and social relations; students who attended a pre-K program were more likely to pass the Michigan Educational Assessment Program's reading and mathematics tests (Xiang & Schweinhart, 2002). A recent national study, using the ECLS-K data, found that kindergarten students who had attended a pre-K program scored higher on reading and math tests than children receiving parental care. Kindergarten students who had attended a preschool or a day care also experienced improvements, but the pre-K participants' improvements were more substantial (Magnuson et al., 2003).<sup>2</sup> However, neither the Michigan study nor the national study controlled adequately for selection bias.

We know very little about the effects of universal pre-K programs, partly because there are so few of them. Here, too, preliminary results are encouraging but not entirely convincing. A study of Georgia's universal pre-K program found that 82% of former pre-K students rated average or better on third-grade readiness in comparison to national norms, but the study lacked a comparison group of children not exposed to pre-K (Henry et al., 2001). A more recent study found that economically disadvantaged children attending Georgia's pre-K program began preschool scoring below national norms on a letter and word recognition test but began kindergarten scoring above national norms (Henry et al., 2003). Unfortunately, this study also lacked a comparison group of children not exposed to pre-K. An evaluation of New York's universal pre-K program was to have been conducted but never received funding from the New York state legislature. Clearly, more research is needed, and Oklahoma presented a promising target of opportunity.

### **Oklahoma's Blueprint for Program Quality**

Oklahoma established its universal pre-K program in 1998, after having administered a targeted pre-K program for economically disadvantaged children for eight years. Under the 1998 legislation and accompanying regulations, each of the state's 543 public school districts is free to participate or not. The program proved phenomenally popular, especially in large metropolitan areas like Tulsa and Oklahoma City, with relatively large populations of disadvantaged children. As of 2002-3,

494 (91%) of the state's school districts and 65% of all 4-year-old children were participating.<sup>3</sup>

The Oklahoma pre-K program utilizes public school districts to deliver services directly to students. In this respect, Oklahoma's program differs significantly from both the Georgia and New York universal programs (as well as from most targeted programs), which rely on a mix of service delivery mechanisms. In Georgia, for example, 57% of the publicly funded pre-K programs are run by private operators, such as for-profit or nonprofit day care centers. In contrast, all of Oklahoma's pre-K programs are run by the public schools, either as stand-alone programs or in collaboration with Head Start programs or child care centers.

Oklahoma made a commitment to providing high quality early education from the program's inception and has sustained this commitment through the transition to universality. For example, pre-K teachers are guaranteed the same compensation and benefits as teachers in public elementary schools. This requirement distinguishes Oklahoma's pre-K program from child care centers in Oklahoma and elsewhere. Oklahoma's pre-K teachers have a starting salary of at least \$27,060. In contrast, the average starting salary for child care providers nationwide is \$16,980 (U.S. Department of Labor, 2001) and, in Oklahoma, for center-based teachers, approximately \$13,500, based on their average wage of \$9.30 an hour (Center for the Child Care Workforce, 2002).

Strong teacher qualifications distinguish Oklahoma's pre-K program from many other states' pre-K programs, from Head Start, and from Oklahoma's child care centers. According to the 1998 law, all pre-K teachers must have a college degree and a certificate in early-childhood education. Whereas 100% of Oklahoma's pre-K teachers have a college degree, fewer than 20% of non-home-based day care providers nationwide have a college degree.<sup>4</sup> Only 12 of 33 states recently surveyed by Gilliam and Ripple (2004) require their pre-K teachers to possess both a bachelor's degree, typically specific to the field of early-childhood education, and a teaching certificate. Georgia, for example, allows its lead teachers to have a two-year associate's degree in early-childhood education in lieu of a four-year degree. It is not uncommon for states to accept teachers with only a Child Development Associate (CDA) Certificate<sup>5</sup> in substitution for a college degree. Under 30% of Head Start teachers have a bachelor's degree or higher (U.S. Department of Health and Human Services, 2002).<sup>6</sup> Within Oklahoma, licensing requirements for lead teachers in child care centers are much weaker than pre-K teacher requirements. Specifically, lead teachers in child care centers must be at least 19 years of age, have a high school diploma or GED, and have earned at least 12 college credit hours of training in early education or a related field.

Oklahoma's pre-K program is also characterized by relatively strict ratio and group size requirements. By state law, group sizes for Oklahoma's pre-K program are set at 20 and child/staff ratios cannot exceed 10/1. These requirements correspond to the accreditation guidelines of the National Association for the Education of Young Children (NAEYC), as well as to program guidelines for Head Start. Most state pre-K programs require group sizes and ratios that correspond loosely to those of Oklahoma (Barnett et al., 2003) However, only 6% of child care centers nation-

ally are accredited by NAEYC and are thus clearly in compliance with their guidelines.<sup>7</sup> Within Oklahoma itself, child care centers are allowed to have child/staff ratios of 15/1 and group sizes of 30 for four-year-old children.<sup>8</sup>

All of these program requirements have important implications for program quality. Studies of child care centers, for example, show that children progress more rapidly at centers with low child-staff ratios, small group sizes, and teachers who are well-educated, well-trained, and well-paid (Love, Schochet, & Meckstroth, 1996; Phillips et al., 2000; Vandell & Wolfe, 2000). Teacher wages are strongly associated with their educational levels, as well as with teacher retention and overall quality of care (Phillips et al., 2000). These features also characterize successful early intervention programs (Barnett, 1998; Karoly et al., 1998). In short, there are reasons to expect that Oklahoma's pre-K program should have a positive impact on young children.

A different approach to program quality, which Oklahoma declined to pursue, is for the state to mandate use of specific curricula or compliance with explicit pedagogical guidelines. Unlike Georgia, which established a clear set of pedagogical principles to accompany its pre-K program,<sup>9</sup> Oklahoma leaves these matters in the hands of individual school districts—a practice that characterizes the vast majority of state pre-K programs. As a result, Oklahoma's pre-K teachers, in consultation with their principals and other school officials, have often created their own curriculum. In other instances, they have borrowed from such standardized curricula as Curiosity Corner (developed in conjunction with Success for All), the Waterford Early Learning Program, Integrated Thematic Instruction, Creative Curriculum, Scholastic Inc.'s curriculum for four-year-olds, and Direct Instruction. One school offers full immersion French and Spanish programs. The only explicit policy that may have had some unifying effect on teaching practices is the mandated use of a state report card that establishes benchmarks for children's achievement in areas ranging from language arts, math, and science to behavior and social skills.<sup>10</sup>

### **Tulsa Public Schools as a Research Site**

The Tulsa Public Schools (TPS) system is the largest in the state of Oklahoma (41,495 students), slightly bigger than the Oklahoma City school system (37,231 students). Its students include a diverse cross-section of racial and ethnic groups (see Table 1). As of October 2002, 77% of its students qualified for a free or reduced-price school lunch, as opposed to 52% of Oklahoma students.<sup>11</sup> Thus, Tulsa students are poorer than Oklahoma students as a whole, who in turn are somewhat poorer than students nationwide.<sup>12</sup> Aside from collaborative relationships with the local Head Start program, TPS provides all pre-K services in public school classrooms, with public school personnel as teachers.

As of the fall of 2001, approximately 66% of all Tulsa four-year-olds were participating in either the pre-K program or a Head Start program with some sort of collaborative relationship with TPS.<sup>13</sup> This penetration rate slightly exceeds the state average for the same point in time.

TPS offers both full-day and half-day pre-K programs, depending on the school. As of the fall of 2000, approximately 43% of all pre-K students were in full-day

**Table 1.** Racial, Ethnic Composition of Tulsa Public Schools Student Body, 2001–2002

Group	Proportion of Student Body
White	43%
Black	35%
Hispanic	12%
Native American	9%
Asian	1%

Source: Tulsa Public Schools (<http://www.tulsaschools.org>, accessed July 15, 2003).

programs, and approximately 57% were in half-day programs.<sup>14</sup> Most of the half-day programs are provided in double sessions (morning, afternoon).

A key reason for selecting Tulsa as a research site is the unusual availability of some test data from late summer 2001.<sup>15</sup> The test, known as the Early Childhood Skills Inventory (ECSI), was administered by TPS teachers to four-year-olds about to begin the TPS pre-K program and to five-year-olds about to begin the TPS kindergarten program. It featured three questions on socioemotional development, seven on cognitive/general knowledge, six on motor skills, and ten on language. All questions were asked in English.<sup>16</sup>

Although the ECSI is a homegrown testing instrument, it correlates rather well with nationally normed tests, including the Brigance Screens (0.85) and the Battelle Developmental Inventory (0.80) (Daleiden & DeBois, 2001). Performance on the Battelle Developmental Inventory as a preschooler correlates well with subsequent performance on the Woodcock-Johnson Achievement Test in elementary school (Berls & McEwen, 1999). The principal weakness of the ECSI is the socioemotional dimension, whose three test items essentially tap the child's response to the testing situation. Furthermore, the socioemotional test items elicit little variation from tested children.<sup>17</sup>

Approximately 76% of the district's 1,690 pre-K students (1,284) and approximately 66% of the district's 3,441 kindergarten students (2,276) were tested, yielding a total sample size of 3,560 children. A comparison of the demographic characteristics of tested children and the universe of children, for the pre-K and kindergarten cohorts respectively, found that the tested children were reasonably representative of the larger population.

A distinctive feature of the Tulsa evaluation is its elaborate controls for "selection bias"—a problem that has compromised many previous evaluations of this nature. Because both four-year-olds and five-year-olds took the same test at the same time, and because Tulsa has a strict age qualification for when a child may enroll in pre-K (the child must be four-years-old before September 1 of the relevant year), it is possible to compare children with very similar birthdays (e.g., August 1996, September 1996) whose parents are alike in that they selected the pre-K program for their child (see Table 2). This is important because parents who choose pre-K for their child may differ from parents who do not in terms of their education, work profile, parenting practices, or motivation.

**Table 2.** Evaluation Strategies

		Conventional Evaluation K, 01-02		Our Evaluation K, 01-02	
		No	Yes	No	Yes
Pre-K 00-01	Yes		Experimental Group		Experimental Group
	No		Control Group	Control Group: must be enrolled in Pre-K 01-02	

The children with the August 1996 birthday enrolled in pre-K in 2000–2001 and were tested as kindergarteners a year after their enrollment; the children with the September 1996 birthday enrolled in pre-K in 2001–02 and were tested at the time of pre-K enrollment. By adding statistical controls for gender, race, ethnicity, eligibility for the school lunch program, and precise date of birth, it is possible to move beyond August-September birth comparisons to more extensive comparisons of children with birthdays ranging from September 1995 through August 1997. In effect, the evaluation captures the effects of the 2000–2001 Tulsa pre-K program one year after children enrolled in it.<sup>18</sup> The treatment group consists of kindergarten children who have just completed the TPS pre-K program; the comparison group consists of pre-K children who have not yet been exposed to the pre-K program. Statistical controls for date of birth (and gender, race, ethnicity, school lunch status) help to ensure that fair comparisons are made.<sup>19</sup> Due to a lack of data, we were unable to control for child care experiences (including Head Start) prior to enrollment in the TPS pre-K program.

In this article, we focus on key findings and their policy implications. Our methodology is more fully explained in another paper (Gormley and Gayer in press). To measure impacts, we log dependent variables (or test scores), after controlling for other variables. This yields an intelligible measure of impact and allows for the possibility of a nonlinear functional form. Each number reported below indicates the percentage improvement in test score attributable to the pre-K program. The baseline for comparison, in every instance, is a relevant sample of children enrolled in TPS pre-K but not yet exposed to it. Thus, for example, the effects of TPS pre-K on Hispanic children are measured by comparing Hispanic kindergarten children enrolled in TPS pre-K the previous year to Hispanic children currently enrolled in TPS pre-K, with appropriate statistical controls for date of birth and other variables.

### Findings

We first present findings for the total sample, followed by findings for racial-ethnic and income groups. We then present findings for children attending part- or full-day programs.

**Table 3.** Effects of Pre-K on Test Scores, Tulsa, Oklahoma

	Total	Soc/Emt	Cognitive	Motor	Language
All children (N = 2,243)	16.0% <sup>a</sup>	n.s.	17.2% <sup>a</sup>	8.4% <sup>c</sup>	16.5% <sup>b</sup>

*Note:* Each number indicates the percentage improvement in test score attributable to the pre-K program. This percentage was obtained by logging the dependent variable (or test score), after controlling for other variables. Logging yields an intelligible measure of impact and accounts for the possibility of a non-linear functional form. It is particularly appropriate because it measures the percentage increase in scores at the discontinuity birth date (September 1, 1995), where eligibility to enroll in pre-K changes. Only statistically significant effects (at the 0.10 level or better) are reported. An "n.s." signifies not statistically significant. Statistical significance at the 1%, 5%, and 10% levels (two-tailed) is denoted by "a," "b," and "c," respectively.

**Table 4.** Effects of Pre-K on Test Scores, Tulsa, Oklahoma, by Race, Ethnicity

	Total	Sos/Emt	Cognitive	Motor	Language
Blacks (N = 906)	17.1% <sup>b</sup>	n.s.	28.1% <sup>a</sup>	n.s.	15.2% <sup>c</sup>
Hispanics (N = 276)	53.6% <sup>a</sup>	n.s.	54.3% <sup>b</sup>	n.s.	58.6% <sup>a</sup>
Whites (N = 829)	n.s.	n.s.	n.s.	n.s.	n.s.

*Note:* Each number indicates the percentage improvement in test score attributable to the pre-K program. This percentage was obtained by logging the dependent variable (or test score), after controlling for other variables. Logging yields an intelligible measure of impact and accounts for the possibility of a non-linear functional form. It is particularly appropriate because it measures the percentage increase in scores at the discontinuity birth date (September 1, 1995), where eligibility to enroll in pre-K changes. Only statistically significant effects (at the 0.10 level or better) are reported. An "n.s." signifies not statistically significant. Statistical significance at the 1%, 5%, and 10% levels (two-tailed) is denoted by "a," "b," and "c," respectively.

## Overall Outcomes

As Table 3 suggests, the Tulsa pre-K program has positive effects for children as a whole. Children who have been exposed to the TPS pre-K program experience, on average, a 16% increase in their overall test score, after controlling for other variables. Positive effects of pre-K on language and cognitive skills account for most of the overall effects; motor skills also improve somewhat. For children as a whole, there are no statistically significant effects on socioemotional development.

### *Outcomes by Race/Ethnicity and Income*

A closer look at racial and ethnic subgroups reveals some interesting differences (see Table 4). Hispanic children benefit the most from the program. Their test scores improve by 54%, after controlling for other factors, with sharp gains in both cognitive development and language skills. For black children, test scores improve by 17%, after controlling for other factors. Cognitive test score gains are especially noticeable for black children, followed by language skill improvements. For white children as a whole, there are no statistically significant effects. We should note, however, that the testing instrument may not include a sufficient range of more difficult items to capture improvements by high-performing white students.<sup>20</sup> We do

**Table 5.** Effects of Pre-K on Test Scores, Tulsa, Oklahoma, by School Lunch Status

	Total	Soc/Emt	Cognitive	Motor	Language
Full price (N = 849)	n.s.	n.s.	n.s.	n.s.	n.s.
Reduced price (N = 238)	n.s.	n.s.	n.s.	n.s.	34.7% <sup>c</sup>
Free (N = 1,156)	25.7% <sup>a</sup>	-9.0% <sup>c</sup>	31.2% <sup>a</sup>	15.4% <sup>b</sup>	18.4% <sup>b</sup>

*Note:* Each number indicates the percentage improvement in test score attributable to the pre-K program. This percentage was obtained by logging the dependent variable (or test score), after controlling for other variables. Logging yields an intelligible measure of impact and accounts for the possibility of a non-linear functional form. It is particularly appropriate because it measures the percentage increase in scores at the discontinuity birth date (September 1, 1995), where eligibility to enroll in pre-K changes. Only statistically significant effects (at the 0.10 level or better) are reported. An n.s. signifies not statistically significant. Statistical significance at the 1%, 5%, and 10% levels (two-tailed) is denoted by “a,” “b,” and “c,” respectively.

not report any results for Asian or Native American children, because the number of children in these two categories was relatively small.<sup>21</sup>

If we examine outcomes by school lunch status, we also see some interesting differences (see Table 5). For children who do not receive a free or reduced-price school lunch (i.e., students from a higher socioeconomic bracket), there are no effects. For children who receive a reduced-price lunch, pre-K boosts their language scores by 35%. More substantial effects are evident for children who receive a free lunch. For such children, we see a 31% increase in cognitive skills, an 18% increase in language skills, and a 15% increase in motor skills as a result of exposure to pre-K. Socioemotional skills seem to decline somewhat, but we do not have a great deal of confidence in these particular measures.

#### *Outcomes for Half-and Full-Day Programs*

As noted earlier, some TPS children experience a half-day pre-K program, whereas others experience a full-day program. Do children exposed to a full-day pre-K program fare better than children enrolled in such a program but not yet exposed to it? Do children exposed to a half-day pre-K program fare better than children enrolled in such a program but not yet exposed to it?

Because children from different racial and ethnic backgrounds are exposed to a full-day pre-K program at different rates, it is important to break down our results separately for full-day and half-day program participants. For example, black children are much more likely and white children are much less likely to enroll in a full-day pre-K program. Hispanic children are more evenly distributed across part- and full-day programs. Thus we need to consider each ethnic group separately if we are properly to assess the effects of a full-day program (see Table 6). In a nutshell, we compare children who have just completed a full-day program with children who are about to begin a full-day program; we also compare children who have just completed a half-day program with children who are about to begin a half-day program.

Tulsa’s full-day pre-K program is especially beneficial for Hispanic children. For these children, we see dramatic increases in test scores for full-day children, but no improvements for half-day children. Overall, the test scores of Hispanic children

**Table 6.** Effects of Pre-K on Test Scores by Half-Day/Full-Day Status and Race/Ethnicity

	Total	Social/ Emotional	Cognitive	Motor	Language
HISPANICS, HALF-DAY (N = 140)	n.s.	n.s.	n.s.	n.s.	n.s.
HISPANICS, FULL-DAY (N = 131)	73.4% <sup>a</sup>	n.s.	90.8% <sup>a</sup>	38.5% <sup>c</sup>	73.8% <sup>a</sup>
BLACKS, HALF-DAY (N = 145)	n.s.	n.s.	n.s.	n.s.	n.s.
BLACKS, FULL-DAY (N = 745)	18.5% <sup>b</sup>	n.s.	33.3% <sup>a</sup>	n.s.	n.s.
WHITES, HALF-DAY (N = 609)	n.s.	n.s.	n.s.	n.s.	18.9% <sup>c</sup>
WHITES, FULL-DAY (N = 216)	n.s.	n.s.	n.s.	n.s.	n.s.

*Note:* Each number indicates the percentage improvement in test score attributable to the pre-K program. This percentage was obtained by logging the dependent variable (or test score), after controlling for other variables. Logging yields an intelligible measure of impact and accounts for the possibility of a non-linear functional form. It is particularly appropriate because it measures the percentage increase in scores at the discontinuity birth date (September 1, 1995), where eligibility to enroll in pre-K changes. Only statistically significant effects (at the 0.10 level or better) are reported. An “n.s.” signifies not statistically significant. Statistical significance at the 1%, 5%, and 10% levels (two-tailed) is denoted by “a,” “b,” and “c,” respectively.

in a full-day pre-K program improve by 73%, after controlling for other factors. Cognitive and language skills improve dramatically; motor skills improve as well.

In the case of black children, we also see statistically significant increases in test scores for full-day children, but no increases for half-day children. Specifically, the overall test scores of black children exposed to full-day pre-K increase by 18%, buoyed primarily by a 33% increase in cognitive test scores.

White students enrolled in a half-day pre-K program experience a 19% increase in language test scores. In short, white students do benefit from pre-K, though these benefits are weaker than for other ethnic groups. There are no statistically significant effects of full-day pre-K on white children.

It is also useful to consider effects for children whose socioeconomic status varies, as measured by school lunch status, depending on whether they enroll in a full-day or half-day pre-K program. As Table 7 indicates, students who receive a free lunch benefit from pre-K, whether half-day or full-day. Students who receive a reduced-price lunch benefit from pre-K if it is a full-day program but not if it is a half-day program. Students who pay full price for lunch benefit from pre-K if it is a half-day program but actually fare worse if it is a full-day program.

## Discussion

The relatively recent proliferation of pre-K programs across the states has been motivated by expectations that they will promote school readiness and contribute to closing the achievement gap between children at risk and their more advantaged peers. The findings reported here provide a strong affirmation of this expectation. The positive effects of the Oklahoma pre-K program indicate that a “scaled-up”

**Table 7.** Effects of Pre-K on Test Scores by Half-Day/Full-Day Status and Free Lunch Status

	Total	Social/ Emotional	Cognitive	Motor	Language
FREE LUNCH, HALF-DAY (N = 335)	27.3% <sup>c</sup>	n.s.	23.7% <sup>c</sup>	n.s.	n.s.
FREE LUNCH, FULL-DAY (N = 802)	25.7% <sup>b</sup>	n.s.	34.8% <sup>a</sup>	14.9%	n.s.
REDUCED PRICE LUNCH, HALF-DAY (N = 108)	n.s.	n.s.	n.s.	n.s.	n.s.
REDUCED PRICE LUNCH, FULL-DAY (N = 128)	52.2% <sup>b</sup>	n.s.	61.0% <sup>a</sup>	n.s.	63.8% <sup>a</sup>
FULL PRICE LUNCH, HALF-DAY (N = 583)	n.s.	n.s.	n.s.	n.s.	24.8% <sup>b</sup>
FULL PRICE LUNCH, FULL-DAY (N = 259)	n.s.	n.s.	n.s.	n.s.	-24.6% <sup>c</sup>

*Note:* Each number indicates the percentage improvement in test score attributable to the pre-K program. This percentage was obtained by logging the dependent variable (or test score), after controlling for other variables. Logging yields an intelligible measure of impact and accounts for the possibility of a non-linear functional form. It is particularly appropriate because it measures the percentage increase in scores at the discontinuity birth date (September 1, 1995), where eligibility to enroll in pre-K changes. Only statistically significant effects (at the 0.10 level or better) are reported. An "n.s." signifies not statistically significant. and 10% levels (two-tailed) is denoted by "a," "b," and "c," respectively.

intervention focused exclusively on four-year-olds can lead to significant gains, especially for Hispanic and black children and children of lower socioeconomic status, in cognitive and language skills. The findings raise numerous policy issues.

*Targeted or Universal Pre-K?* The major benefits of the Tulsa program accrued to minority and economically disadvantaged children, although white children attending part-day pre-K programs showed modest test gains. These results are directly pertinent to current debates about targeted versus universally available pre-K programs. Although the Oklahoma results suggest that targeted programs may focus resources on the children who generate the greatest benefits, other considerations point to the value of a universal approach. These include the political advantages of widespread public support and concerns about equity of access across racial and economic lines (Wolfe & Scrivener, 2003).

It is possible that pre-K benefits experienced by white students and high-SES students are underestimated by the ECSI testing instrument. Of white kindergarten children who were tested, a considerable number received the highest possible score on a particular dimension: 85.1 percent for social-emotional; 9.7 percent for language; 51.1 percent for motor skills; and 46.1 percent for cognitive development. The corresponding percentages are lower for blacks and Hispanics. Of full-price lunch kindergarten children who were tested, a considerable number received the highest possible score on a particular dimension: 86.8 percent for socioemotional; 12.8% for language; 55.0 percent for motor skills; and 47.6 percent for cognitive development. These findings suggest the presence of "ceiling effects" for white children and children whose family income does not qualify them for a free or reduced-price lunch. In research using a different testing instrument, we find support for the "ceiling effects" hypothesis (Gormley & Gayer, in press).

It is also possible that some of the classroom benefits that accrue to disadvantaged children are attributable in part to the presence of more advantaged children in the same classroom. In fact, some research on elementary and secondary school children points in this direction (Coleman et al., 1966; Hanushek et al., 2001; Hoxby, 2000). Because we did not know the socioeconomic characteristics of children in different pre-K classrooms during the 2000–2001 school year, we were unable to examine questions about how the ethnic and socioeconomic mix in pre-K classrooms affects the pattern of gains found in the Tulsa evaluation. We hope, however, to address this question in future research, when we will have access to more detailed information on the pre-K classroom environment to which children were exposed.

*Full-day or Half-day Program?* Substantial evidence indicates that greater exposure to early interventions generates greater benefits (Shonkoff & Phillips, 2000). The current results seem to support this conclusion, especially for Hispanic students, where a better comparison can be made because of relatively equal numbers of students in full-day and half-day pre-K programs.<sup>22</sup> The fact that full-day programs are more likely to address the child care needs of working families is a secondary, but not inconsequential, benefit.

It is important to recall, however, that we did not directly compare children who attended half- and full-day programs. Rather, in comparisons between children who were exposed to a full-day pre-K program and children who were about to begin such a program, we found statistically significant differences for Hispanic and black children; we did not find such differences when we compared children who were exposed to a half-day pre-K program and children who were about to begin a half-day program, except for whites. As noted earlier, students enrolled in full-day and half-day pre-K programs differ in their observable characteristics. If they also differ in their unobservable characteristics, then it would be premature to conclude that full-day programs are more effective than half-day programs. Possibly, students who select into full-day programs are more likely to be at-risk and therefore stand to benefit more from either a full-day or half-day program. Although we can control for selection bias with respect to pre-K enrollment, we cannot control for selection bias with respect to full-day enrollment. Therefore, we reach no firm conclusions on the relative merits of full-day and half-day programs.

Also, full-day programs are more costly. For example, in Oklahoma, the base compensation rate, which determined how much school districts received from the state per pre-K child, was \$3,238 for a full-day program, \$1,743 for a half-day program in 2002–2003. In short, the state paid approximately 86% more for each full-day slot than for each half-day slot. Also, it is possible that some children, such as more advantaged children, reap fewer benefits from a full-day program.<sup>23</sup>

*Public School or Multiple Service Delivery Sites?* The Tulsa Public Schools run all of their pre-K programs, which helps them to maintain a relatively high level of program control. Although they collaborate with Head Start programs, they insist, for the most part, that Head Start personnel meet their higher teacher education requirements. Across the state, collaborations also occur. For example, the three school districts that collaborate with child care centers place early-childhood-certified teachers in the classrooms (at no cost to the center). Overall, these arrangements set Oklahoma apart

from most other states, which typically rely on subcontracts with Head Start, and, in many instances, with child care programs, multiservice community agencies, and religious organizations to provide their pre-K programs.

Trade-offs involve expanded flexibility and the potential for more rapid program expansion at the cost of program control and perhaps more variable staffing and quality, as well as program philosophy. The Tulsa evaluation, restricted as it is to public school programs, is not able to bring data to bear on these trade-offs. It does, however, lend empirical support to the proposition that the public school system is a viable and effective vehicle for delivering educational services to young children.

*Avenues to Quality.* The Oklahoma pre-K program emphasizes the value for young children of highly educated, trained, and compensated teachers, a premise that is universally accepted once children enter kindergarten. It also ensures that the teachers are responsible for manageable numbers of children. Other approaches place a greater emphasis on standardized curricula or pedagogical guidelines; adherence to nationally accepted guidelines for high-quality early-childhood care (e.g., NAEYC guidelines or Head Start Performance Standards); or blends of teacher qualifications, program guidelines, comprehensive services, and parent involvement.

Again, the Tulsa evaluation is not able to compare the relative effectiveness of these approaches; its findings are restricted to Oklahoma's relatively unique reliance on highly and appropriately prepared teachers combined with group sizes that promote adequate attention to every child in the program. Nevertheless, the Tulsa evaluation does suggest that a strategy for educational gains focused on employing well-qualified and well-compensated teachers can be successful, either in addition to or as an alternative to a curriculum-focused strategy.

*To Evaluate or Not?* Only a handful of state pre-K programs have instituted routine testing of participating children and even fewer have been subjected to rigorous program evaluations (Gilliam & Zigler, 2001). This is regrettable in this era of accountability. Specifically, it leaves states and school districts with virtually no basis on which to make significant decisions about the future direction of their pre-K programs. Credible evaluations are difficult to mount in the context of ongoing programs but, as the Tulsa evaluation attests, not impossible. When conducted, it is important that pre-K evaluations be planned in close collaboration with program administrators and teachers, be carefully focused on program goals, use the most comparable contrast groups and most psychometrically sound tests possible, and gather ample information about internal program practices.

A particularly interesting finding of the Tulsa evaluation is that failure to control for selection bias may underestimate the effects of pre-K on young children (see Gormley & Gayer, in press). The direction of selection bias that may affect previous studies is difficult to predict on the basis of social science theorizing alone. If only the most motivated and effective parents are the ones who manage to enroll their children in pre-K programs, then unmeasured parent characteristics may lead earlier studies to overstate the benefits of pre-K participation. On the other hand, if pre-K program administrators select children from the most disadvantaged families

to participate or otherwise encourage such participation, then unmeasured family attributes may cause earlier studies to understate the gains from such programs. Because both of these scenarios are plausible, previous non-experimental evaluations have been appropriately interpreted with some caution. But in Tulsa, at least, when selection bias is accounted for, the discernible effects of pre-K actually increase.

### Conclusion

The Tulsa pre-K program offers an example of the success with which systematic, school-based initiatives can launch four-year-olds on a promising trajectory into elementary and secondary school education. Minority children showed dramatic gains in the cognitive and language skills that predict strong kindergarten achievement. These effects were evident in full-day programs but not in half-day programs. The effects of pre-K on white children were weaker and were limited to half-day programs, but future research, employing a different testing instrument, will be better suited to capturing the effects of pre-K across the full spectrum of students. The pre-K program produced limited gains in motor skills, no gains in socioemotional development. The limited gains in motor skills are not surprising given that pre-K programs typically do not focus on motor development. The lack of findings for socioemotional development is also not surprising given that the three test items focus on children's responses to the testing situation, rather than on their classroom behavior.

Future research would benefit from including observations of classroom experiences in studies of pre-K programs so that hypotheses regarding classroom-level contributions to group differences, such as those found in this study, can be examined. Such observations need to include assessments of traditional curricular features and aspects of the classroom social climate, both of which have been found to make independent contributions to young children's school readiness (Howes & Richie, 2002; Pianta, 1999; Stipek & Byler, 2004). Other pressing issues raised by this study concern whether the mix of children in the classroom influences the successes of pre-K programs, the relative merits of stand-alone school-based or collaborative programs, and the reasons for the lack of socioemotional outcomes attributable to the pre-K program.

Several features of the Oklahoma program offer promising opportunities for replication in other sites. These include reliance on highly and appropriately trained teachers, comparable levels of teacher compensation across the pre-K and elementary grades, and small group sizes and ratios. Oklahoma's relatively unique emphasis on universality has engendered political and public support for the program and may contribute to classroom mixes of children that foster the gains we have demonstrated, particularly for children of color and those from disadvantaged families. As the nation continues its experimentation with pre-K education, it will be critical to support high-quality evaluations that can elucidate the key ingredients of successful programs as they foster not only academic outcomes, but also the development of pro-social behavior and motivation to learn.

## Notes

1. Personal communication, Mary Gill, August 29, 2003.
2. A child's participation in a particular type of program is based on parental reports.
3. This penetration rate includes Head Start programs with some sort of collaborative relationship with the public schools. In effect, it means that 65% of Oklahoma four-year-olds were participating in either the state-funded pre-K program or a Head Start collaborative program. Personal communication, Melissa Basse, Oklahoma Department of Education, August 13, 2003.
4. Unpublished tables based on data regarding workers in the Child Day Care Services industry from the 2002 Current Population Survey, Keystone Research Center, Tracking the Educational Qualifications of Early Care and Education Workers Using the Current Population Survey, July 2003.
5. The CDA requires teachers to possess at least: (1) a high school diploma or equivalent, (2) 480 clock hours of appropriate preschool experience; (3) 120 clock hours of specific formal early childhood education; (4) documented competency through formal observation of their teaching, and (5) passing scores on the CDA written and oral examinations (Council for Early Childhood Professional Recognition, 1996).
6. As of FY2003, at least half of all Head Start teachers must hold a two-year associates degree or higher in a field related to early-childhood education.
7. Personal communication from Mark Ginsberg, executive director, NAEYC, August 8, 2003.
8. See Licensing Requirements for Child Care Centers, 2/1/2002, <http://nrc.uchsc.edu/oklahoma/oklahoma.htm>, (August 7, 2003). Centers that seek to be designated as three star centers must meet NAEYC requirements for ratios and group sizes, plus additional teacher qualification requirements. See Oklahoma Department of Human Services, Reaching for the Stars: For Child Care Centers, Oklahoma DHS Publication No. 99-39, rev. June 1, 2003.
9. The Georgia Office of School Readiness, which runs the pre-K program, has prepared a 12-page, single-spaced list of curriculum goals. For example, language development features four goals: Children will develop and expand receptive language (listening) skills; children will develop and expand expressive language (speaking) skills; children will begin to develop age-appropriate writing skills; and children will begin to develop age-appropriate strategies that will assist them in reading. Each goal includes lots of specific examples. See <http://www.osr.state.ga.us/Prekgoals.htm>.
10. Beginning in July 2003, pre-K curriculum guidelines developed by the state Department of Education became available to pre-K programs. As the term guideline implies, however, these are voluntary, not mandatory.
11. Oklahoma State Department of Education, Low Income Report for 2002-2003. According to Joanie Hildenbrand, Oklahoma Department of Education, the figures are based on October 2002 data.
12. Oklahoma has a higher child poverty rate (20%) than the U.S. average (17%). In 2000, Oklahoma ranked 39th in the nation in child poverty (Kids Count Data Book, 2003, Baltimore, Md., Annie Casey Foundation, 145).
13. According to the TPS Attendance Report for 2001-2002, 1,626 four-year-olds were in the TPS pre-K program and 663 four-year-olds were in Head Start programs linked to TPS as of October 17, 2001. This yields the numerator 2,289. According to the TPS Attendance Report for 2002-2003, 3,641 kindergarten students were in TPS as of November 8, 2002. This is the denominator, because it captures those students who were eligible for pre-K the year before. Thus the penetration rate for Tulsa was 66.4%.
14. The information on early-childhood enrollments by school comes from the Office of Pupil Accounting, Tulsa Public Schools, Attendance Report for 2000-2001. Information on full-day versus half-day programs comes from Tulsa Public Schools Early Childhood Sites, 2000-2001.
15. Approximately 78% of the tested children were tested in August 2001. Approximately 12% were tested in July 2001, and approximately 10% were tested in other months, due to scheduling challenges. It is important to note that the child's age in our analysis is always the age at the time of testing.
16. The Director of Elementary School Improvement for TPS, Andrew McKenzie, reports that teachers may have accepted some answers in Spanish.

17. Of the children tested, 93% responded appropriately to a greeting, 87% displayed an adequate attention span, and 94% behaved appropriately.
18. A parallel evaluation, of a more conventional nature, focuses on children enrolled in kindergarten in 2001–2002 and compares those who enrolled in pre-K the previous year with those who did not. Because the parallel evaluation does not control for selection bias, it provides a good baseline for assessing the extent of selection bias. The results of the parallel evaluation are reported in (Gormley & Gayer, in press).
19. As noted elsewhere (Gormley & Gayer, in press), some modest demographic differences between the treatment and control groups vanish altogether when we focus our attention on the regression-discontinuity point, which is the cutoff birthday for pre-K eligibility. At the regression-discontinuity point, the observable characteristics of the treatment and control groups are, in statistical terms, identical.
20. Thirty-five percent of white children receive the maximum cognitive score as opposed to 24% of black children and 15% of Hispanic children. For the future, we have remedied this problem by administering the Woodcock-Johnson Achievement test, with no artificial ceiling, to all children.
21. Our sample included 42 Asian children and 191 Native American children. In future research, we hope to be able to assess the effects of pre-K on Native American children.
22. It is easier to demonstrate statistically significant findings for a sample of 745 children (blacks, full-day) than for a sample of 145 children (blacks, half-day). Thus we hesitate to assert that full-day programs benefit black children more than half-day programs, even though the evidence does point in that direction.
23. Although the Tulsa data suggest this to be the case, given the likely difference in the mixes of children in full- vs. part-day programs in our sample (a larger share of disadvantaged children in the full-day programs), the fact that the white children benefited from the part-day (but not the full-day) program could be as attributable to the peer group as it is to the duration of the program day.

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