THE EFFECTS OF OKLAHOMA'S PRE-K PROGRAM ON HISPANIC CHILDREN

William T. Gormley, Jr.
Georgetown University

Direct all correspondence to: William T. Gormley, Jr., Georgetown Public Policy Institute, Georgetown University, 3520 Prospect St., N.W., Washington, D.C. 20007 (gormleyw@georgetown.edu). The author will share data and coding information with those wishing to replicate the study.

ACKNOWLEDGMENTS

The author would like to thank Dan Cullinan for valuable technical support. He would also like to thank Carolyn Hill, Ed Zigler, Julia Henly, Peter Hinrichs, Ruby Takanishi, Elizabeth Rigby, Kimber Bogard, and several anonymous reviewers for helpful comments on an earlier draft. Mireya Almazan, Joy Chen, Ah-Hyun Cho, Deanna Ford, Angeles Gottheil, Katie Newmark, and Kate Perper did a great job of coding the data, and Mireya Almazan helped with the Spanish-language training as well. The author is grateful to the Foundation for Child Development, the David and Lucile Packard Foundation, the Spencer Foundation, the A.L. Mailman Family Foundation, and the Georgetown University Graduate School for their generous financial support. He dedicates this paper to the late Tucky Roger, principal of the Newcomer School in Tulsa, whose help in setting up the Spanish-language testing was indispensable and whose devotion to English language learners was deep and unshakable.

ABSTRACT

Objective. To determine how much Hispanics benefit from a high-quality pre-K program and which Hispanic students benefit the most. *Methods*. Hispanic students in Tulsa, Oklahoma were tested (in English, Spanish) in August 2006. A regression discontinuity design addressed potential selection bias by comparing pre-K alumni (treatment group) with pre-K entrants (control group), controlling for age and other demographic variables. *Results*. Hispanic students experienced substantial improvements in pre-reading, pre-writing, and pre-math skills. Hispanic students whose parents speak Spanish at home or whose parents were born in Mexico benefited the most. English language test gains were stronger than Spanish language test gains, but the latter were sometimes significant. *Conclusions*. Preschool education has considerable potential to improve educational outcomes for Hispanic children.

THE EFFECTS OF OKLAHOMA'S PRE-K PROGRAM ON HISPANIC CHILDREN

Hispanics, now the largest minority group in the U.S., face substantial education deficits. Hispanics are less likely to finish high school than whites or Asian Americans and less likely to graduate from college than whites, blacks, or Asian Americans (Kohler and Lazarin 2007). Nearly 44 percent of Hispanic children in 2000 had mothers who weren't high school graduates, compared with 9 percent of non-Hispanic white children; fewer than 10 percent of Hispanic children had mothers who were college graduates, compared with 30 percent of white children (Glod 2007). Educational achievement is especially low among Mexican-Americans, who constitute the majority of Hispanics in the U.S. (Portes and Rumbaut 2001: 278). Among many possible explanations for this education deficit, Hispanics are less likely to enroll in preschool than members of other racial and ethnic groups (Magnuson and Waldfogel 2005: 178-181).[1] Studies show that children benefit from preschool in the short run (Magnuson et al. 2004; Gilliam and Zigler 2004) and that some of these benefits persist over time (Reynolds 2001; Barnett 1993). Underenrollment in preschool deprives Hispanic children of cognitive benefits that other children will enjoy. In the short run, Hispanics are less likely to begin school with valuable pre-reading, pre-writing, and pre-math skills. In the long run, Hispanics are less likely to complete high school or enroll in college.

An additional reason for the Hispanic education deficit is that many young Hispanic children are English language learners. Approximately two thirds of all Hispanic children ages 0-8 come from families in which one or both parents are immigrants (National Task Force on Early Childhood Education for Hispanics 2007: 6).

In homes with immigrant parents, Spanish is often the primary language spoken. For these students, school is doubly challenging. Because most classroom instruction is exclusively in English, these students must somehow learn valuable cognitive skills before they have mastered the language of instruction. Although English language learners include children from diverse racial and ethnic backgrounds, nearly three-fourths of all limited English proficiency (LEP) students in elementary schools are Hispanic (Capps et al. 2005: 36). As one indicator of the scope of the problem, about 30 percent of Hispanic children are not proficient enough in oral English to be assessed in English at the start of kindergarten (National Task Force 2007: 14).

The federal government has attempted to address these problems primarily through an *information release* strategy. The No Child Left Behind Act requires all public schools (and charter schools) to test all students in reading and in math annually, from 3rd grade through 8th grade. Hispanics' test scores must be documented separately, in order to determine whether Hispanic students are progressing at the same rate as other students. English language learners' test scores must also be documented separately. The hope is that public disclosure of test score gains for students with different demographic characteristics will induce states and local school districts to adopt policies and practices that promote educational achievement for students from all racial and ethnic groups, including English language learners.

While the federal government has focused on testing and information disclosure, state governments have pursued other strategies. In recent years, a *preschool education* strategy has become extremely popular. As of 2005-06, 38 states had state-funded pre-K programs, which cost approximately $3.3 billion (Barnett et al. 2006). Nearly 950,000

children are currently being served. More four-year-olds are now participating in state-funded pre-K programs than in the federally funded Head Start program. A silent revolution in early childhood education has occurred.

Although many states have adopted innovative preschool education programs, Oklahoma stands out. Thanks to a universal pre-K program, available to all four-year-olds, irrespective of income, Oklahoma now reaches a higher percentage of four-year-olds (70 percent) than any other state in the union (Barnett et al. 2006). Thanks to a requirement that every state-funded pre-K classroom be led by a college-educated, early childhood certified teacher, Oklahoma's program is a very high quality program.

In this paper, I assess the effects of Oklahoma's universal pre-K program on Hispanic students in Tulsa, Oklahoma, the largest school district in the state. I ask five key questions: 1. Do Hispanic students experience test score gains in pre-reading, pre-writing, and pre-math? 2. Do Hispanic students who come from a home where Spanish is the primary language spoken experience bigger learning gains? 3. Do Hispanic students whose parents were born in Mexico experience bigger learning gains? 4. Do Hispanic students whose teachers speak some Spanish experience bigger learning gains? and 5. To what extent do observed gains reflect improved English language skills, as opposed to improved cognitive development?

Underlying these questions is an attempt to understand the relative importance of *need* and *capacity* as contextual variables for learning gains. As Bruner (1996: 53) has noted, "When an adult demonstrates or models a successful or skilled action to a child, that demonstration is implicitly based on the adult's belief that (a) the child does not know how to do x and (b) the child can learn how to do x by being shown." Need (as

measured by risk factors) and capacity (a more difficult concept to measure) are both important factors in cognition, but their relative importance may depend on how challenging the task is, how much the child already knows, how supportive the child's environment is, and how motivated the child is. In the U.S., Hispanic students who come from Spanish-speaking homes (or whose parents were born in Mexico) typically need educational help more than other Hispanic students but may be less equipped, in terms of language skills, to benefit from instruction, if conducted in English. If need trumps capacity, in this context, then Hispanic students from Spanish-speaking homes (or whose parents were born in Mexico) should benefit more than other students from a pre-K program. In a nutshell, this paper asks how much Hispanics benefit from a strong state-funded pre-K program, which Hispanics benefit the most, and whether these benefits are due to cognitive improvement, English language skill improvement, or both.

LITERATURE REVIEW

A growing body of literature points to the conclusion that preschool programs enhance school readiness. Analyses of ECLS-K data on pre-K program participation reported short-term effect sizes of .19 of a standard deviation for reading and .17 of a standard deviation for math, for children as a whole (Magnuson et al. 2007) and even larger effect sizes for disadvantaged children (Magnuson et al. 2004). An evaluation of Georgia's universal pre-K program found that children who enrolled in the program did better in comparison to national norms following their participation (Henry et al. 2003). An evaluation of Oklahoma's universal pre-K program found substantial gains in pre-reading, pre-writing, and pre-math skills. The effect sizes were impressive: .79 of a

standard deviation for pre-reading skills, .64 of a standard deviation for pre-writing skills, and .38 of a standard deviation for pre-math skills (Gormley et al. 2005). Other early childhood education programs, including day care centers, Head Start, and early childhood demonstration programs, have also proven to be effective, though their effects vary quite a bit (Gormley 2007).

Hispanic students, when enrolled in early childhood education programs, benefit at least as much as students from other racial and ethnic groups. A series of studies using sibling-based comparisons indicated that Hispanic children (and white children) benefit more from Head Start in the long run than black children (Currie and Thomas 1995; Currie and Thomas 1999; Garces et al. 2002). An analysis using ECLS-K data found that Hispanic children who attended preschool experienced statistically significant gains in reading and math test scores – gains of higher magnitude than for white or black children (Loeb et al. 2005: Table 4). Research on Oklahoma's universal pre-K program indicated that Hispanic students experienced greater test score improvements (in pre-reading skills, pre-writing skills, and pre-math skills) than any other racial or ethnic group (Gormley and Gayer 2005; Gormley, Gayer, Phillips & Dawson 2005).

Less is known about which Hispanic students benefit the most from pre-K, though a good deal of evidence hints at a conclusion. Using ECLS-K data, Magnuson et al. (2006: 1258) found that children of immigrants (Hispanics and others) who attended preschool improved their reading and math skills about as much as other children (Hispanic and others). The authors also found that preschool was more beneficial for children whose mothers spoke a language other than English at home. They attributed this to English language acquisition in a preschool setting (Magnuson et al. 2006: 1258).

Surprisingly, Crosnoe (2007: 172), also using ECLS-K data, found that children from Mexican immigrant families benefited less from preschool, as measured by math achievement tests, than children from native Latino families.

One problem with research based on ECLS-K data is that attributions of program participation are based on parent recall, as opposed to administrative data. If parents misremember, and there is some evidence that they do (Lopez and Barrueco 2005), then classifications of children's program participation will be inaccurate. Another problem with ECLS-K is that the reading assessment was conducted in English only. This is problematic for two reasons. First, nearly one-third of Hispanic students could not speak English well enough to be tested in English, which means that they were excluded from the reading testing process. Second, without testing in Spanish, it is impossible to determine whether learning gains are due in whole or in part to English language acquisition, as opposed to cognitive improvement. In the ideal situation, all Hispanic students who can speak some Spanish will be tested in Spanish for all relevant tests, and all Hispanic students who can speak some English will be tested in English for all relevant tests.

DATA

The data for this assessment come from student tests and parent surveys administered in August 2006, just prior to the beginning of the school year, in Tulsa, Oklahoma. The chosen testing instrument was the Woodcock-Johnson Achievement Test, a nationally-normed test widely used in educational evaluations (Chase Lansdale et al. 2003; Henry et al. 2006; Puma et al. 2005) Three subtests especially appropriate to

young children were selected: the Letter-Word Identification Test (which measures pre-reading skills); the Spelling Test (which measures pre-writing skills); and the Applied Problems Test (which measures pre-math skills). A comparable – but not identical – test in Spanish – known as the Woodcock-Munoz Bateria – was also utilized. In effect, this test measures the same set of skills but with a different set of questions.

All tests were administered by Tulsa Public Schools personnel, who were trained by an independent consultant, Barbara Wendling, an expert on the Woodcock-Johnson Test. Regular classroom teachers administered the Woodcock-Johnson Test to incoming pre-K and kindergarten students, including Hispanic students who were capable of being tested in English. Para-professionals who possessed a college degree or an associate's degree (from a U.S. or Latin American college) and who were deemed to be bilingual (by a Tulsa Public Schools principal) were recruited to administer the Woodcock-Munoz Bateria to Hispanic students who were capable of being tested in Spanish (described further below). Teachers and para-professionals were compensated for their participation.

To understand how the testing process worked, let's consider a hypothetical Hispanic student who is about to enroll in a Tulsa Public Schools pre-K program and who is capable of communicating in both English and Spanish. The student is brought to school by a parent or guardian at a designated time a few days before classes are to commence. The student's new teacher administers the Woodcock-Johnson Test to the student in English, while at the same time the parent/guardian completes a brief parent survey (in English or in Spanish). Then, after a brief interval, the para-professional administers the Woodcock-Munoz Bateria in Spanish. Teachers and para-professionals

were instructed to attempt to administer both English and Spanish versions of the test to all Hispanic students. If, after the initial set of questions, it became apparent that the student could not be tested in a particular language, then the testing in that language ceased.[2] A potential worry might be that pre-K alumni, who have been exposed to classroom English for a year, would be less likely to be tested in Spanish than pre-K entrants. In practice, however, that difference was small and insignificant.[3]

Although we recommended a test sequencing strategy to follow (English first in schools where the student's name began with A-M, Spanish first in schools where the student's last name began with N-Z), it was difficult for many schools to adhere to this strategy because of the logistical challenges of the testing process (e.g., sometimes a student was ready to be tested in Spanish, but the Spanish test administrator was busy with another student, so the student was tested in English first). Also, many teachers neglected to note the precise time of the test. Nevertheless, for those students whose testing sequence was clear, it appears that testing sequence did not matter.[4]

Of 410 Hispanic students who enrolled in the Tulsa Public Schools pre-K program in the fall of 2006, 81.2 percent were tested. Of all tested pre-K Hispanic students, 36.3 percent took the Woodcock-Johnson Test only, 6.3 percent took the Woodcock-Munoz Test only, and 57.4 percent took both tests. Of 336 Hispanic TPS pre-K alumni who enrolled in the TPS kindergarten program in the fall of 2006, 81.5 percent were tested.[5] Of all 274 tested pre-K alumni in kindergarten, 39.1 percent took the Woodcock-Johnson Test only, 2.9 percent took the Woodcock-Munoz Bateria only, and 58.0 percent took both tests. The Woodcock-Munoz participation rate was lower than the

Woodcock-Johnson participation rate in part because we were unable to deploy suitable para-professionals at every school on every day of the testing period.[6]

The parent survey, two pages in length, asked a variety of crucial questions about the child and the parent, including the child's place of birth, the parent's place of birth, the primary language spoken at home, the mother's education, and other questions. Participation in the parent survey exceeded expectations. 87 percent of parents of Hispanic kindergarten students who attended the Tulsa pre-K program the previous year completed a survey, as did 86 percent of parents of Hispanic pre-K entrants.[7]

METHODOLOGY

The key to any assessment of an educational program's effects is a credible strategy for addressing selection bias. The children who enroll in a voluntary pre-K program may differ in key respects from the children who do not enroll in such a program. Some of these differences are measurable, while others are not. For example, if the children differ in their motivation or their intelligence – or if their parents differ in these same attributes and parental behavior matters – then comparisons will be flawed.

The strategy used here, which builds on previous work (Gormley and Gayer 2005; Gormley et al. 2005), is a regression-discontinuity design in which the treatment group consists of Hispanic kindergarten students who attended pre-K the previous year and the control group consists of Hispanic pre-K students who are about to experience the same pre-K program. The students are tested at precisely the same point in time, under similar conditions. They differ, of course, in their respective ages (the kindergarten students are,

on average, exactly one year older), but age is extremely easy to measure and can be included as a control variable in the models, along with other control variables.

A regression-discontinuity design works in Tulsa because the Tulsa Public Schools is very strict in enforcing the state's September 1 birthday cutoff for determining eligibility to enroll in pre-K in a given year. A student born on September 1, 2001 was eligible to enroll in pre-K for the 2005-06 school year; a student born on September 2, 2001 was not eligible to enroll until the 2006-07 school year. Although the regression-discontinuity design utilizes all data points for students in the treatment group (kindergarten students who participated in the TPS pre-K program in 2005-06) and the control group (students who began the TPS pre-K program in 2006-07), it focuses attention on the September 1, 2001 cutoff, to determine whether students born before and after this date differ in their test scores.[8] The effects being measured are treatment on the treated (TOT) effects, not intent to treat (ITT) effects.

One can easily imagine a simpler strategy – e.g., a comparison of kindergarten students who had participated in pre-K during the previous year with kindergarten students who had not participated in pre-K in the previous year. However, the big advantage of the regression-discontinuity design is that students in the treatment group and the control group are alike in that their parents, for whatever combination of reasons, decided that they ought to enroll in pre-K and in the Tulsa program in particular. They are also alike in other respects (gender, primary language spoken at home, parent's place of birth, school lunch eligibility, and mother's education). As Table 1 indicates, there are no statistically significant differences between the treatment group and the control group for any of these variables.

As a practical matter, then, I will run a series of OLS regressions in which both pre-K entrants and pre-K alumni are included. Age will be included as a control variable (*Qualify*), measured as the difference in days between the student's date of birth and the date for qualifying to enter pre-K. A dichotomous variable – *Cutoff* – will capture whether the student was born on or before September 1 of 2001, the eligibility cutoff for pre-K admission for the 05-06 school year. This variable is equal to one for students who participated in pre-K during the 2005-06 school year, and equal to zero for students who participated in pre-K during the 2006-07 school year. Eligibility in the fall of 2005 and participation in the 05-06 pre-K program are one and the same, for those students whose parents chose to enroll them in the program. Additional variables in the model include: gender, school lunch eligibility, and mother's education. Note that these variables should be uncorrelated with the *Cutoff* variable; they are included in the model to account for any chance correlation with treatment status, and to increase the precision of the estimated treatment effect.

FINDINGS

Table 2 presents a straightforward test of the proposition that Hispanic students who enroll in the Tulsa pre-K program benefit from it. Over 500 Hispanic students were tested in English (using the Woodcock Johnson Test). Hispanic students who participated in pre-K have higher Letter-Word Identification Test scores, higher Spelling scores, and higher Applied Problems Test scores than those who selected into – but have not yet experienced – the program, after controlling for age and other variables. The effects are rather large. If we convert the impact coefficients into effect sizes by dividing

them by the standard deviation for the control group, we see an effect size of .846 of a standard deviation for the Letter-Word Identification Test (pre-reading skills), 0.52 of a standard deviation for the Spelling Test (pre-writing skills), and 0.38 of a standard deviation for the Applied Problems Test (pre-math skills).

Although these findings are interesting, we also want to know which Hispanic students benefit the most from the pre-K program. Table 3 shows results reported separately for Hispanic students, based on the primary language spoken at home. For Hispanic students whose primary home language is Spanish, test score improvements are evident in all three areas. For Hispanic students whose primary home language is English, no test score gains are statistically significant, though the coefficients are consistently positive and one of the effect sizes (for Letter-Word Identification) is relatively large. Of course, students whose parents speak Spanish at home outnumber those whose parents speak English at home by nearly 3 to 1, which means that statistical significance is less likely for the latter group, ceteris paribus.

An alternative to presenting these data through separate models for Spanish-speaking and English-speaking homes would be to integrate the Spanish-speaking and English-speaking homes into one model. This can be done by dropping the generic constant and substituting separate constants for English-speaking and Spanish-speaking homes. Then each variable in the model is interacted with the English-speaking home variable and the Spanish-speaking home variable. If this is done, one can conduct an F test to determine whether the difference in coefficients for Spanish-speaking and English-speaking homes is statistically significant. Three F tests indicate that the difference is not

significant for Letter-Word ID, marginally significant for Spelling (p=.15), and significant for Applied Problems (p=.07).

As an alternative to the primary language spoken at home, I have also focused on the country of origin of the parent who completed our parent survey while the student was being tested. This category overlaps considerably with the primary language spoken at home but is not identical to it.[9] In Table 4, we see results reported separately for Hispanic students, based on the parent's country of origin.[10] For Hispanic students whose responding parent was born in Mexico, test score gains are evident in all three areas. For Hispanic students whose responding parent was born in the U.S., test score gains are statistically significant in only one instance (Spelling). Here also it is important to note substantial differences in sample sizes. F tests indicate that the difference in coefficients for children whose parent was born in Mexico and children whose parent was born in the U.S. is significant for Applied Problems (p=.073), not significant for the other two tests.

If we focus only on English language testing (the Woodcock Johnson Test) for Hispanic students, it is impossible to disentangle gains in English language skills from other cognitive improvements. However, if we compare test score gains in English with test score gains in Spanish, we can gauge the extent to which test score gains reflect improvements in English language ability. Table 5 reports test score gains for those students who took *both* the Woodcock-Johnson Test (in English) and the Woodcock-Munoz Bateria (in Spanish). Gains are apparent for both test types, which indicates that more is going on than simply the acquisition of English language skills. However, the effect sizes are higher for the Woodcock-Johnson Test than for the Woodcock-Munoz

Bateria. The most obvious difference in effects sizes is for the Letter-Word Identification Test, where the Woodcock-Johnson test score gains are dramatic ($p = .006$, effect size is .807), while the Woodcock-Munoz test score gains are insignificant ($p=.44$, effect size is .19).[11] In short, Hispanic students are improving their cognitive skills (as evidenced by Woodcock-Munoz test score gains), but they are also improving their language skills (as evidenced by bigger effect sizes for the Woodcock-Johnson Test).

DISCUSSION

Although Hispanic students who enroll in the Tulsa pre-K program generally benefit from it, some students benefit more than others. Specifically, students who come from a home where Spanish is the primary language and students whose parents were born in Mexico (groups that overlap to a considerable extent) experience greater cognitive benefits. This finding supports a *need* hypothesis rather than a *capacity* hypothesis. Whereas English-speaking students might have a greater capacity to learn in an English-speaking school environment, Spanish-speaking students have a greater need to learn in an English-immersion program.

Any English language test will measure both English language skills and other cognitive abilities. Certainly, that is true of the Woodcock-Johnson Test. In the absence of Spanish language testing, it is difficult to know just how large the English language skill boost is, in comparison to overall test gains. With Spanish language testing (the Woodcock Munoz Bateria), it is possible to distinguish between the two types of learning gains. The fact that the Woodcock Johnson test score gains appear to exceed the Woodcock Munoz test score gains (especially for the Letter-Word Identification test)

suggests the presence of some language skill gains. However, the presence of substantial Woodcock Munoz test score gains (statistically significant gains for Spelling and marginally significant gains for Applied Problems) also confirms the reality of broader improvements in cognitive development. In an English immersion program, such as the Tulsa pre-K program, Hispanic students do improve their language skills, rather dramatically. But they also acquire other skills, including pre-writing skills and pre-math skills. In short, the Tulsa pre-K program enhances the English language skills of Hispanic students but it does other things as well.

How substantial are the learning gains reported in Tulsa? For Hispanic students as a whole, effect sizes for the Woodcock-Johnson Test are .846 (for Letter-Word Identification), .523 (for Spelling), and .377 (for Applied Problems). These are impressive and substantial learning gains. By way of comparison, they are roughly comparable to short-term learning gains for black students reported for the Perry Preschool project and the Abecedarian project (Ramey et al., 1985; Ramey et al. 2000). .

How has Tulsa achieved such good results for Hispanic children? One strategy recommended by some experts – the presence of a Hispanic teacher – has not been a factor. Only a very small fraction of TPS teachers are Hispanic. Clearly, TPS teachers have managed to connect with Hispanic children despite the absence of an ethnic bond. .

We do know how TPS has been able to achieve good results for children generally -- their classroom quality is higher than average, and their time devoted to academic subjects is much higher than average. As reported elsewhere, TPS pre-K classrooms score higher on measures of instructional support than other school-based pre-K classrooms (Phillips, Gormley and Lowenstein 2007). Also, TPS pre-K teachers

devote much more time to pre-reading, pre-writing, and pre-math skills than teachers in other school-based classrooms. For example, TPS pre-K teachers spend twice as much time (10.5%) as their national counterparts (5.6%) reading to students, and they spend three times as much time (12.5%) as their national counterparts (4.7%) practicing letters and sounds. TPS pre-K students and their teachers are engaged in math 17.3 percent of the time, as opposed to a national norm of 8.6 percent. These classroom characteristics may be especially important to Hispanic students whose parents were born in Mexico and, similarly, students whose parents speak Spanish at home. For these students, a strong academically focused pre-K program offers linguistic and cognitive benefits that their parents are less able to provide.

An equally important consequence of the TPS pre-K program is that it has managed to attract a remarkable number of Hispanic participants. Nationwide, Hispanics are considerably less likely to enroll in state-funded pre-K programs than members of other racial and ethnic groups. As Magnuson and Waldfogel (2005: 169) have noted, "Hispanic children are much less likely than white children to attend preschool."[12] That is true in most jurisdictions but not in Tulsa. In 2005-06, approximately 61 percent of white four-year-olds and approximately 61 percent of Hispanic four-year-olds enrolled in the TPS pre-K program or Head Start.[13] One of the remarkable accomplishments of the TPS pre-K program is that it has managed to overcome the well-established diffidence of Hispanic parents with respect to preschool. Thus Hispanic students benefit two ways in Tulsa, from a high-quality pre-K program and from relatively high participation rates.

CONCLUSION

In recent years, the number of English language learner (ELL) students in U.S. public schools has increased sharply. Nearly four-fifths of ELL students are Hispanics whose native language is Spanish, and nearly half of all Hispanic children in our public schools are ELL students (Kohler and Lazarin 2007: 7). These students face substantial obstacles as they seek to overcome education deficits that tend to widen over time.

Many solutions to this problem have been proposed, including greater access to preschool, bilingual education, a reallocation of resources across school districts, the hiring of more Latino teachers, and others. The Tulsa pre-K program is one promising approach to this problem. The Tulsa pre-K program is reaching a higher percentage of Hispanic four-year-olds than other preschool programs, it offers higher instructional quality than other school-based pre-K programs, and it provides substantial benefits to Hispanic students.

Hispanic students whose parents were born in Mexico and who come from homes where Spanish is the primary spoken language are somewhat more likely to benefit from the Tulsa pre-K program than other Hispanic students. These results are encouraging in that students who need help more actually benefit more from pre-K.

Table 1
Characteristics of Tested Hispanic Students: Pre-K Alumni vs. Pre-K Entrants

	Pre-K Alumni	**Pre-K Entrants**
Female	47.1%	47.2%
	(N = 274)	(N = 333)
Primary Language Spoken at Home:		
English	27.4%	26.9%
Spanish	68.3%	70.3%
	(N = 234)	(N = 279)
Parent's Place of Birth:		
USA	23.6%	24.0%
Mexico	71.8%	69.7%
	(N = 216)	(N = 261)
School Lunch Eligibility:		
Free	80.7%	76.3%
Reduced	10.2%	11.7%
Paid	9.1%	12.0%
	(N = 274)	(N = 333)
Mother's Education:		
No High School Diploma	49.0%	44.1%
High School or GED	33.0%	38.4%
Some College or Associate's Degree	15.0%	11.4%
College Degree or Graduate Degree	3.1%	6.1%
	(N = 194)	(N = 245)

(column percentages shown)
No statistically significant differences between groups

Table 2

Effects of TPS Pre-K Program on Cognitive Development of Hispanic Students

	Letter-Word (Woodcock-Johnson Test 1)	**Spelling (Woodcock-Johnson Test 7)**	**Applied Problems (Woodcock-Johnson Test 10)**
Born before cut-off (treated)	2.471***	1.360***	1.928**
	(0.583)	(0.417)	(0.767)
Qualify (days)	0.005***	0.009***	0.011***
	(0.002)	(0.001)	(0.003)
Qualify*Cut-off	0.007**	-0.000	0.003
	(0.003)	(0.002)	(0.004)
Reduced-price lunch	-2.049***	-1.150**	-2.291**
	(0.782)	(0.498)	(0.914)
Free lunch	-2.618***	-1.366***	-2.715***
	(0.632)	(0.433)	(0.758)
Female	0.851***	0.999***	0.468
	(0.287)	(0.212)	(0.377)
High school degree	0.790**	0.418*	0.661
	(0.323)	(0.253)	(0.462)
Some College	1.416**	0.579*	1.831**
	(0.549)	(0.334)	(0.724)
College Degree	2.080**	0.596	4.199***
	(0.808)	(0.737)	(1.093)
Lives with Father	0.043	-0.137	-0.463
	(0.390)	(0.263)	(0.582)
Internet	0.903*	0.406	1.660***
	(0.505)	(0.336)	(0.540)
Constant	4.739***	6.382***	8.611***
	(0.801)	(0.588)	(1.200)
Observations	568	540	554
R-squared	0.46	0.54	0.45
Effect Size	0.846	0.523	0.377
Robust standard errors in parentheses			
* significant at 10%; ** significant at 5%; *** significant at 1%			
Effect sizes were calculated by dividing the regression coefficient for the Cutoff variable by the standard deviation for the control group.			

Table 3

Effects of TPS Pre-K Program on Cognitive Development of Hispanic Students by Primary Language Spoken at Home

Primary Language	English	Spanish	English	Spanish	English	Spanish
	Letter-Word (Woodcock-Johnson Test 1)	**Letter-Word (Woodcock-Johnson Test 1)**	**Spelling (Woodcock-Johnson Test 7)**	**Spelling (Woodcock-Johnson Test 7)**	**Applied Problems (Woodcock-Johnson Test 10)**	**Applied Problems (Woodcock-Johnson Test 10)**
Born before cut-off (treated)	1.438	2.607***	0.094	1.506***	0.832	3.734***
	(1.213)	(0.755)	(0.822)	(0.543)	(1.287)	(0.975)
Qualify (days)	0.007**	0.004*	0.009***	0.010***	0.014***	0.005
	(0.003)	(0.002)	(0.003)	(0.002)	(0.005)	(0.003)
Qualify*Cut-off	0.006	0.009**	0.003	-0.002	-0.003	0.009**
	(0.005)	(0.004)	(0.004)	(0.003)	(0.006)	(0.005)
Reduced-price lunch	-1.678	-1.955	-2.173***	-0.285	-2.478*	-1.688
	(1.307)	(1.331)	(0.677)	(0.930)	(1.359)	(1.314)
Free lunch	-2.397**	-2.058*	-1.780***	-0.437	-2.143*	-1.966*
	(1.004)	(1.152)	(0.601)	(0.816)	(1.144)	(1.048)
Female	2.116***	0.408	1.141***	0.913***	1.385*	0.144
	(0.621)	(0.373)	(0.425)	(0.271)	(0.722)	(0.494)
High school degree	1.882**	0.272	1.366***	0.080	2.974***	-0.102
	(0.778)	(0.392)	(0.517)	(0.343)	(0.938)	(0.597)
Some College	2.145**	1.349*	0.868	0.885*	2.017*	2.575***
	(0.830)	(0.757)	(0.597)	(0.502)	(1.023)	(0.911)
College Degree	1.931*	2.697	-0.356	2.024*	5.266***	4.143
	(1.123)	(1.643)	(0.683)	(1.213)	(1.195)	(2.673)
Lives with Father	0.492	0.273	-0.110	0.116	0.117	0.134
	(0.688)	(0.512)	(0.460)	(0.374)	(0.771)	(0.776)
Internet	0.368	0.604	0.299	0.484	0.286	0.975
	(0.785)	(0.794)	(0.548)	(0.499)	(0.843)	(0.822)
Constant	4.365***	4.070***	6.782***	5.429***	9.746***	5.949***
	(1.259)	(1.349)	(0.844)	(0.956)	(1.823)	(1.452)
Observations	136	335	131	320	135	323
R-squared	0.51	0.45	0.60	0.55	0.49	0.44
Effect Size	0.423	1.021	0.038	0.595	0.168	0.827
Robust standard errors in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%						
Effect sizes were calculated by dividing the regression coefficient for the Cutoff variable by the standard deviation for the control group.						

Table 4

Effects of TPS Pre-K Program on Cognitive Development of Hispanic Students, by Parent's Place of Birth

Parent Born:	USA	Mexico	USA	Mexico	USA	Mexico
	Letter-Word (Woodcock-Johnson Test 1)	**Letter-Word (Woodcock-Johnson Test 1)**	**Spelling (Woodcock-Johnson Test 7)**	**Spelling (Woodcock-Johnson Test 7)**	**Applied Problems (Woodcock-Johnson Test 10)**	**Applied Problems (Woodcock-Johnson Test 10)**
Born before cut-off (treated)	1.001	2.858***	1.675*	1.361**	0.599	3.826***
	(1.241)	(0.828)	(0.869)	(0.573)	(1.446)	(1.067)
Qualify (days)	0.010**	0.004**	0.008***	0.010***	0.016***	0.006*
	(0.004)	(0.002)	(0.003)	(0.002)	(0.005)	(0.004)
Qualify*Cut-off	0.002	0.007*	-0.001	-0.002	-0.004	0.006
	(0.006)	(0.004)	(0.004)	(0.003)	(0.007)	(0.005)
Reduced-price lunch	-1.865	-0.753	-1.401*	0.483	-2.076	-1.087
	(1.321)	(1.299)	(0.718)	(0.937)	(1.515)	(1.405)
Free lunch	-3.472***	-0.972	-2.232***	0.565	-2.190*	-1.805
	(0.980)	(1.116)	(0.635)	(0.831)	(1.192)	(1.172)
Female	2.332***	0.449	1.544***	0.912***	1.759**	-0.239
	(0.672)	(0.381)	(0.419)	(0.283)	(0.856)	(0.508)
High school degree	2.105**	0.178	2.035***	-0.075	3.003**	-0.059
	(0.883)	(0.422)	(0.638)	(0.298)	(1.223)	(0.538)
Some College	2.095**	1.336*	1.111*	0.602	2.745**	2.048**
	(0.901)	(0.746)	(0.642)	(0.470)	(1.306)	(0.964)
College Degree	1.305	1.732	0.128	0.284	5.780***	1.229
	(1.158)	(1.613)	(0.781)	(1.204)	(1.558)	(2.478)
Lives with Father	-0.094	0.215	-0.391	-0.214	-0.578	0.357
	(0.755)	(0.506)	(0.507)	(0.378)	(0.878)	(0.757)
Internet	0.355	1.152	0.093	0.922*	0.877	1.172
	(0.749)	(0.866)	(0.543)	(0.537)	(0.980)	(0.837)
Constant	5.435***	3.241**	6.048***	5.034***	9.098***	6.249***
	(1.320)	(1.304)	(0.943)	(0.982)	(1.817)	(1.581)
Observations	113	318	109	304	112	308
R-squared	0.52	0.47	0.63	0.57	0.48	0.45
Effect Size	0.269	1.225	0.664	0.558	0.113	0.872
Robust standard errors in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%						
Effect sizes were calculated by dividing the regression coefficient for the Cutoff variable by the standard deviation for the control group.						

Table 5

Cognitive Gains for Hispanic Students who took both the Woodcock-Johnson Test (English) and the Woodcock-Muñoz Batería (Spanish)

	Letter-Word (Woodcock-Johnson Test 1)	**Letter-Word (Woodcock-Muñoz Batería 1)**	**Spelling (Woodcock-Johnson Test 7)**	**Spelling (Woodcock-Muñoz Batería 7)**	**Applied Problems (Woodcock-Johnson Test 10)**	**Applied Problems (Woodcock-Muñoz Batería 10)**
Born before cut-off (treated)	2.142***	0.412	1.452***	1.008**	3.155***	1.359
	(0.781)	(0.536)	(0.557)	(0.439)	(1.066)	(0.912)
Qualify (days)	0.005**	0.003*	0.009***	0.003**	0.007**	0.008***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)	(0.003)
Qualify*Cut-off	0.008**	0.005*	0.001	0.001	0.006	0.003
	(0.004)	(0.003)	(0.003)	(0.002)	(0.005)	(0.004)
Reduced-price lunch	-2.774**	-1.373	-0.512	-0.295	-1.960	0.213
	(1.336)	(0.976)	(1.030)	(1.009)	(1.612)	(1.310)
Free lunch	-3.104***	-1.143	-0.905	-0.548	-2.785*	-0.942
	(1.172)	(0.919)	(0.924)	(0.897)	(1.461)	(1.198)
Female	0.747**	-0.354	0.987***	0.747***	0.533	0.561
	(0.359)	(0.276)	(0.274)	(0.223)	(0.530)	(0.465)
High school degree	0.397	0.496	0.069	-0.078	0.021	-0.161
	(0.398)	(0.314)	(0.339)	(0.264)	(0.565)	(0.555)
Some College	1.912***	1.115*	0.967**	0.422	2.379**	0.178
	(0.704)	(0.648)	(0.480)	(0.542)	(0.988)	(0.843)
College Degree	2.323*	2.828**	1.678	1.684	3.754*	-0.949
	(1.239)	(1.198)	(1.458)	(1.205)	(2.206)	(1.874)
Lives with Father	0.037	0.108	-0.084	0.188	0.298	0.117
	(0.439)	(0.401)	(0.433)	(0.287)	(0.664)	(0.649)
Internet	0.669	0.481	0.186	0.543	1.195	0.305
	(0.709)	(0.621)	(0.508)	(0.526)	(0.893)	(0.867)
Constant	5.352***	3.282***	5.857***	4.271***	7.036***	8.925***
	(1.317)	(1.032)	(1.079)	(1.012)	(1.785)	(1.459)
Observations	343	343	320	320	322	322
R-squared	0.48	0.26	0.58	0.34	0.44	0.30
Effect Size	0.807	0.190	0.560	0.503	0.667	0.333
Robust standard errors in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%						
Effect sizes were calculated by dividing the regression coefficient for the Cutoff variable by the standard deviation for the control group.						

REFERENCES

Barnett, W. Steven, Jason Hustedt, Laura Hawkinson, and Kenneth Robin. 2006. The State of Preschool: 2006 State Preschool Yearbook. New Brunswick, N.J.: National Institute for Early Education Research.

Barnett, W. Steven. 1993. "Benefit-Cost Analysis of Preschool Education," *Journal of Orthopsychiatry* 63, pp. 500-08.

Bruner, Jerome. 1996. *The Culture of Education.* Cambridge, Mass.: Harvard University Press.

Capps, Randy, Michael Fix, Julie Murray, Jason Ost, Jeffrey Passel, and Shinta Herwantoro. 2005. The New Demography of America's Schools: Immigration and the No Child Left Behind Act. Washington, D.C.: Urban Institute.

Chase-Lansdale, P. Lindsay, Robert Moffitt, Brenda Lohman, Andrew Cherlin, Rebekah Levine Coley, Laura Pittman, Jennifer Roff, and Elizabeth Votruba-Drzal. 2003. "Mothers' Transitions from Welfasre to Work and the Well-Being of Preschoolers and Adolescents," *Science* 299 (March), pp. 1548-52.

Crosnoe, Robert. 2007. "Early Child Care and the School Readiness of Children from Mexican Immigrant Families," *International Migration Review* 41 (Spring), pp. 152-81.

Currie, Janet and Duncan Thomas. 1995. "Does Head Start Make a Difference?" *American Economic Review* 85 (June), pp. 341-64.

Currie, Janet and Duncan Thomas. 1999. "Does Head Start Help Hispanic Children?" *Journal of Public Economics* 74 (November), pp. 235-62.

Fuller, Bruce. 2007. *Standardized Childhood: The Political and Cultural Struggle over Early Education*. Stanford: Stanford University Press.

Fuller, Bruce, Susan Holloway, and Xiaoyan Liang. 1996. "Family Selection of Child-Care Centers: The Influence of Household Support, Ethnicity, and Parental Practices," *Child Development* 67, pp. 3320-37.

Garces, Eliana, Duncan Thomas, and Janet Currie. 2002. "Longer Term Effects of Head Start," *American Economic Review* 92 (September), pp. 999-1012.

Gilliam, Walter and Edward Zigler. 2004. State Efforts to Evaluate the Effects of Prekindergarten: 1977 to 2003. New Haven: Yale University Child Study Center.

Glod, Maria. 2007. "ABCs of Change for Latino Children," *Washington Post*, March 24, p. B1.

Gormley, William. 2007. "Early Childhood Care and Education: Lessons and Puzzles," *Journal of Policy Analysis and Management* 26 (Summer), pp. 633-71.

Gormley, William, Ted Gayer, Deborah Phillips, and Brittany Dawson. 2005. "The Effects of Universal Pre-K on Cognitive Development," *Developmental Psychology* 41 (November), pp. 872-84.

Gormley, William and Ted Gayer. 2005. "Promoting School Readiness in Oklahoma: An Evaluation of Tulsa's Pre-K Program," *Journal of Human Resources* 40 (Summer), pp. 533-58.

Henry, Gary, Craig Gordon, and Dana Rickman. 2006. "Early Education Policy Alternatives: Comparing Quality and Outcomes of Head Start and State Prekindergarten," *Educational Evaluation and Policy Analysis* 28, pp. 77-99.

Henry, Gary, Laura Henderson, Bentley Ponder, Craig Gordon, Andrew Mashburn, and Dana Rickman. 2003. "Report of the Findings from the Early Childhood Study: 2001-02." Atlanta, Ga.: Andrew Young School of Policy Studies, Georgia State University.

Kohler, Adriana and Lazarin, Melissa. 2007. "Hispanic Education in the United States." Statistical Brief No. 8. Washington, D.C.: National Council of La Raza.

Loeb, Susanna, Margaret Bridges, Daphna Bassok, Bruce Fuller, and Russ Rumberger. 2005. "How Much is Too Much? The Influence of Preschool Centers on Children's Social and Cognitive Development." NBER Working Paper 11812. Cambridge, Mass.: National Bureau of Economic Research, December.

Lopez, Michael and Sandra Barrueco. 2005. "In Search of Meaning: Disentangling the Complex Influences on Children's School Readiness." Paper presented at the National Symposium on Family Issues. State College, Pa.: Pennsylvania State University, October 13.

Magnuson, Katherine, Christopher Ruhm, and Jane Waldfogel. 2007. "Does Prekindergarten Improve School Preparation and Performance?" *Economics of Education Review* 26 (February), pp. 33-51.

Magnuson, Katherine, Claudia Lahaie, and Jane Waldfogel. 2006. "Preschool and School Readiness of Children of Immigrants," *Social Science Quarterly* 87 (December), pp. 1241-62.

Magnuson, Katherine and Jane Waldfogel. 2005. "Early Childhood Care and Education: Effects on Ethnic and Racial Gaps in School Readiness," *The Future of Children* 15 (Spring), pp. 169-196.

Magnuson, Katherine, Marcia Meyers, Christopher Ruhm, and Jane Waldfogel. 2004. "Inequality in Preschool Education and School Readiness," *American Educational Research Journal* (spring), pp. 115-57.

National Task Force on Early Childhood Education for Hispanics. 2007. A Demographic Portrait of Young Hispanic Children in the United States. Tempe, Ariz.: College of Education, Arizona State University, March.

Phillips, Deborah, William Gormley, and Amy Lowenstein. 2007. "Classroom Quality and Time Allocation in Tulsa's Early Childhood Programs." Paper presented at the Annual Meeting of the Society for Research in Childhood Development, Boston, Mass., March 30, 2007.

Portes, Alejandro and Ruben Rumbaut. 2001. *Legacies: The Story of the Immigrant Second Generation*. New York: Russell Sage Foundation.

Puma, Michael, Stephen Bell, Ronna Cook, Camilla Heid, and Michael Lopez. 2005. "Head Start Impact Study: First Year Findings." Washington, D.C.: Administration for Children and Families, U.S. Department of Health and Human Services (May).

Ramey, Craig, Donna Bryant, and T Suarez. 1985. "Preschool Compensatory Education and the Modifiability of Intelligence: A Critical Review." In D. K. Detterman, ed., *Current Topics in Human Intelligence: Vol. 1, Research Methododology*. Norwood, N.J.: Ablex Publishing, pp. 247-96.

Ramey, Craig, Frances Campbell, Margaret Burchinal, Martie Skinner, David Gardner, and Sharon Ramey. 2000. "Persistent Effects of Early Childhood Education on High-Risk Children and Their Mothers," *Applied Developmental Science* 4, pp. 2-14.

Reynolds, Arthur. 2001. "Long-term Effects of an Early Childhood Intervention on Educational Achievement and Juvenile Arrest: A 15-Year Follow-Up of Low-Income Children in Public Schools," *Journal of the American Medical Association* 285, pp. 2339-46.

---

[1] Similarly, children whose families speak Spanish at home are less likely to be enrolled in preschool (Fuller et al., 1996: 3334) and children of immigrant mothers are less likely to be enrolled in preschool (Magnuson et al., 2006: 1250). Differences in cultural norms and family practices help to explain these differences (Fuller 2007: 227-70).

[2] More specifically, English testers were instructed to administer all three subtests in English, and Spanish testers were instructed to administer all three subtests in Spanish, if possible. If, after asking five questions in a row in a given language, the tester concluded that the student could not take a subtest in that language, then the tester was to proceed to the next subtest, using the same groundrules.

[3] Of tested Hispanic pre-K entrants, 63.7 percent took the Woodcock Munoz Bateria; of tested Hispanic pre-K alumni, 60.9 percent took the Woodcock-Munoz Bateria.

[4] Of those cases where a testing sequence was clear, three-fourths were tested in English first and one-fourth were tested in Spanish first. There were no statistically significant differences in test score gains for these two groups.

[5] We also tested TPS kindergarten students who were not TPS pre-K alumni, but they are not relevant to the present analysis.

[6] English-speaking teachers were available to conduct tests in English on every test day at every site. Spanish-speaking para-professionals were in shorter supply and were therefore dispatched to school sites where Hispanic enrollments were highest. In practice, this meant that some Hispanic students who were capable of being tested in Spanish were not tested in Spanish because a suitable tester was not available.

[7] The overwhelming majority of parent surveys were obtained in August 2006. We obtained a relatively small number of additional surveys from Hispanic parents who did not complete the original survey in September 2007.

[8] An alternative to using all the data points would be to focus on a smaller set of students whose ages are extremely similar (e.g., students who were born within one month of the regression discontinuity cutoff point). Such a strategy might reduce bias but at a great cost to efficiency. The sample size would shrink considerably and standard errors would increase sharply. Such a strategy might be worth considering when looking at the entire sample of students but not when looking at the much smaller Hispanic sub-sample.

[9] Among Hispanic students who took the Woodcock Johnson Test, 89.4 percent of those who come from a Spanish speaking home have a parent who was born in Mexico.

[10] For ease of presentation, only students whose parents were born in either Mexico or the U.S. are analyzed here. Of the Hispanic pre-K entrants who took the Woodcock-Johnson Test, 94.0 percent have a parent who was born in either Mexico or the U.S. Of the Hispanic pre-K alumni who took the Woodcock-Johnson Test, 96.2 percent have a parent who was born in either Mexico or the U.S.

[11] No F test results are reported here because the Woodcock Johnson Test and the Woodcock Munoz Bateria,, though structurally similar, are different tests.

[12] In 2005, 66 percent of black children and 59 percent of white children participated in preschool programs, as opposed to only 43 percent of Hispanic children (Kohler and Lazarin 2007: 3).

[13] Blacks are more likely than whites or Hispanics to enroll in either TPS pre-K or Head Start as four-year-olds. The leading Head Start program in Tulsa (CAP of Tulsa County) has a “collaborative” relationship with TPS for all of its four-year-old programs.