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**Preschool Participation and the Cognitive and Social Development  
of Language Minority Students**

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Russell W. Rumberger and Loan Tran  
University of California, Santa Barbara

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# **PRESCHOOL PARTICIPATION AND THE COGNITIVE AND SOCIAL DEVELOPMENT OF LANGUAGE MINORITY STUDENTS**

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and  
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## **Executive Summary**

This study examined participation in preschool and its relationship with the cognitive and social development of language minority students. Although there is a large body of research that demonstrates the cognitive and social benefits of attending preschool (Barnett, 1995; Gorey, 2001; National Research Council, Committee on Early Childhood Pedagogy, 2000; Vandell, 2004), very little of this research has included language minority students, or at least those who do not speak English. Either non-English speaking families are not included in the design of the study, such as with the widely cited National Institute for Child Health and Development (NICHD) Early Child Care Study, or the studies are based on cognitive and social assessments that are only conducted in English (e.g., Magnuson, Meyers, Ruhm, & Waldfogel, 2004). Consequently, little is known about participation in and outcomes of preschool for the growing population of language minority students.

The present study was able to overcome many of the limitations of previous studies. The data used in this study came from the Early Childhood Longitudinal Study of the Kindergarten Class of 1998-99 (ECLS-K) and included a representative sample of students and parents who did not speak English. Parent interviews were conducted primarily via telephone with bilingual staff, so only one percent of the parent interviews could not be conducted because of language problems (U.S. Department of Education, National Center for Education Statistics, 2000, p. 5-14). The direct math assessment was conducted in both English and Spanish, which thereby included the majority of non-English speaking language minority students. And teachers were asked to assess students' cognitive skills irrespective of language.

However, the ECLS-K data still have limitations for conducting studies of preschool. The study relied on retrospective parent interviews for information on their child's preschool experiences. As such, it is subject to recall error. It also meant there was little information on the quality of the preschools that the child attended, which previous studies have shown impacts student outcomes (NICHD Early Child Care Research Network, 2003). Finally, it meant that it was difficult to control for all of the characteristics of families that could have influenced their decision to send their child to preschool, making it hard to assess the causal impacts of preschool on cognitive and social development. Nonetheless, the study was able to generate considerable and valuable information on preschool participation and its relationship with school outcomes.

### **Research Questions**

The study addressed three research questions:

1. How widespread is participation in preschool the year before kindergarten and does participation vary by language background?
2. What is the relationship between preschool participation and cognitive and social development at entry to kindergarten and does this relationship vary by language background?
3. What is the relationship between preschool participation and cognitive and social development at the end of third grade and does this relationship vary by language background?

In this study the term *preschool* refers to an array of center-based child care programs, including day care centers, nursery schools, pre-kindergarten programs, preschools, and Head Start<sup>1</sup> programs. In most of the analyses we compare students who attended Head Start preschool programs and other non-Head Start, center-based preschool programs with students who did not attend any preschool programs the year before kindergarten.

To better understand the role of language background, we identified three sub-groups of language minorities: students from households where English was the primary language spoken (English dominant), students from Spanish-speaking households where English was NOT the

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<sup>1</sup> *Head Start* refers to the federally-funded program for low-income children (see Currie & Duncan, 1995).

primary language (Spanish dominant), and students from non-Spanish-speaking households where English was NOT the primary language (Other language dominant).

## **Participation**

Consistent with previous studies, we found that the majority of students who entered kindergarten in the fall of 1998 had attended some form of preschool the year before entering kindergarten. Specifically, we found that 68 percent of kindergarteners had attended preschool, which is consistent with national estimates from other datasets (see Table 4 ). But participation among language minority children (58 percent) was lower than among non-language minority children (72 percent), with children from Spanish-dominant households having even lower participation rates (48 percent). Moreover, language minority children were more likely to attend Head Start programs rather than non-Head Start programs.

Our statistical models confirmed these results. After controlling for other factors that predicted preschool participation, such as socioeconomic status (SES) and mother's employment, language minority students were still 30 percent less likely to attend non-Head Start programs than non-language minority students (Figure 1). However, they were just as likely to attend Head Start programs as non-language minority students.

We also examined the amount and timing of preschool that students received. The majority of students attended preschool part-time (20 hours or less per week) and for more than nine months in the year before kindergarten (Tables 7 and 8). These rates did not vary widely by language background, but there were differences in the age students first attended non-Head Start preschool programs. The majority of students who attended Head Start programs first attended those programs at age 4 and those rates did not vary widely by language background. In contrast, more than two-thirds of students who attended non-Head Start programs first attended prior to age 4, and more than one-third first attended prior to age 3 (Table 9). These rates did vary widely by language background: whereas 37 percent of non-language minority students first attended non-Head Start programs prior to age 3, only 25 percent of all language minority students and only 12 percent of students from Spanish-dominant households first attended before age 3.

The most important finding from this part of the study is that not only are language minority students less likely than non-language minority students to attend non-Head Start

programs the year before kindergarten, they are also less likely to attend such programs for more than one year. These disparities are most pronounced for language minority students from Spanish-dominant households.

### **School Readiness**

We found widespread differences in several cognitive and non-cognitive measures of school readiness that were assessed by teachers and ECLS-K field staff in the fall of kindergarten.

Our analysis revealed that only about half of all students identified as language minority based on the parent questionnaire were identified as a language minority by their schools. As a result, only half of all language minorities were given an English proficiency test (Table 10). The results of these tests showed that about half of all language minority students given the test were classified as English proficient and were subsequently given all of the direct assessments in English. Students who were not proficient in English, but who spoke Spanish, were given the direct math assessment in Spanish. Students who were not proficient in Spanish, but who spoke a language other than Spanish, were not given any of the direct cognitive assessments. As a result, analyses of the direct cognitive assessments conducted by ELCS-K field staff provide an inaccurate picture of the cognitive abilities of language minority students, especially for non-Spanish, largely Asian students (Table 2). In contrast, teachers were instructed to assess students' cognitive skills in their native language if they could not demonstrate them in English.

These different procedures led to observed differences in cognitive development by language background. For example, whereas the average difference between language minority students and non-language minority students is only .19 standard deviations (SD) on the direct reading assessment (Table 11), which excluded all non-English proficient students, the difference was .39 SD on the direct assessment of math, which included Spanish-speaking students (Table 12) and the difference was .43 SD on the teacher assessment of literacy skills, which included all students (Table 13).

The results also revealed widespread differences by preschool participation. Students who attended non-Head Start programs had reading and math scores about half a standard deviation higher than students who did not attend preschool, whereas students who attended Head Start programs had reading and math scores about one-quarter of a standard deviation

lower than students who did not attend preschool. At least some of these differences can be attributed to differences in the characteristics of students and their families that may be related both to participation in preschool and to cognitive development in kindergarten. After controlling for the effects of a number of these characteristics in our statistical models, we estimated that students who attended non-Head start programs had literacy scores (the most inclusive measure of cognitive development) that were .25 SD higher than students who did not attend preschool, whereas students who attended Head Start programs had literacy scores similar to students who did not attend preschool (Figure 3).<sup>2</sup> These findings are consistent with other studies of preschool, which have found effect sizes between .2 and .4 (Vandell, 2004). The results are also consistent with a recent study based on ECLS-K, which found an effect size of non-Head Start, center-based care of about .17 SD in fall kindergarten direct-assessed reading and math scores (which excluded non-English proficient language minority students) after controlling for a similar, but somewhat larger set of student and family demographic variables (Magnuson et al., 2004, Table 2).<sup>3</sup> We also found that the effects of attending non-Head Start programs did not differ by language background. That is, all students benefited equally from attending non-Head Start programs.

We found that the amount of time children spent in preschool and the age first enrolled were associated with cognitive outcomes, although the associations were not large. In general, students who attended non-Head Start programs more than half time the year before kindergarten and first attended prior to age 4 had larger cognitive benefits than students who first attended at age 4 and attended less than half time. For example, students who attended non-Head Start programs the year before kindergarten more than 20 hours per week and who first attended at age 2 or earlier had literacy scores .28 SD higher than students who did not attend any preschool, whereas students who attended non-Head Start programs beginning at age 4 and less than 50

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<sup>2</sup> Throughout this report, we use the terms *effect* and *effect sizes* to represent the predicted relationship between an independent variable and a dependent variable in a statistical model that controls for the effects of other predictor variables. These terms do not prove that the predicted relationship is causal. Effect sizes for achievement outcomes were computed by dividing the estimated parameters from the statistical models by the student-level standard deviation from the corresponding unconditional models.

<sup>3</sup> As we explain in the report, the direct-assessed scores excluded about half of the language minority students. Because language minority students were also less likely to attend preschool, as we show in the report, excluding them from the analysis biases the estimated effects of preschool downward. In estimating a model of direct-assessed reading scores identical to the one we estimated for teacher-assessed literacy, the effect size for attending a center was about .06 SD lower for direct-assessed reading scores than for teacher-assessed literacy scores, which accounts for much of the difference between our estimates and those of Magnuson, et al.

percent time had literacy scores no higher than students who did not attend preschool at all (Figure 4).

Our analysis also revealed that preschool participation had relatively little association with a range of social skills, such as learning behaviors and relationships with peers. However, students who attended preschool, both Head Start and non-Head Start programs, were also more likely to exhibit externalizing problem behaviors in the fall of kindergarten. These behaviors were fairly consistent across language groups (Figure 5). For example, students who attended Head Start programs (except Spanish-dominant students) were 71 percent more likely to exhibit externalizing problem behaviors and students who attended non-Head Start programs (except English-dominant students) were 86 percent more likely to exhibit problem behaviors than students who did not attend any preschool the year before kindergarten. We also found that the more and the earlier students attended non-Head Start programs, the more likely they were to exhibit problem behaviors (Figure 6). Students who first attended a non-Head Start program at age 4 and attended 20 hours per week or less, in fact, did not exhibit problem behaviors at a higher rate than students who did not attend preschool at all (Figure 6). This finding is also consistent with results from other studies, including the NICHD Study of Early Child Care (Vandell, 2004).

Students who attended preschool were also less likely to repeat kindergarten. Students who attended Head Start programs were 26 percent less likely to repeat kindergarten, and students who attended non-Head Start programs were 34 percent less likely to repeat kindergarten than students who did not attend preschool at all (Figure 7). Controlling for other factors, students from English-dominant and other-language-dominant households were no more likely than non-language minority students to repeat kindergarten, but students from Spanish-dominant households were 34 percent more likely to repeat kindergarten. We consider these to be small effects, similar to those for cognitive outcomes.<sup>4</sup>

Students who attended preschool were also less likely to be identified as having a disability and requiring special education services. Students who attended non-Head Start

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<sup>4</sup> We selected this threshold to correspond to one (Cohen, 1988) used to establish .2 SD as the threshold for a “small” effect size. Cohen argues that .2 SD corresponds to moving someone from the 50<sup>th</sup> to the 58<sup>th</sup> percentile (p. 25). The corresponding change in probability from 50 percent to 58 percent corresponds to an odds ratio of 1.38 percent  $(.58/.42)/(.50/.50)$ . The change in probability from 50 percent to 42 percent corresponds to an odds ratio of 0.72  $(.42/.58)/(.50/.50)$ .



programs were 24 percent less likely to be identified as having a disability during kindergarten as non-language minority students, whereas students who attended Head Start programs were just as likely to be identified (Figure 7). Controlling for other factors, English-dominant students were no more likely to be identified as having a disability as non-language minority students; but students from Spanish-dominant households were 34 percent less likely to be identified and students from other-language-dominant households were 61 percent less likely to be identified.

Overall, our results corroborated what other studies have found: students who attended preschool, especially non-Head Start programs, had higher levels of school readiness (as evidenced by more advanced cognitive development, reduced likelihood of repeating kindergarten, and reduced likelihood of being identified as having a disability). But preschool participation was also associated with an increased likelihood of exhibiting external behavior problems. These positive and negative associations apply to all students no matter what their language background with only a few exceptions.

### **Third Grade Outcomes**

Differences in cognitive and social development by language background and preschool participation were still observed four years after starting kindergarten, when most students were finishing third grade. Overall, differences by language background in the direct-assessed cognitive measures were much larger than differences in the teacher-assessed measures. For example, language minority students scored .34 SD lower than non-language minority students on the direct-assessed reading test (Table 17) and .49 SD lower than non-language minority students on the directed-assessed science test, and .21 SD lower than non-language minority students on the direct-assessed math test (Table 18). In contrast, language minority students only scored about .1 SD lower than non-language minority students in four content areas assessed by their classroom teachers (Table 19). Some of these differences could be due to differences in the types of skills measured by the two assessments.<sup>5</sup>

Differences in cognitive development by preschool participation remained modest and were similar to those observed in the fall of kindergarten. For example, students who attended non-Head Start preschool programs the year before kindergarten had direct-assessed math scores

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<sup>5</sup> Part of this difference is due to the fact that about 25 percent of the students in the five wave of the study did not have teacher assessments and those that did had scores on the direct-assessments that were about .06 SD higher than the full sample of students.

in the fall of kindergarten that were .37 SD higher, and students who attended Head-Start programs had math scores that were .24 SD lower, than students who did not attend preschool (Table 12). In third grade, those differences were .36 SD and .43 SD, respectively (Table 18). But when we estimated a statistical model that controlled for the same set of predictors as we did for fall kindergarten scores, the estimated effects of preschool became inconsequential, although still statistically significant. The estimated effects of attending a non-Head Start program were .1 SD on reading (Figure 9), .13 SD on math (Figure 10), and .06 SD on science (Figure 10). However, the estimated effects of attending a Head Start center remained negative and small, albeit larger than the effects of non-Head Start programs. The effects of Head Start and non-Head start programs did not vary among language groups, except that Spanish-dominant students who attended Head Start programs had significantly higher achievement than Spanish-dominant students who did not attend any preschool.

Although the average effect of preschool on cognitive development was inconsequential, we did find that the effects varied among schools, especially for students who attended Head Start programs. In some schools, students who attended preschool programs were doing up to .33 SD better than students who didn't attend any preschool, while in other schools they were doing as much as .56 SD worse (see Figure 11).

We found statistically significant, but inconsequential, effects of Head Start on problematic behaviors (relative odds equal to 1.29) and no statistically significant effects of non-Head Start preschool programs (see Figure 12). We also found that the effects did not vary by language group, but students who attended non-Head Start programs more than part-time had somewhat higher odds of problematic behavior than students who attended less than part-time.

The estimated retention and special education effects of preschool also declined from kindergarten to third grade, but remained larger than the cognitive effects. Students who attended non-Head Start programs were 28 percent less likely to be below grade level than students who did not attend preschool, and 22 percent less likely to be identified as a special education student; however, there were no significant differences for students who attended Head Start programs (Figure 12). Both of these positive effects appear due to the effects of non-Head Start programs on kindergarten literacy. There were some differences in these effects among language groups and by the intensity and duration of preschool participation.

Overall, the cognitive effects of non-Head Start preschool programs were reduced by about half. The effects on retention and special education, however, are more likely to be sustained, which could explain the long-term effects of preschool on high school graduation (Barnet, 1995; Karoly & Bigelow, 2005). These results are consistent with an earlier study using ECLS-K that found the estimated cognitive effects of attending non-Head Start preschool were reduced by 60 percent between the fall of kindergarten and the spring of first grade (Magnuson et al., 2004, p. 135). The lack of sustainability is also consistent with reviews of a range of experimental preschool interventions that found the cognitive effects of most interventions had become insignificant two to four years after the intervention ended (Caldwell, 1987). The exceptions are long-term, high quality interventions, such as the Carolina Abecedarian Project, where students received full-day care for five years prior to entering kindergarten (Campbell & Ramey, 1994; Gorey, 2001)..

The modest effects of preschool compare to large disparities in achievement by language background. Entering school, the achievement levels of language minorities were about .4 SD below non-language minority students. The disparities were somewhat smaller by the end of third grade, about .3 SD; but there were also large differences among language groups. In particular, students from Spanish-dominant households entered kindergarten almost .8 SD behind non-language-minority students in literacy skills, and were still .7 SD behind at the end of third grade.

## **Conclusions**

The findings from this study suggest that attending preschool can improve the school readiness of language minority students. Currently, however, language minority students are less likely to enroll in preschool, particularly non-Head Start programs that appear to make the biggest educational impact. As a result, preschool attendance fails to reduce the large achievement gap between language minority and non-language-minority students that exists at kindergarten entry. Improving access to preschool programs and improving the quality of the programs could help address existing disparities in school readiness (Magnuson & Waldfogel, 2005). Yet because the achievement impact of preschool appears to diminish during the first four years of school, while the achievement gap—especially for Spanish-dominant language minority students—increases, preschool alone may have limited use as a long-term strategy for

improving the achievement gap without strengthening the schools these students attend or without providing additional support during the school years.<sup>6</sup> In other words, preschool should be viewed as part of a more comprehensive and sustained effort to improve the educational outcomes of language minority students.

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<sup>6</sup> In a study of the Chicago Child Center Program, low-income Black students who received two or three years of support in grades 1-3 had significantly higher achievement than students who had preschool alone (Reynolds, 1994).



# **PRESCHOOL PARTICIPATION AND THE COGNITIVE AND SOCIAL DEVELOPMENT OF LANGUAGE MINORITY STUDENTS**

**Russell W. Rumberger and Loan Tran**

**National Center for Research on Evaluation, Standards, and Student Testing  
(CRESST)/University of California, Los Angeles  
and  
University of California Linguistic Minority Research Institute**

## **1. Introduction**

Education is widely recognized as the most important pathway to prepare young people for healthy and productive adult lives. Historically, formal education began at age 6 with entry into first grade, but over the last few decades, most children begin formal school with entry into kindergarten, typically at age 5. With the increase in women who work outside of the home, more and more children now receive child care outside of the home prior to beginning kindergarten, with much of this care taking place in center-based programs. In 1999, 70 percent of 4-year-olds were enrolled in center-based child care programs, including day care centers, nursery schools, pre-kindergarten programs, preschools, and Head Start programs (Snyder, Tan, and Hoffman, 2004, Table 45). In this report, we refer to all of these programs as *preschools*.

Preschools differ widely in their purposes and the types of experiences they provide young children. The differences can be characterized by two widely used terms, *child care* and *preschool*, with the former suggesting an environment primarily oriented towards caring for children and the latter suggesting an environment more oriented to formal learning. But a recent National Research Council (2000) report on preschool-age children questions those distinctions:

There has been in the past a sharp distinction between *child care*, i.e., full-day programs of care for children whose parents are working, and *preschool*, i.e., half-day programs focused on children's social and academic learning, but this is changing. Child care professionals increasingly define their mission in educational terms, with growing support from parents and educators. This does *not* mean that child care should be devoted to academic training for children under 5 any more than preschool. The developing consensus is that out-of-home care for young children should attend to their education, including school readiness, *as well as* providing protection and a facilitating environment for secure emotional development and sound relationships with other children and adults. A central theme of this report is that preschools, child care, and other early childhood settings

must combine loving care with learning, as implied by the terms “educare” and “early childhood care and education.” We recommend it as a fundamental premise of public policy on early childhood (p. 25).

One of the reasons for the increased attention on preschools is that a growing body of research evidence finds that good experiences in quality preschool programs can have a positive impact on school readiness in kindergarten and long-term performance in school (Barnett, 1995; Gorey, 2001; National Research Council, Committee on Early Childhood Pedagogy, 2000; Vandell, 2004). Yet access to preschools varies widely among children from different racial, ethnic, and social class backgrounds. For example, in 1999, 44 percent of Hispanic children were enrolled in preschool compared to 60 percent of White, non-Hispanic children, and only 56 percent of children from low-income households were enrolled compared to 75 percent of children from high-income households (Snyder et al., 2004, Table 45). These differences in preschool participation may be contributing to the achievement gap by providing better preparation for kindergarten to middle-income students than to low-income minority students (Lee & Burkam, 2002).

Although much of the attention on disparities in preschool participation and school achievement has focused on racial and ethnic groups, another important demographic group is the growing population of language minority children. According to figures from the 2000 Census, almost 10 million children in the United States ages five to seventeen—18 percent of the population—spoke a language other than English at home (U.S. Census Bureau, 2003, Table 2). More than two-thirds of these children spoke Spanish. In some states, the proportion of language minority or bilingual children is much greater. California is home to the largest number and largest concentration of language minority children in the U.S.—more than 2.8 million children, or 43 percent of the population spoke a non-English language at home in 2000. In five other states—Arizona, Nevada, New Mexico, New York, and Texas—the concentration of language minority children exceeded 25 percent of the population.

Although some language minority children enter school already proficient in English (FEP—fluent English proficient), most are not yet proficient and are referred to as English language learners (ELLs). Research demonstrates that language minority students, both those who are fluent when they enter school and those who are not, have lower academic

achievement than students from English-only backgrounds. For example, a recent study that compared the four-year growth rates in reading scores among three cohorts of California English-only and language minority students, both FEP and ELL, found a sizeable and increasing achievement gap as students progress through school (Gandara, Rumberger, Maxwell-Jolly, & Callahan, 2003, Figure 2). The achievement gap in other subjects is similar (Berman et al., 1992). But language groups vary by other characteristics related to school performance, such as income and parental education, so it is often difficult to determine whether these differences are related to language background and English proficiency or other, related demographic factors (National Research Council, Committee on Early Childhood Pedagogy, 2000).

Preschool may provide a useful strategy for improving school readiness for all students and reducing initial achievement differences among social groups, including language groups. But as in the case of ethnic, racial, and social class groups, preschool may also be contributing to the achievement gap. One of the limitations of existing research on preschools is that language minority students are frequently not included in the studies. For example, two of the largest studies of child care experiences in the U.S., the Cost, Quality, and Outcomes Study and the National Institute for Child Health and Development (NICHD) Study of Early Child Care (Burchinal & Cryer, 2003), only include families who speak English. As we show later in this report, the majority of language minority students come from households where English is not the primary language, so many existing studies of preschool are not applicable to language minority students.

This report examines differences in access to preschool between language minority and English background students and whether those differences are associated with differences in school readiness when students enter kindergarten and to differences in school performance during elementary school. The study addresses the following research questions:

1. How widespread is participation in preschool the year before kindergarten and does participation vary by language background?
2. What is the relationship between preschool participation and cognitive and social development at entry to kindergarten and does this relationship vary by language background?



3. What is the relationship between preschool participation and cognitive and social development at the end of third grade and does this relationship vary by language background?

Because this study is based on surveys conducted after preschool participation, it is impossible to establish a causal connection between preschool participation and school outcomes. Instead, we use statistical models to control for a number of student and family background characteristics that may be associated with both preschool participation and school outcomes, which provides stronger yet still inconclusive evidence that any predicted relationships are causal.<sup>7</sup>

### **Research Methods**

This report is based on data from the Early Childhood Longitudinal Study Kindergarten cohort (ECLS-K). ECLS-K is a national sample of about 20,000 kindergarteners that entered about 1,000 public and private schools in the fall of 1998 and are being tracked as they progress through school. Two samples of data from ECLS-K were used in this study: a cross-sectional sample of students, parents, teachers and schools from the initial wave of the study in the fall of kindergarten (N=17,124); and a longitudinal subsample of students that were tracked until third grade (N=12,558). The first sample was used to address the first two research questions that focused on preschool participation and its relationship with kindergarten school readiness; the second sample was used to address the third research question that focused on third-grade school performance. Child-level weights, which adjusted for differences in selection and response, were used to generate accurate population estimates.

The language background of the students in both samples was determined from several questions in the fall kindergarten parent questionnaire. First, all parents were asked, “Is any language other than English regularly spoken in your home?” (PLQ.020). If the answer was affirmative, the student was identified as “language minority”; otherwise the student was identified as “non-language minority”. Second, parents who indicated another language was spoken were asked, “What languages other than English were spoken in your home?”

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<sup>7</sup> The most rigorous method for assessing causal impacts of programs is to randomly assign half of would-be participants to the program and the other half to a control group. This assures that the two groups are equivalent in all other respects. A recent first-year study of Head Start using random assign found significant impacts of Head Start on pre-kindergarten outcomes (See U.S. Department of Health and Human Services, 2005).

(PLQ.040). Third, parents who indicated another language was spoken were also asked, “What is the primary language spoken in your home? (PLQ.060). Students whose parents indicated that English was the primary language spoken at home were classified as “English dominant.” Students from Spanish-speaking households whose parents indicated that English was NOT the primary language were identified as “Spanish dominant.” Students from non-Spanish-speaking households whose parents indicated that English was NOT the primary language were identified as “Other dominant.”

Both samples contain sizeable and representative samples of language minority students (see Table 1). According to these figures, more than 22 percent of kindergarteners in the fall of 1998 came from a home where a language other than English was spoken. More than 10 percent of all students, or almost half of all language minority students, came from homes where English was the primary language. Of the remaining language minority students, the vast majority came from households where Spanish was the primary language.

**Table 1. ECLS samples by language background**

	Number and (percent distribution)			
	Fall K Sample		K-3 Sample	
	Sample size	Population	Sample size	Population
Non-language minority	13,104 (76.5)	2,987,459 (77.5*)	8,771 (69.8)	2,789,547 (80.0*)
Language minority	3,967 (23.2)	867,214 (22.5)	2,697 (21.5)	696,964 (20.0)
English dominant	1,852 (10.8)	406,447 (10.5)	1,252 (10.0)	331,670 (9.5)
Spanish dominant	1,343 (7.8)	352,193 (9.1)	923 (7.3)	289,463 (8.3)
Other dominant	772 (4.5)	108,574 (2.8)	522 (4.2)	75,832 (2.2)
Language background unknown	53 (.3)	11,272	1,090 (8.7)	357,096
Total	17,124 (100.0)	3,865,946 (100.0)	12,558 (100.0)	3,843,607 (100.0)

\*Percent distribution excludes language background unknown.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99. Weighted N based on the fall kindergarten child-parent-teacher weight (C1CPTW0) and child panel weight (C1\_5FC0).

## Variables and Measures

The ECLS-K data provide measures of students' academic, social, and physical development as they progress through elementary school and extensive data on their background as well as the characteristics of their families, teachers, and schools. These data were collected from:

- **Direct assessments of children's cognitive, psychomotor, and physical skills and characteristics.** These assessments were obtained through untimed, one-on-one, computer-assisted interviews. The cognitive assessment focused on three general areas of competence: (1) language use and literacy (reading); (2) mathematics; and (3) knowledge of the social and physical world, referred to as "general knowledge." These assessments were conducted in the fall of kindergarten, spring of kindergarten, fall of first grade (for a subset of the sample), spring of first grade, and spring of third grade. Children who were identified by the school as language minority were given a brief language screener, the Oral Language Development Scale (OLDS). Children who were determined to be proficient in English, based on the screener, were given the full direct assessment battery. Children from a Spanish background who were not proficient in English were given the mathematics and psychomotor assessments in Spanish. Children from a non-Spanish background who were not proficient in English were excluded from the cognitive assessments.
- **Parent/guardian questionnaires.** Parents were asked to provide key information about their children, especially during the first years of the study. Information was collected from parents each time children were assessed using computer-assisted telephone interviewing (CATI) or computer-assisted personal interviewing (CAPI) if they did not have a telephone.
- **Teacher questionnaires.** Teachers were not only asked to provide information about their own backgrounds, teaching practices, and experience, they were also called upon to provide information on the classroom setting for the sampled children they teach and to evaluate each sampled child on a number of critical cognitive and non-cognitive dimensions. Teachers completed self-administered questionnaires each time children were assessed, with the exception of the fall first grade data collection.

- **School administrator questionnaires.** School administrators were asked to complete self-administered questionnaires during the spring data collection. They were asked to provide information on the physical, organizational, and fiscal characteristics of their schools, and on the schools' learning environment and programs.

The data were used to create a number of dependent and independent variables:

**Dependent variables.** This study created a number of dependent variables to measure students' cognitive and social development, and school performance in school:

- Direct assessments of cognitive development: reading, mathematics, and science (third grade);
- Teacher assessments of academic performance: language and literacy, mathematics, general knowledge (kindergarten), science (third grade), and social studies (third grade);
- Teacher assessments of five measures of social development, which were developed from the Social Skills Rating System developed by Gresham and Elliot (1990): approaches to learning, self-control, social interaction, internal problem behaviors, and external problem behaviors;
- Direct assessments of students' social-emotional development in six areas (third grade only): their perceived competence and interest in reading, mathematics, and school in general, their perceived competence and popularity with peers, and their reported problems with their external (anger/distractibility) and internal (sad/lonely/anxious) behavior;
- School record data indicating whether the student was retained, below grade level, or was identified as a special education student since entering kindergarten.

**Independent variables.** We created a number of independent variables in three broad categories. First, we created variables collected from parents in the fall kindergarten questionnaire about their current child care arrangements and arrangements the year prior to entering kindergarten, including:

- Who provided child care (relatives, non-relatives, Head Start, or non-Head Start center);
- Age when child first attended;

- Number of different providers child attended;
- Type of program (for non-Head Start program only: day care center, nursery school, preschool, pre-kindergarten);
- Number of children and adults in child's room or group (for Head Start only);
- Hours per week and length of time child attended;

Second, we created two sets of language measures: one set simply identified students as language minorities or non-language minorities. Then we created a series of three sub-groups of language minorities: students from English-dominant households, students from Spanish-dominant households, and students from other-language-dominant households.

Finally, the study uses a number of family and student characteristics in the statistical models to differentiate the effects of language background from the effects of other, related characteristics:

- Family socioeconomic status;
- Family structure (not living with both biological parents);
- Number of children in the home less than 18 years of age;
- Number of books in the household;
- Mother's working status (working full-time, working part-time);
- Child has a disability

These particular variables were selected because they primarily represent stable characteristics of students and families that likely existed prior to preschool, and that prior research suggests could be associated both with participation in preschool and performance in school (Coleman, 1990; National Research Council, Committee on Early Childhood Pedagogy, 2000).<sup>8</sup> Controlling for

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<sup>8</sup> We selected a smaller set of variables than Magnuson, Meyers, Ruhm, and Waldfogel (2004), who also used the ECLS dataset in their study. However, some of the variables they used, such as those related to parenting, could have been influenced by participation in preschool and therefore do not represent independent background variables.

these characteristics in the statistical models of school readiness and third grade performance provides more accurate estimates of the effects of language background and preschool.<sup>9</sup>

Appendix A provides a complete description of all the variables used in the present study.

### **Analyses**

Two types of analyses were conducted to address the research questions in this study. First, we computed descriptive statistics to examine differences in preschool participation, school readiness, and third grade school performance by language background. Second, we developed and tested a series of statistical models to examine predictors of preschool participation and the effects of preschool on kindergarten school readiness and third grade school performance after controlling for the effects of other background characteristics. These models were used to examine the extent to which these outcomes were directly related to language background versus other, related factors. A complete description of the models is provided in Appendix A.

### **Demographic characteristics of the language minority population**

As we mentioned earlier, language background is related to a number of other demographic characteristics. Two important ones are race/ethnicity and income/socioeconomic status. These relationships are illustrated in Tables 2 and 3. The figures show that language background varies widely between race and ethnic groups. White and black kindergarteners overwhelmingly come from non-language minority backgrounds, while Asian and Hispanic kindergarteners come from predominantly non-English backgrounds. Family income, poverty, and socioeconomic status (which is a comprehensive measure of income, parental education, and occupational status) also vary greatly, but only among some language minority groups. Overall, language minority children come from families with lower income and socioeconomic status than children from English-only backgrounds. But children from Spanish-dominant households have much lower income and socioeconomic status than children from English-dominant or other-language-dominant households.

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<sup>9</sup> Other variables would have been useful to include had they been available in ECLS. For example, ECLS did not include any information on whether students' parents were immigrants, only whether the child was born outside the United States (and this information was only provided in the spring kindergarten questionnaire, not in the fall kindergarten questionnaire).

## Organization of the report

The remainder of this report is organized into three primary chapters. Chapter 2 examines participation in preschool. Chapter 3 examines the relationship between preschool and kindergarten school readiness. Chapter 4 examines the relationship between preschool on third grade school performance. Chapter 5 summarizes the findings and discusses the implications for education policy.

**Table 2. Race/ethnicity by language background, fall 1998 kindergarteners**

(percent distribution within language groups)

	Population	Language background--percent distribution within race/ethnic groups				
		Non-language minority	Language minority			
			Total	English dominant	Spanish dominant	Other language dominant
Total	3,854,673 (100.0)	77.5 (100.0)	22.5 (100.0)	10.5 (100.0)	9.1 (100.0)	2.8 (100.0)
Race/ethnicity						
Asian	111,177 (2.9)	16.7 (0.6)	83.3 (10.7)	27.3 (7.5)	0.0 (0.0)	55.9 (57.2)
Black	604,352 (15.7)	94.7 (19.2)	5.3 (3.7)	4.3 (6.4)	.1 (0.2)	.8 (4.7)
Hispanic	743,516 (19.3)	25.3 (6.3)	74.7 (64.1)	27.3 (50.0)	46.9 (99.0)	.5 (3.5)
White	2,208,972 (57.3)	93.7 (69.3)	6.3 (15.9)	4.8 (26.0)	.1 (0.7)	1.4 (27.5)
Other	186,656 (4.8)	73.8 (4.6)	26.2 (5.6)	22.1 (10.2)	0.0 (0.0)	4.1 (7.1)

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

**Table 3. Family income, poverty, and socioeconomic status by language background, fall 1998 kindergarteners**

	Total	Language background				
		Non-language minority	Language minority			
			Total	English dominant	Spanish dominant	Other dominant
Mean Family income (standard deviation)	\$50,578 (53,252)	\$53,606	\$40,143	\$50,973	\$25,016	\$48,671
Percent below poverty	19	16	31	20	46	22
Mean Socioeconomic status (standard deviation)	.00 (1.00)	.08	-.29	.04	-.83	.20

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).



## 2. Participation in Preschool

This chapter focuses on participation in preschool. First we examine differences in the type and amount of preschool and other forms of non-parental care that kindergarteners had prior to entering school. Second, we examine factors that predict participation in preschool

### Types of Early Care and Education

In the fall of 1998 parents in the ECLS-K study were asked a series of questions about their child care arrangements. They were asked whether their kindergartener was currently receiving or had ever received care from: (1) relatives; (2) non-relatives in a private home; or attended: (3) Head Start; (4) day-care center, nursery school, preschool, or prekindergarten program other than Head Start (henceforth, we will refer to this last category as *non-Head Start programs* or simply *centers*). Parents also were asked whether their child received care at or attended these programs on a regular basis the year before kindergarten.

Parents reported that their kindergarteners had participated in a number of child care arrangements: 43 percent had received care from relatives, 36 percent had received care from non-relatives, and 77 percent had attended some sort of preschool program, including Head Start (Table 4). These arrangements varied by language background. Fewer language minority children received non-relative care and attended preschool than non-language minority children. But there were also differences among language minority children: Kindergarteners from English-dominant households were the most likely to attend preschool, kindergarteners from Spanish-dominant households were the least likely to attend preschool, and kindergarteners from other-language-dominant households were between these two groups. There were also differences in the type of preschool attended—language minority children were more likely to attend Head Start programs whereas non-language minority children were more likely to attend non-Head Start programs.

**Table 4. Child care arrangements by language background, fall 1998 kindergarteners**

	(Percent reporting)				
	Relative Care	Non-Relative Care	Preschool		
Total			Head Start	Non-HS	
Ever received or attended					
Total	43	36	77	16	66
Non-language minority	42	38	80	16	70
Language minority	44	25	64	22	48
English dominant	50	31	73	20	60
Spanish dominant	40	22	53	24	34
Other dominant	37	13	64	17	51
Received or attended the year before kindergarten					
Total	24	16	68	16	55
Non-language minority	24	17	72	15	59
Language minority	25	11	58	19	41
English dominant	27	13	65	18	50
Spanish dominant	22	10	48	21	29
Other dominant	26	5	63	15	49

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

Similar differences appear with respect to child care arrangements the year before kindergarten. Overall, 68 percent of kindergarteners attended preschool the year before kindergarten, a figure similar to national estimates from other data sources.<sup>10</sup> Non-language-minority kindergartners were more likely to attend non-Head Start centers compared to language minority kindergartners, particularly those from Spanish-dominant households, whereas language minority kindergartners were more likely to attend Head Start centers.

<sup>10</sup> Figures from the National Household Education Survey (NHES) show that 65 percent of 4-year-olds attended preschool programs (including day care centers, nursery schools, prekindergarten, and Head Start programs) in 1995 and 70 percent attended preschool programs in 1999 (Snyder, Tan, & Hoffman, 2003, Table 45). Since most kindergartners in the ECLS study were 4-year-olds in the year before kindergarten (1997-98), our estimate of 68 percent is midway between the two NCES figures.

Parents whose child attended a non-Head Start program the year before kindergarten were also asked the kind of center program their child attended the most.<sup>11</sup> Overall, half of the parents reported that their child attended a preschool, 28 percent reported that their child attended a pre-kindergarten program, 18 percent reported that their child attended a day care center, and 4 percent reported that their child attended a nursery school (Table 5).<sup>12</sup> These patterns were similar across language groups.

**Table 5. Type of non-Head Start program attended most the year before kindergarten by language background, fall 1998 kindergarteners**

	(Percent distribution)			
	Day care center	Nursery school	Preschool	Pre-K program
Total	18	4	50	28
Non-language-minority	19	3	51	27
Language minority	15	3	48	34
English dominant	15	4	48	33
Spanish dominant	13	2	45	39
Other dominant	22	3	52	23

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

Many parents reported using more than one type of child care arrangement. Based on the number of hours per week that parents reported for each type, it was possible to determine the primary type of non-parental care that children received the year before kindergarten. The results show that preschool (either Head Start or Center) was the dominant form of non-parental care for kindergarteners overall, but again language minorities and Spanish-dominant language minorities were more likely to attend Head Start programs and less likely to attend non-Head Start programs than non-language minority students (Table 6). In addition, language minority kindergarteners, particularly Spanish-dominant language minorities, were more likely to have only parental care the year before kindergarten.

<sup>11</sup> Parents were also asked how many centers or programs their child attended the year before kindergarten. Ninety percent of parents indicated only one center or program.

<sup>12</sup> NCES staff indicated that parents were not always sure what kind of center or program their child attended, so these responses should not be viewed as conclusive. Nonetheless, some researchers have found differences in outcomes associated with attendance at different types of centers and programs (Magnuson, Ruhm, & Wadlfogel, 2004).

**Table 6. Primary type of non-parental child care arrangement the year before kindergarten by language background, fall 1998 kindergarteners**

(Percent distribution)						
	Parental care only	Relative Care	Non-Relative Care	Head Start	Non-HS	Two or more
Total	19	14	11	10	41	5
Non-language minority	16	14	12	9	44	5
Language minority	28	16	7	14	30	5
English dominant	21	17	9	12	36	5
Spanish dominant	36	15	7	16	21	5
Other dominant	30	16	2	13	34	5

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

### **Intensity of Exposure to Preschool**

It is also useful to examine how much time children spent in preschool the year before kindergarten. The results show that 43 percent of kindergartners who attended Head Start programs were there 20 hours or more per week, and 40 percent of children who attended non-Head Start programs were there 20 hours or more per week (Table 7). Among those who attended Head Start, non-language-minority students were more likely to attend more than 20 hours (50 percent) compared to language minority students (31 percent), with students from Spanish-dominant households the least likely to attend more than 20 hours (27 percent). Among those who attended non-Head Start programs, patterns were similar across language groups.

**Table 7. Hours per week in preschool the year before kindergarten by language background, fall 1998 kindergarteners**

(Percent distribution)

	Hours per week				
	1-10	11-20	21-30	31-40	41+
Head Start program					
Total	11	45	21	20	2
Non-language minority	10	41	23	24	3
Language minority	15	53	20	10	1
English dominant	13	51	25	10	2
Spanish dominant	19	55	16	9	2
Other dominant	11	54	20	15	0
Non-Head Start program					
Total	33	27	13	19	8
Non-language minority	35	25	12	19	9
Language minority	23	37	14	19	7
English dominant	26	32	14	22	7
Spanish dominant	17	48	16	14	6
Other dominant	23	35	11	19	11

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

Parents of kindergartners who attended non-Head Start programs the year before kindergarten were also asked how many months their child attended. The vast majority of children (81 percent) attended nine to 12 months, or most of the year (Table 8). These patterns were also similar across language groups.

**Table 8. Months attended non-Head Start program the year before kindergarten by language background, fall 1998 kindergarteners**

(Percent distribution)

	Months			
	1-2	3-5	6-8	9-12
Total	1	4	14	81
Non-language minority	1	4	15	80
Language minority	2	4	13	81
English dominant	1	4	13	82
Spanish dominant	2	5	12	80
Other dominant	3	4	12	81

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

Parents were also asked how old their kindergartner was when he or she first attended preschool on a regular basis. The majority of kindergartners who attended Head Start programs first attended at age 4, whereas the majority of kindergartners who attended non-Head Start programs started before age 4, with more than one-third starting before age 3 (Table 9). In general, language minority kindergartners were more likely to first enroll in preschool at an older age than non-language minority kindergartners, with the greatest disparities for Spanish-dominant language minorities.

**Table 9. Age first attended preschool by language background, fall 1998 kindergarteners**

	(Percent distribution)						
	Age (in years)						
	0	1	2	3	4	5	6
Head Start program							
Total			1	37	58	4	
Non-language minority			1	38	57	3	
Language minority			1	37	58	7	
English dominant			2	39	54	5	
Spanish dominant			1	35	62	2	
Other dominant			1	40	55	4	
Non-Head Start program							
Total	11	8	16	32	27	6	<1
Non-language minority	12	8	17	32	25	6	<1
Language minority	5	6	14	33	36	7	<1
English dominant	7	8	17	33	29	6	<1
Spanish dominant	2	3	7	32	50	6	<1
Other dominant	2	4	19	34	35	4	2

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

### Predicting Preschool Participation

The preceding descriptive statistics show that language minority students were more likely to attend Head Start preschool programs and less likely to attend non-Head Start preschool programs the year before kindergarten than non-language-minority students. But what accounts for those differences—were they directly related to the language background of students or other, related demographic characteristics, such as socioeconomic status (SES)? To address this question, we developed and estimated a series of statistical models to predict preschool attendance the year before kindergarten. In particular, the models predicted the change in odds of attending a Head Start program or a non-Head Start program versus some other form of care (parental care, relative care, or non-relative care) associated with each predictor variable in the model controlling for the effects of the other predictor variables. The change in odds is expressed as a ratio that can vary from less than one to greater than one. A value of one signifies

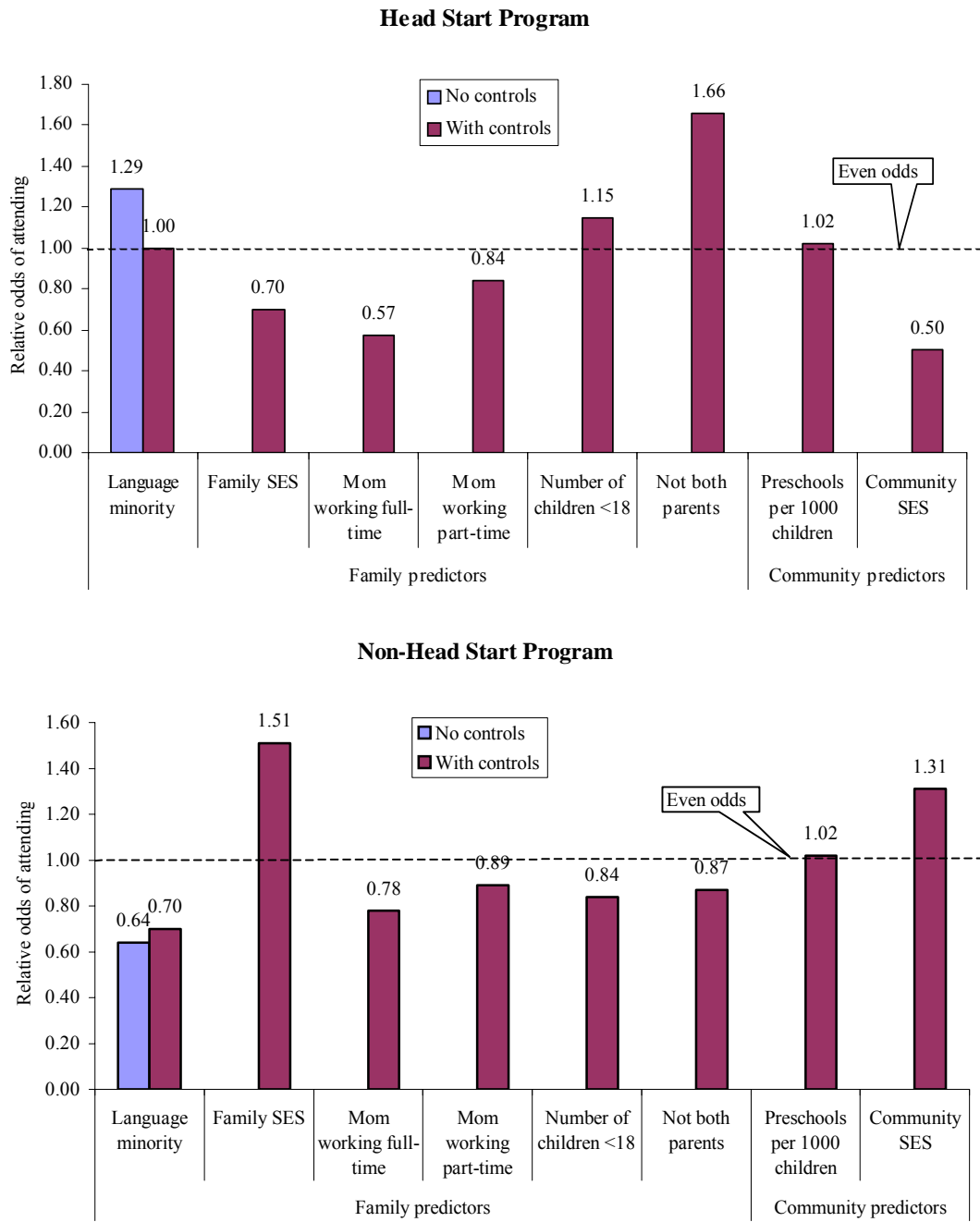
no significant change in the odds (sometimes referred to as even odds) or likelihood of attending a preschool program versus some other form of care, while a value greater than one indicates an increased likelihood, and a value less than one indicates a decreased likelihood.

First, we estimated a model that predicted the relative odds of language minority students attending Head Start or non-Head Start preschool programs compared to non-language minority students with no other variables (controls) in the model. The results for Head Start programs are shown in the top panel of Figure 1 and the results for non-Head Start programs are shown in the bottom panel of Figure 1. The left-most figure in each panel illustrates the results of the first model. The results show that the odds of a language minority student attending Head Start relative to the odds of a non-language minority student attending Head Start are 1.29 or 29 percent higher. In contrast, the odds of a language minority student attending a center-based program relative to the odds of a non-language minority student attending are .64, or 36 percent less. These results confirm the descriptive findings presented earlier that show language minority students are more likely to be enrolled in Head Start programs and less likely to be enrolled in non-Head Start programs than non-language minority students.

The next model added a series of other predictor variables to the model. The results show that a number of other variables predict whether students attended Head Start or non-Head Start programs the year before kindergarten. Students from high SES families were less likely to attend Head Start and more likely to attend preschools than students from low SES families. Students with mothers who were currently working (fall kindergarten) full time or part time were less likely to attend either Head Start or non-Head Start programs the year before



**Figure 1. Predicted relative odds of attending preschool the year before kindergarten, fall 1998 kindergarteners**



SOURCE: Appendix Table A.3

kindergarten compared to students with mothers who were not working. Students in families with more children and in non-traditional families (not living with both parents) were more likely to have attended Head Start, and less likely to have attended non-Head Start programs.

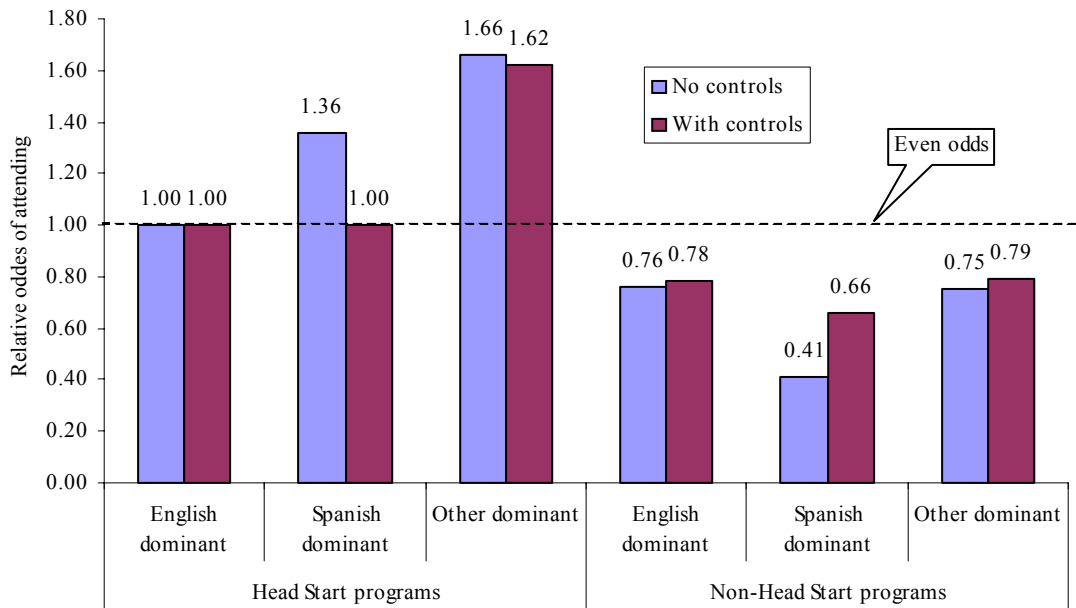
We also analyzed the effects of two neighborhood variables (based on the home zip code)—the number of preschools per 1000 children and the mean SES of the community. The availability of preschools had a small positive effect of attendance in Head Start and center programs. Community SES was a sizeable predictor—students who lived in high SES communities were less likely to attend Head Start and more likely to attend non-Head Start programs, even controlling for the availability of all preschools. This may reflect the influence of neighbors on desirability of non-Head Start programs versus Head Start, or the greater likelihood of centers versus Head Start programs in higher SES communities.

After controlling for these family background and community characteristics, the odds of language minority students attending Head Start programs the year before kindergarten were the same as non-language minority students (even odds or 1.0). In contrast, the odds of language minority students attending non-Head Start programs remained almost the same. That is, language minority students were less likely to attend center-based programs than non-language-minority students, even after controlling for a number of family background and community variables.

We then estimated a second set of similar models to see whether preschool attendance varied among the three language minority subgroups—English dominant, Spanish dominant, and other language dominant—first with no control variables in the models and then with the same set of control variables as earlier. The results, illustrated in Figure 2, show that preschool participation varied widely among the three language subgroups. English-dominant students were just as likely as non-language minority students to attend Head Start programs, but less likely to attend non-Head Start programs, even after controlling for other factors. Spanish-dominant students were more likely than non-language minority students to attend Head Start programs, but just as likely after controlling for other factors. Spanish-dominant students were 60 percent less likely than non-language minority students to attend non-Head Start programs and were 40 percent less likely after controlling for other factors,. Other-language-dominant students were 67 percent more likely than non-language minority students to attend Head Start

with and without controlling for other factors. Conversely, other-language-dominant students were about 25 percent less likely than non-language minority students to attend non-Head Start programs, even after controlling for other factors.

**Figure 2. Predicted relative odds of attending preschool year before kindergarten by language background. fall 1998 kindergarteners**



SOURCE: Appendix Table A.3

To summarize, these results confirm the descriptive findings—language minorities as a group were less likely than non-language minority students to attend non-Head Start preschool programs the year before kindergarten, with Spanish-dominant language minority students even less likely than English-dominant and other-language-dominant students.

### **3. The Relationship between Preschool and School Readiness**

The second issue addressed in this study is the relationship between preschool and school readiness at the beginning of kindergarten. Previous research has suggested that students who attend preschool are more likely than other students to have mastered some preliminary skills in reading and math, and to display proper social behaviors conducive to school learning (Barnett, 1995; Gorey, 2001; National Research Council, Committee on Early Childhood Pedagogy, 2000; Vandell, 2004).

Do students in the ECLS dataset show similar patterns? And do language minority students show similar patterns compared to non-language minority students? To answer these questions, we first analyzed differences in school readiness by preschool participation and language background. We examined both cognitive dimensions of school readiness and social dimensions based on the direct cognitive assessments administered by ECLS field staff and on teacher assessments of classroom academic performance and social behavior. We also examined two other education outcomes: kindergarten retention and identified special education. Next, we tested a series of statistical models to determine the effects of language background and other factors on school readiness.

#### **English Proficiency**

One of the major challenges facing language minority students is becoming fluent in English. English fluency allows language minority students to fully comprehend and benefit from the language of instruction, which in most classrooms in America is English. Typically, English-proficient students do not need nor require additional support to learn and succeed in school. In contrast, language minority students who enter school not proficient in English, who are often referred to as English language learners, often cannot comprehend the language of instruction in English classrooms and, therefore, cannot learn at the same rate as other students without sufficient support in the form of specialized classroom materials, appropriate modes of instruction, and adequate teacher knowledge (National Research Council, 1997).

English fluency is typically assessed when students first enter school. In ECLS-K, students were identified as language minority by a number of means, with the most common

being a language survey given to parents when they registered their child for kindergarten. The surveys ask a series of questions about the language background of the child and of the child's home, such as the child's first language and whether anyone in the home speaks a language other than English. About half of the parents in ECLS-K completed the home language survey. If no language survey was available, teachers or other school personnel determined language background. Students identified by the school as language minority were given a brief language screener, the Oral Language Development Scale (OLDS), which measured their oral English proficiency.

As explained in Chapter 1, in this study we determined language background from information in the parent questionnaire. As a result, our estimates of the number of language minority students in the ECLS-K dataset were quite different than the number of language minority students identified by the schools, as shown in Table 10. Only 52 percent of all language minority students took the OLDS, which means that the schools identified a language minority population about half the size that we did based on the parent questionnaire. This may be attributable to the fact that only about half of the parents filled out a language survey when they enrolled their child in school.<sup>13</sup> As a result, schools may not have had an accurate way of identifying the language background or English proficiency of their entering students,<sup>14</sup> or some parents—concerned that their child may be identified as language minority and placed in a bilingual classroom—may have intentionally not identified the language background of their child when they enrolled them in school. For whatever reason, our estimates of the language minority population are much larger than estimates based on school records, an issue that is worthy of further study.

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<sup>13</sup> This information was collected as part of the students' school record information, which asks schools whether they ascertain English proficient with a home language survey.

<sup>14</sup> Schools could have used more stringent criteria for identifying language minority students, such as obvious difficulty in using English.

**Table 10. English proficiency in fall 1998 by language background and preschool participation, fall 1998 kindergarteners**

	Percent taking language screener	Percent English Proficient			
		Total	Head Start	Center	None
Total	14	48	44	61	42
Non-language minority	1	61	35	76	56
Language minority	52	47	44	59	42
English dominant	21	83	89	83	84
Spanish dominant	84	31	35	39	28
Other dominant	69	65	48	76	62

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

Because only the students the schools identified as language minorities were given the language screener, we only know the levels of English proficiency for some of the language minority population. Overall, 47 percent of all language minorities who were given the language screener were classified as English proficient, but the proficiency levels varied widely among the language minority subgroups. Only 21 percent of students from English-dominant households were identified by their schools as a language minority and were administered the language screener, but 83 percent of those students were classified as English proficient. In contrast, 84 percent of the students from Spanish-dominant households were identified by their schools as a language minority, and only 31 percent of those students were classified as English proficient. Finally, 69 percent of students from other-language-dominant households were identified by their schools as a language minority and were administered the language screener, and 65 percent of those students were classified as English proficient.

Rates of English proficiency varied among language minority students based on their preschool experience. Whereas students from other-language-dominant households who attended non-Head Start programs had higher rates of English proficiency than students from other-language-dominant households who attended Head Start or did not attend preschool, this relationship did not apply to either English-dominant or Spanish-dominant students.

## Cognitive Skills

As described in Chapter 1, cognitive skills were assessed in two ways—through a direct assessment administered one-on-one by ECLS-K field staff, and through a teacher evaluation. For language minority students, the direct assessment of cognitive skills was only conducted if the students were classified as English proficient based on the language screener, with the exception of Spanish-speaking students, who were given the mathematics assessment in Spanish.

In contrast, the teachers were asked to assess the cognitive skills of all students, no matter what their language background. In fact, the teacher questionnaire explicitly stated:

**Children with Limited English Proficiency:** Please answer the questions based on your knowledge of this child's skills. If the child does not yet demonstrate skills in English but does demonstrate them in his/her native language, please answer the questions with the child's native language in mind.

Moreover, teachers were asked to evaluate their students on all four modalities of literacy: oral comprehension, oral expression, reading, and writing. As a result, the teacher assessments provide a more comprehensive measure of language minority students' cognitive skills, especially in literacy.

We analyzed differences in cognitive skills by language background and preschool participation, focusing on reading and mathematics, the two core subjects taught in early elementary school. For each subject area, an overall score was calculated for each student. We normalized these scores so that the mean score for the entire population of kindergarteners was 0 and the standard deviation was 1. This allows easy comparisons among different groups and different assessments using a common metric—standard deviations, sometimes referred to as effect sizes (Cohen, 1988). Additionally, the results of the assessments were used to determine whether the students were proficient in performing a series of specific skills related to that area. First, we examine the results from the direct assessments and then the results from the teacher assessments.

The direct assessment in reading shows widespread differences by language background and preschool participation (Table 11). Overall, mean reading scores for language minority students are .17 standard deviations (SD) below the mean for all kindergarteners, or .19 SD below the mean for non-language minority students. Although there are no strict standards to

interpret these values, values above .8 SD are often considered large, values above .5 are considered moderate, values above .2 SD are considered small, and values below .2 are considered inconsequential (see Cohen, 1988, pp. 24-27). Based on these criteria, this difference is inconsequential.

**Table 11. Mean direct-assessed reading scores and proficiencies in fall 1998 by language background and preschool participation, fall 1998 kindergarteners**

	Mean Total score	Letter recognition	Reading skills (Percent proficient)*			
			Beginning sounds	Ending sounds	Sight words	Words in context
Total	0.00	65	30	18	4	1
Non-language minority	0.02	67	31	18	4	1
Language minority	-0.17	57	28	16	6	1
English dominant	-0.11	60	30	19	5	1
Spanish dominant	-0.56	39	17	8	3	<1
Other dominant	0.22	74	40	23	12	2
Head Start program	-0.51	48	13	8	<1	<1
Non-language minority	-0.49	50	12	7	<1	<1
Language minority	-0.57	42	14	7	1	<1
English dominant	-0.52	45	14	9	1	1
Spanish dominant	-0.72	30	14	5	0	0
Other dominant	-0.37	62	18	4	2	0
Non-Head Start program	0.17	74	38	23	5	1
Non-language minority	0.17	75	38	23	5	1
Language minority	0.16	71	39	24	8	
English dominant	0.19	73	40	26	6	2
Spanish dominant	-0.35	49	24	10	6	1
Other dominant	0.62	88	52	30	16	4
No preschool	-0.26	56	23	14	3	<1
Non-language minority	-0.22	58	23	23	3	1
Language minority	-0.40	47	21	13	3	<1
English dominant	-0.33	49	23	25	3	1
Spanish dominant	-0.65	35	13	11	1	0
Other dominant	-0.20	58	29	31	4	<1

\*Proficiency scores represent the percentage of students who correctly answered at least three or four questions related to each specific skill area.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).



Differences among language minority groups are much larger, however. While reading scores for English-dominant students are similar to those for non-language-minority students, scores for Spanish-dominant students are more than .5 SD below those of non-language minority students, a moderately large gap. In contrast, mean reading scores for other-language-dominant groups are somewhat larger than those of non-language minority students. Of course these comparisons only include language-minority students who took and passed the language screener, so they represent only a subset of all language minority students. Reading scores also varied widely by preschool experience. Students who attended Head Start programs the year before kindergarten had mean reading scores one-quarter of a standard deviation ( $-.51 - [-.26] = -.25$ ) lower than students without preschool experience. In contrast, students who attended non-Head Start programs the year before kindergarten had reading scores one-third of a standard deviation higher ( $.17 - [-.26] = .43$ ).

For the most part, these patterns were similar across language groups; that is, students from each language group who attended Head Start programs had lower reading scores than students who did not attend preschool, while students who attended non-Head Start programs had higher reading scores. There was only one exception: Spanish-dominant language minority students who attended Head Start programs had similar reading scores as Spanish-dominant students who did not attend preschool. Additionally, the difference in reading scores between students who attended non-Head Start programs and students who did not attend preschool was generally larger for language minority students than for non-language-minority students. For example, the difference was .39 SD ( $= .17 - [-.22]$ ) for non-language minority students, compared to .52 SD ( $= .19 - [-.33]$ ) for English-dominant students, .30 SD ( $= -.35 - [-.65]$ ) for Spanish-dominant students, and .82 SD ( $= .62 - [-.20]$ ) for other-language-dominant students. This suggests that non-Head Start programs have a higher relative benefit for language minority students than for non-language minority students.

These patterns are also apparent in specific reading skills. Of course, all these comparisons do not consider other factors that may be related to both preschool attendance and language background, such as socioeconomic status. Later in this chapter, we present statistical models that isolate the effects of language background from other, related factors.

Differences in direct-assessed math scores by language background and preschool experience show similar patterns as those discussed above (Table 12). The only exception is that math scores, compared to reading, for Spanish-dominant students are even lower than scores for other language groups, and the relative benefit of attending non-Head Start programs is less than for any other language group. For example, the difference in math scores between Spanish-dominant students who attended non-Head Start programs the year before kindergarten and those who did not attend preschool was .24 SD ( $= -.58 - [-.82]$ ), whereas the difference was .47 SD ( $= .14 - [-.33]$ ) for English-dominant students and .55 SD ( $= .51 - .04$ ) for other-language-dominant students.

The difference in the scores between reading and math for Spanish-dominant students can probably be attributed to the fact that almost all Spanish-dominant students were assessed in math because a Spanish-language version of the assessment was provided, whereas only those Spanish-dominant students who were proficient in English were given the reading assessment. In contrast, students from other-dominant-language backgrounds were only given the math assessment if they were proficient in English.

The teacher assessments of cognitive performance, as mentioned above, were conducted for all students no matter what their level of English proficiency, so they probably provide a more comprehensive picture of the cognitive performance of language minority students.

**Table 12. Mean direct-assessed math scores and proficiencies in fall 1998 by language background and preschool participation, fall 1998 kindergarteners**

	Mean	Number and shape	Math skills (percent proficient)*			
	Total score		Relative size	Ordinal sequence	Add and subtract	Multiply and divide
Total	0.00	90	56	21	4	2
Non-language minority	0.03	92	60	23	5	2
Language minority	-0.36	83	41	13	3	1
English dominant	-0.13	90	52	18	3	<1
Spanish dominant	-0.75	75	23	4	0.9	0
Other dominant	0.22	93	63	27	6	5
Head Start program	-0.52	85	39	8	1	0
Non-language minority	-0.48	87	42	9	1	0
Language minority	-0.64	81	30	5	0.8	0
English dominant	-0.56	85	37	5	2	0
Spanish dominant	-0.77	77	21	4	0	0
Other dominant	-0.27	89	51	8	1	0
Non-Head Start program	0.19	94	66	27	6	2
Non-language minority	0.23	95	68	28	6	2
Language minority	-0.02	91	54	21	5	1
English dominant	0.14	95	63	25	5	<1
Spanish dominant	-0.58	83	28	6	2	0
Other dominant	0.51	96	71	36	11	5
No preschool	-0.28	86	46	15	3	2
Non-language minority	-0.16	90	52	17	3	2
Language minority	-0.56	77	32	9	2	2
English dominant	-0.33	85	44	14	2	2
Spanish dominant	-0.82	70	21	3	0.8	0
Other dominant	-0.04	90	54	22	1	4

\*Proficiency scores represent the percentage of students who correctly answered at least three or four questions related to each specific skill area.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

**Table 13. Mean teacher-assessed literacy scores and proficiencies in fall 1998 by language background and preschool participation, fall 1998 kindergarteners**

	Mean Overall score	Literacy skills (percent proficient)*				
		Speaking Complex sentence structure	Listening Interprets story	Reading Letters	Reads books	Writing Early writing
Total	0.00	13	11	14	4	3
Non-language minority	0.10	15	12	16	4	4
Language minority	-0.33	8	7	9	3	3
English dominant	-0.09	11	9	11	4	4
Spanish dominant	-0.68	4	4	3	1	1
Other dominant	0.15	8	8	16	6	5
Head Start program	-0.40	7	5	6	1	5
Non-language minority	-0.33	7	5	7	1	1
Language minority	-0.59	4	4	3	1	1
English dominant	-0.44	6	5	3	2	<1
Spanish dominant	-0.75	2	3	1	.2	0
Other dominant	-0.53	4	3	4	3	3
Non-Head Start program	0.24	17	14	19	5	5
Non-language minority	0.30	19	15	20	5	5
Language minority	-0.03	12	10	14	5	5
English dominant	0.17	16	13	15	6	5
Spanish dominant	-0.51	6	5	7	2	2
Other dominant	0.11	9	10	26	9	8
No preschool	-0.24	9	8	9	2	2
Non-language minority	-0.11	11	9	11	3	2
Language minority	-0.52	5	5	5	2	2
English dominant	-0.29	7	7	9	3	2
Spanish dominant	-0.75	3	3	2	1	1
Other dominant	-0.35	8	7	7	5	3

\*Proficiency scores represent the percentage of students who correctly answered at least three or four questions related to each specific skill area.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

Differences in mean literacy scores and skill proficiencies by language background and preschool experience look more similar to the directly-assessed math results, which included more language minority students, than to the directly-assessed reading results, which excluded more language minority students (Table 13). Overall, mean literacy scores for language minority students were .43 SD lower than mean literacy scores for non-language minority students ( $= -.33 - [-.10]$ ), a gap more similar to the one from the direct math assessment (.39 SD), than the direct reading assessment (.19 SD). Differences in literacy scores by preschool experience and among language groups are very similar to the differences based on the direct cognitive assessments.

Scores on teacher-assessed math skills show similar patterns, although the achievement gaps are generally lower in math than in literacy (Table 14). For example, the difference between language minority students and non-language-minority students in mean math scores was .34 SD ( $= -.26 - [-.08]$ ), compared to a gap of .43 SD in literacy.

### **Social Skills**

In addition to cognitive skills, kindergarten teachers assessed the social skills of their students in five areas. In general, differences in social skills by language background and preschool experience are similar to those we observe with respect to cognitive skills, but the differences are much smaller and therefore not meaningful in most cases (Table 15). For example, the overall difference in social skills between non-language minority and language minority students was less than .1 SD and therefore should be considered inconsequential. Differences in social skills between students who attended Head Start the year before kindergarten and students who did not attend any preschool were small (about .3 SD), while the differences between students who attended non-Head Start programs and students who did not attend preschool were inconsequential (less than .1 SD).

**Table 14. Mean teacher-assessed math scores and proficiencies in fall 1998 by language background and preschool participation, fall 1998 kindergarteners**

	Mean Overall score	Math skills (percent proficient)*			
		Sorts math materials	Order objects	Perceives quantity relationships	Solves number problems
Total	0.00	10	8	7	4
Non-language minority	0.08	11	8	8	5
Language minority	-0.26	6	5	4	3
English dominant	-0.08	9	7	5	4
Spanish dominant	-0.54	2	2	1	1
Other dominant	-0.04	9	8	8	6
Head Start program	-0.39	5	2	2	1
Non-language minority	-0.35	5	3	3	2
Language minority	-0.50	3	1	1	1
English dominant	-0.45	5	2	1	1
Spanish dominant	-0.55	<1	1	1	<1
Other dominant	-0.46	5	1	5	3
Non-Head Start program	0.21	13	10	9	6
Non-language minority	0.26	13	11	10	9
Language minority	0.00	10	9	6	7
English dominant	0.15	12	11	7	8
Spanish dominant	-0.41	5	3	2	3
Other dominant	0.23	12	13	12	10
No preschool	-0.20	7	5	5	3
Non-language minority	-0.10	8	6	6	3
Language minority	-0.42	4	3	2	2
English dominant	-0.24	7	5	4	3
Spanish dominant	-0.60	2	1	1	1
Other dominant	-0.23	6	5	4	4

\*Proficiency scores represent the percentage of students who correctly answered at least three or four questions related to each specific skill area.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

**Table 15. Mean teacher-assessed social skills in fall 1998 by language background and preschool participation, fall 1998 kindergarteners**

	Mean	Mean	Mean	Percent often	Percent often
	Approaches to learning	Self-control	Interpersonal skills	Externalizing behaviors	Internalizing behaviors
Total	0.00	0.00	0.00	6	2
Non-language minority	0.02	0.01	0.02	6	3
Language minority	-0.06	-0.02	-0.08	4	2
English dominant	-0.06	-0.02	-0.04	4	2
Spanish dominant	-0.12	-0.04	-0.14	4	3
Other dominant	0.15	0.06	-0.07	4	2
Head Start program	-0.31	-0.26	-0.24	9	3
Non-language minority	-0.33	-0.29	-0.25	11	3
Language minority	-0.26	-0.18	-0.22	7	3
English dominant	-0.36	-0.27	-0.31	9	3
Spanish dominant	-0.20	-0.12	-0.16	5	3
Other dominant	-0.03	-0.02	-0.09	4	0
Non-Head Start program	0.09	0.01	0.05	6	2
Non-language minority	0.11	0.02	0.06	6	2
Language minority	0.03	-0.01	-0.01	4	1
English dominant	0.07	0.04	0.06	3	2
Spanish dominant	-0.12	-0.12	-0.12	5	3
Other dominant	0.16	0.02	-0.12	4	0
No preschool	-0.04	0.07	0.00	4	3
Non-language minority	-0.02	0.09	0.05	4	3
Language minority	-0.08	0.02	-0.11	3	2
English dominant	-0.12	-0.01	-0.08	4	2
Spanish dominant	-0.10	0.02	-0.16	2	3
Other dominant	0.20	0.14	0.01	3	1

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

**Table 16. Percent of students below grade level and in special education in kindergarten by language background and participation in preschool, 1998 fall kindergarteners**

	Percent second time kindergartners	Percent in special education since kindergarten
Total	5	4
Non-language minority	4	2
Language minority	5	1
English dominant	4	1
Spanish dominant	7	2
Other dominant	4	<1
Head Start program	6	5
Non-language minority	6	6
Language minority	5	3
English dominant	3	4
Spanish dominant	7	3
Other dominant	3	2
Non-Head Start program	4	2
Non-language minority	3	2
Language minority	4	1
English dominant	4	1
Spanish dominant	4	3
Other dominant	5	<1
No preschool	5	4
Non-language minority	5	5
Language minority	5	3
English dominant	5	3
Spanish dominant	7	3
Other dominant	4	1

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

### Retention and Special Education

We also examined differences in kindergarten retention and referrals to special education by language background and preschool participation (Table 16).

The results do not show widespread differences in kindergarten retention rates by language background or preschool participation. There were more pronounced differences in the percent of students identified as special education after enrolling in school, by preschool



participation. Whereas only two percent of students who attended non-Head Start preschool programs were identified as special education, five percent of students who attended Head Start programs were identified as special education. Similar differences were observed for non-language-minority and English-dominant students, but there were no differences among students from Spanish-dominant and other-language-dominant households.

### **Predicting School Readiness**

The descriptive statistics presented earlier showed large differences in cognitive skills between kindergarten students who attended preschool and students who did not attend preschool. Students who attended non-Head Start programs showed higher levels of cognitive skills, while students who attended Head Start programs showed lower levels of cognitive skills compared to students who did not attend any form of preschool.

However, these differences may not be due to the effects of preschool itself; rather, they could be due to differences in characteristics of students and their families who were able to afford—and who chose to attend—preschool. For example, if more advantaged families—those with higher incomes and more educated parents—were more likely to enroll their children in non-Head Start programs and were also more likely to improve the cognitive skills of their children through family resources (e.g., books) and activities, then some of the observed differences between students with and without non-Head Start preschool could be related to family background differences and not preschool itself. Similarly, if more disadvantaged parents were more likely to enroll their children in Head Start programs and were also less likely to improve the cognitive skills of their children because of a lack of family resources, then some of the observed differences between students with and without Head Start could be related to family background differences. These differences are known as selection effects.

In order to estimate the effect of preschool on school readiness, it is important to control for selection effects, or the effects of family background that could influence both participation in preschool and school readiness. The simplest way to do this is to use a statistical model that predicts the effects of preschool controlling for family background variables. This is the method we used.<sup>15</sup> In conducting this analysis we focused on initial literacy scores assessed by students'

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<sup>15</sup> More sophisticated methods control for unobserved differences in families (see Heckman, 1979). One recent study using these methods found higher effects of pre-kindergarten preschool programs than through simpler

kindergarten teachers because this school readiness measure had the most valid responses for language minority students. Recall that language minorities who were not proficient in English were excluded from the direct assessments (except Spanish-speaking students in the case of the math assessment), whereas teachers assessed all students in their literacy and math skills (although some teachers did not assess math skills in the fall of kindergarten because they were not yet instructing their students in math).

We first estimated a model examining the effects of Head Start programs and non-Head Start programs on literacy scores without controlling for any other variables in the model. The results, illustrated in Figure 3, show that students who attended non-Head Start preschool programs had literacy scores that were .41 standard deviations (SD) higher than students who did not attend any preschool.<sup>16</sup> These results are similar to what we observed with the descriptive data presented earlier. However, students who attended Head Start programs had literacy scores that were .21 SD lower than students who did not attend preschool.

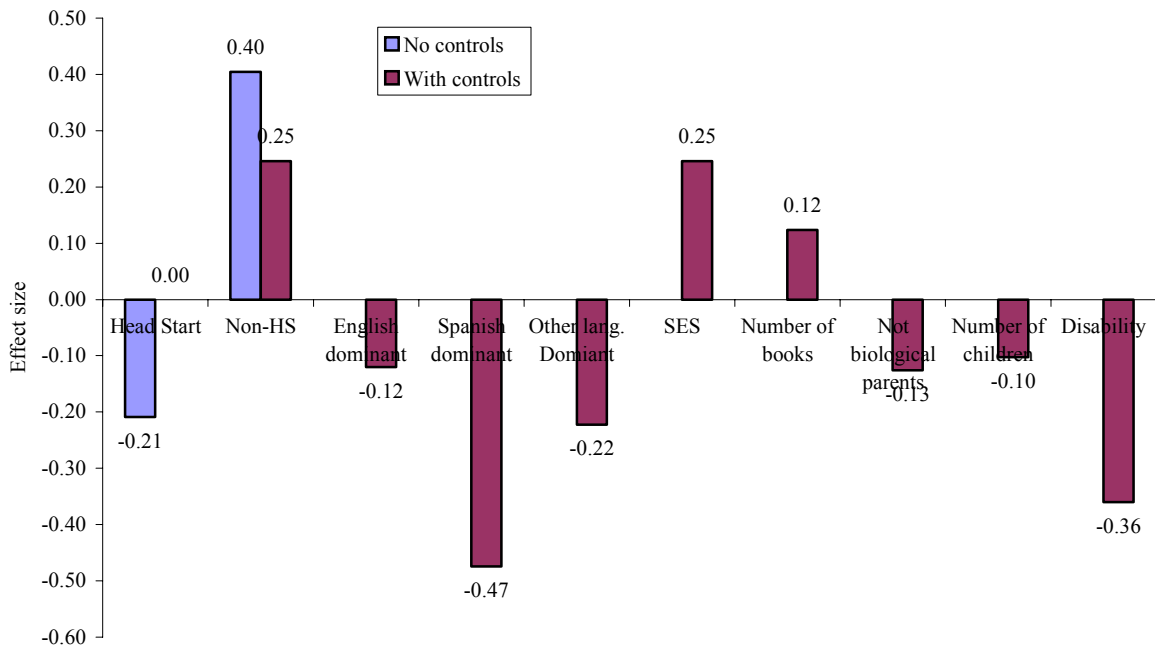
Next, we introduced a series of control variables that we found in earlier analyses were predictive of preschool participation (see Figures 1 and 2). Recall, for example, that increases in family SES increased the likelihood of attending non-Head Start programs and decreased the likelihood of attending Head Start; we also see in Figure 3 that increases in family SES are associated with higher literacy scores, even after controlling for the effects of preschool.

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methods, suggesting that, controlling for other factors, children who attended pre-kindergarten programs would be likely to have lower school readiness scores had they not attended those programs (Magnuson et al., 2004). If this is the case, then our estimates may be considered lower bound estimates.

<sup>16</sup> Throughout this report, we use the terms *effect* and *effect sizes* to represent the predicted relationship between an independent variable and a dependent variable in a statistical model that controls for the effects of other predictor variables. These terms do not prove that the predicted relationship is causal. Effect sizes for achievement outcomes were computed by dividing the estimated parameters from the statistical models by the student-level standard deviation from the corresponding unconditional models.

**Figure 3. Predicted effects of preschool and other background variables on literacy in fall 1998, fall 1998 kindergarteners**



SOURCE: Appendix Table A.4.

Similarly, language minority students were less likely to attend non-Head Start preschool programs (Figure 2) and also had lower literacy scores at the beginning of kindergarten even after controlling for the effects of other predictor variables such as SES. Whereas literacy scores for language minority students from English-dominant households were only slightly lower (-.14 SD), literacy scores for language minority students from Spanish-dominant households were moderately lower (-.45 SD) and literacy scores for language minority students from other-language-dominant households were somewhat lower (-.24 SD). Several other variables that were associated with preschool participation were also associated with school readiness. After controlling for all of these variables, the estimated effect of attending a non-Head Start program was reduced from .41 SD to .25 SD. After controlling for all of these variables, the estimated effect of attending a Head Start program was reduced from -.21 SD to zero.

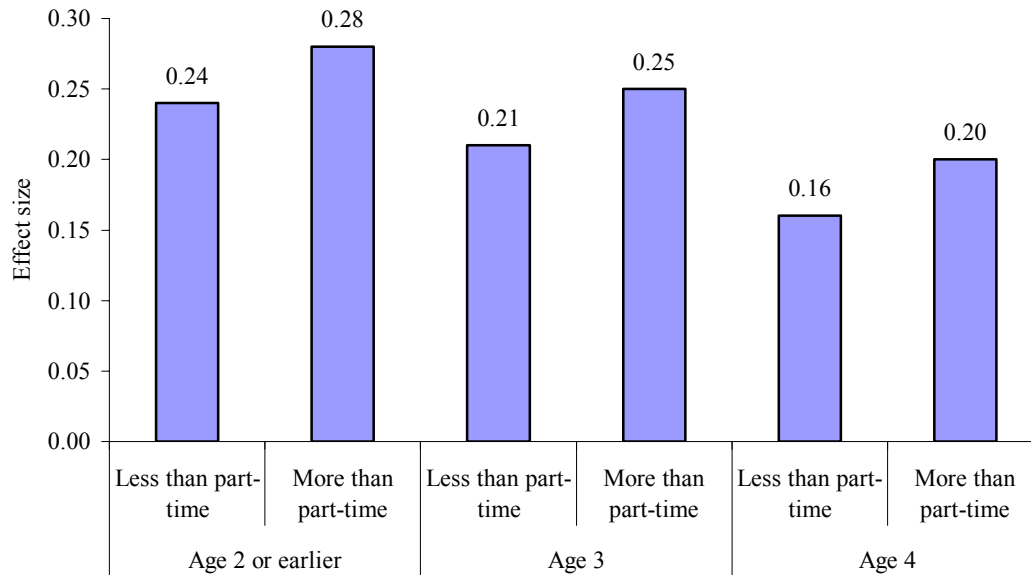
We also examined whether the effects of preschool varied for students from different language backgrounds. We found that there were no differential effects of non-Head Start or Head Start programs among language groups. This means that attending non-Head Start

preschool programs has similar effects on the school readiness of students from all language backgrounds.

Next we examined whether the intensity of preschool participation was associated with school readiness. We created two measures of preschool intensity. The first focused on the amount of preschool students had the year before kindergarten based on the number of hours per week and months over the year (for non-Head Start programs only) that students attended. Students were classified as full-time if they attended more than 20 hours per week and 9 months over the year (for Head Start, only if they attended more than 20 hours per week); otherwise they were classified as part-time. The second focused on the year when they first attended preschool. For students who attended non-Head Start programs, we identified students who first attended earlier than age 3, at age 3, or at age 4 or 5. As shown in Table 9, about one-third of the students first attended preschool earlier than age 3, one third first started at age 3, and about one-third first started at age 4 or later. For students who attended Head Start, few started before age 3, so we identified students who started Head Start at age 3 or earlier, or at age 4 or later.

We found that students who attended non-Head Start programs at an earlier age, or who attended full-time, had higher literacy skills than students who attended at a later age or only part-time. More specifically, students who first attended non-Head Start programs at age 4 or 5 and attended part-time the year before kindergarten, had literacy skills that were .16 SD higher than students who did not attend preschool (Table 4). In contrast, students who first attended preschool at age 2 or earlier and attended non-Head Start programs for more than part-time had literacy skills that were .28 SD higher than students who did not attend preschool. In other words, the more time students spent in non-Head Start programs, the higher level of cognitive skills.

**Figure 4. Predicted effects of non-Head Start preschool on literacy in fall 1998 by age of first preschool attendance and time spent in program the year before kindergarten, fall 1998 kindergarteners**



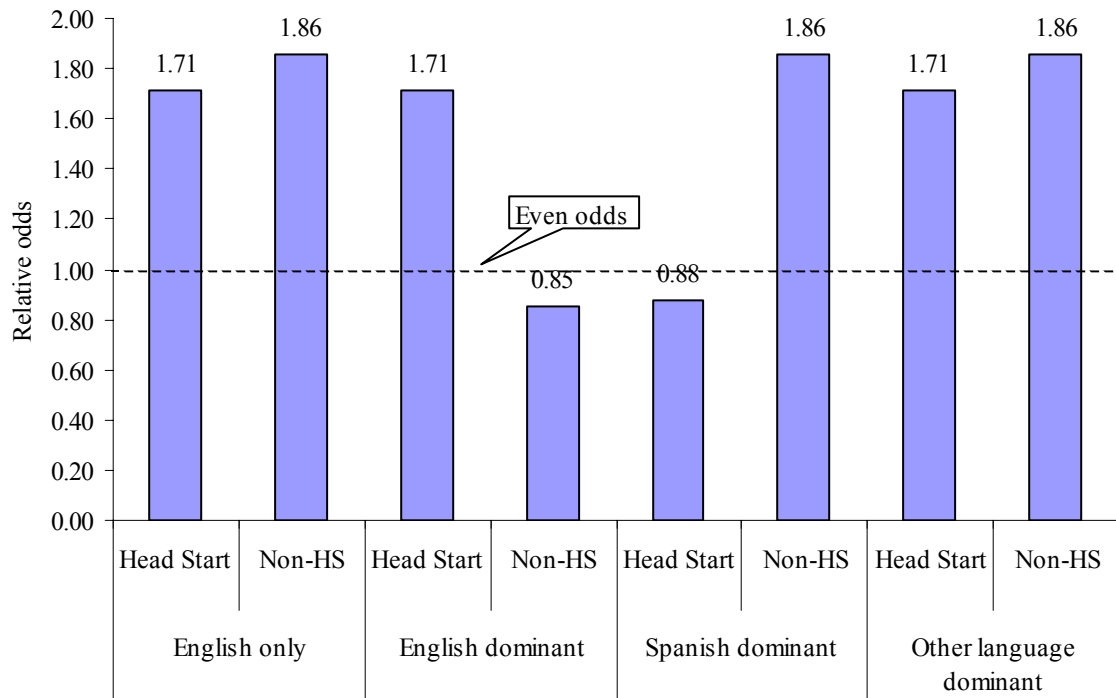
SOURCE: Appendix Table A.4.

Intensity of participation had no association with literacy skills for students who attended Head Start programs the year before kindergarten. We also examined a quality dimension of Head Start programs based on the number of adults and the number of children in the Head Start program, since research suggest that smaller classrooms (15 or less) and more adults per student create a higher quality learning environment (National Research Council, 2002). But again we found no differences between students who attended high quality Head Start programs (less than 15 students and at least two teachers) and those who attended other Head Start programs. Finally, ECLS tried to verify whether parents who reported that their child attended Head Start programs actually attended Head Start programs the year before kindergarten. About half of the identified Head Start programs were located and the child’s attendance verified; the remaining programs could not be located or the child’s attendance could not be verified or it was determined that the program was not actually a Head Start program. We found that the predicted effect of Head Start did not differ between students whose attendance could be verified and those whose attendance could not be verified—in both cases there was no significant relationship between Head Start and literacy skills.

We also estimated models on three other outcomes: externalizing problem behaviors (those students whose mean teacher-rated externalizing problem behaviors was 3 or more, which corresponds to an average rating of “often”), retention (students who were enrolled in kindergarten for a second time), and identified as special education since starting kindergarten (the student had an Individual Education Plan or IEP on record with the school). We estimated a similar model as we did for literacy, controlling for a set of background variables that also predicted preschool participation. After controlling these variables, we found that preschool participation still had a significant effect on each of these outcomes.

The results for externalizing problem behaviors, illustrated in Figure 5, show that students who attended both Head Start and non-Head Start preschool programs were more likely to be identified by their kindergarten teachers as having externalizing problem behaviors. The effects were small and fairly common across language groups, but not consistently so. Students who attended Head Start programs in the year before kindergarten were 71 percent more likely to exhibit problem behaviors than students who did not attend any preschool, with the exception of students from Spanish-dominant households who were 12 percent less likely to exhibit problem behaviors. Students who attended non-Head Start programs were 86 percent more likely to exhibit problem behaviors than students who did not attend any preschool, with the exception of students from English-dominant households, who were 15 percent less likely to exhibit problem behaviors.

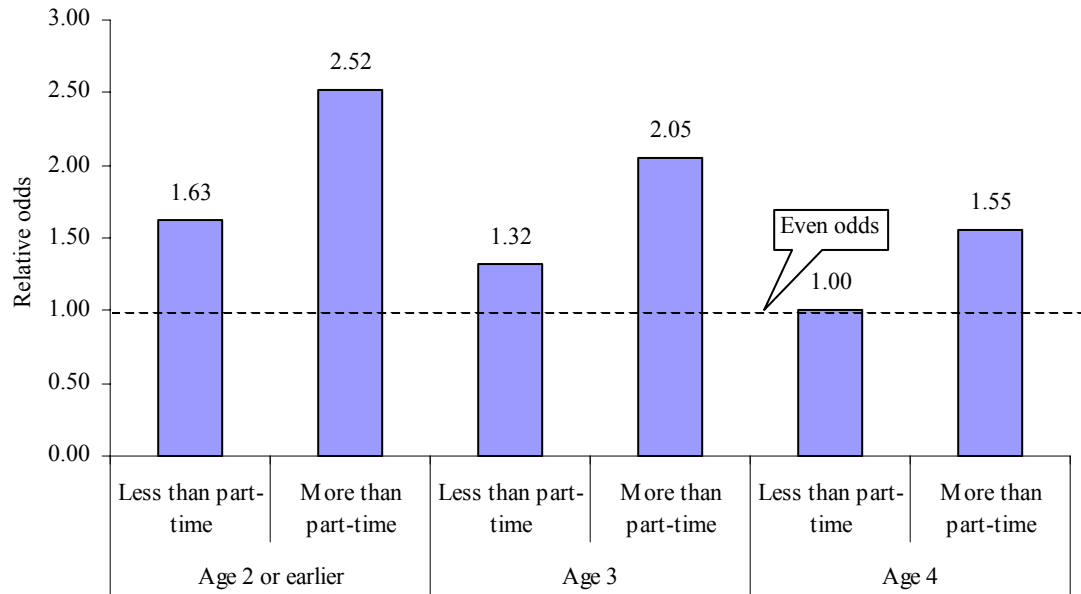
**Figure 5. Predicted relative odds of exhibiting externalizing problem behaviors in fall 1998 by preschool participation and language background, fall 1998 kindergarteners**



SOURCE: Appendix Table A.4.

The effects varied by intensity of participation, but only among students who attended non-Head Start programs. In general, the more time students spent in non-Head Start programs, the more likely they were to exhibit problem behaviors. However, students who first attended non-Head Start programs at age 4 and attended half time or less, were no more likely to exhibit problem behaviors than students who did not attend preschool at all (Figure 6). In contrast, students who attended more than part-time and first attended at age 2 or earlier, were more than twice as likely to exhibit problem behaviors as students who did not attend preschool.

**Figure 6. Predicted relative odds of exhibiting problem behaviors in fall 1998 for students who attended a center the year before kindergarten by age of first center attendance and time spent in center the year before kindergarten, fall 1998 kindergarteners**

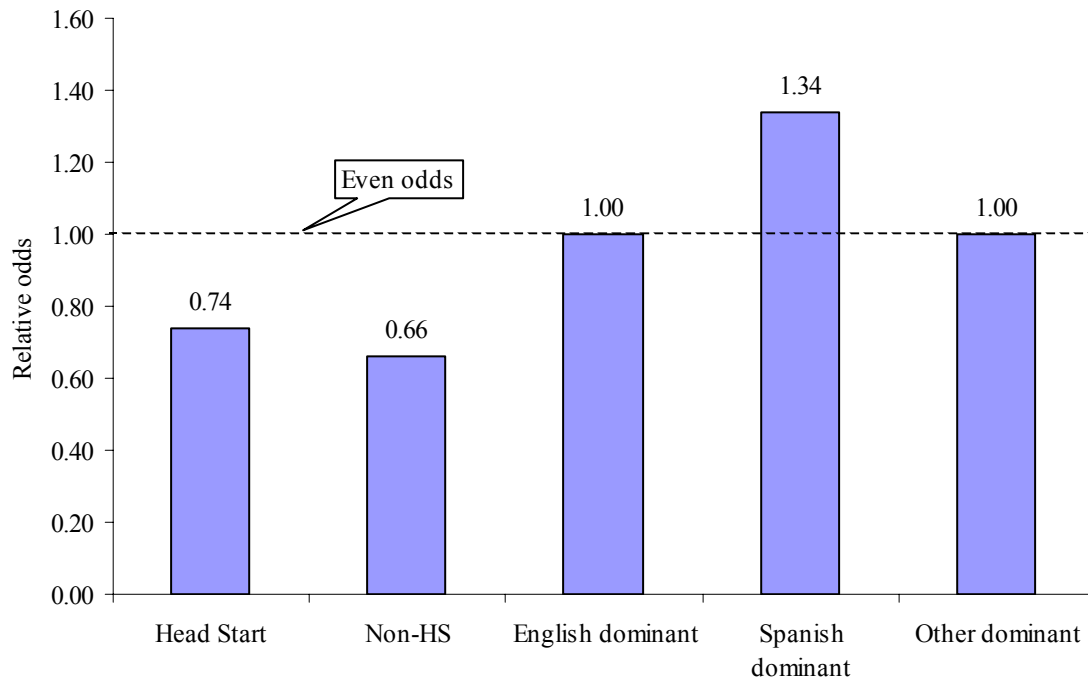


SOURCE: Appendix Table A.4.

The results for kindergarten retention, illustrated in Figure 7, show that students who attended either Head Start or non-Head Start programs were less likely to be attending kindergarten for the second time, although the size of the effects were quite small. For example, after controlling for other predictor variables, students who attended non-Head Start programs were 34 percent less likely to be repeating kindergarten than students who did not attend any preschool. These effects were the same across language groups. In addition, children from Spanish-dominant households were 34 percent more likely to be repeating kindergarten than non-language minority students.



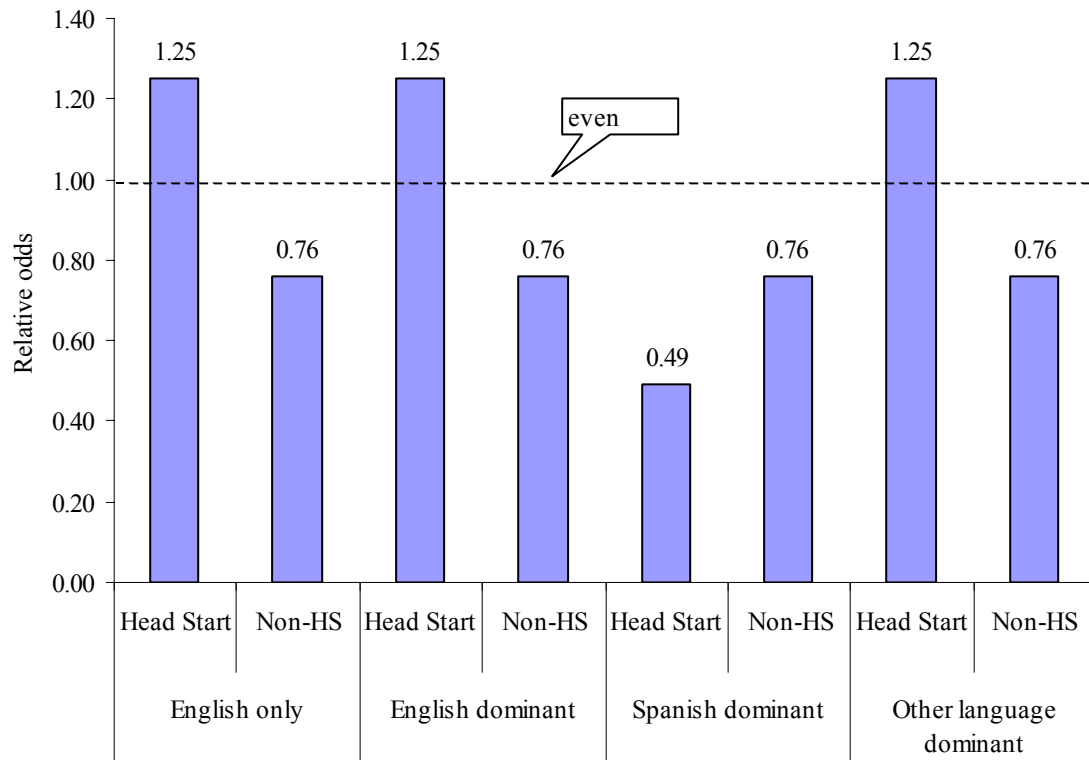
**Figure 7. Predicted relative odds of repeating kindergarten by preschool participation and language background, fall 1998 kindergarteners**



SOURCE: Appendix Table A.4.

The results for special education, illustrated in Figure 8, show that students who attended non-Head Start preschools the year before kindergarten were 24 percent less likely than students who did not attend any preschool to be identified as special education during the kindergarten year. There was no effect for Head Start. In addition, students from Spanish-dominant households were 36 percent less likely to be identified as special education during kindergarten, and students from other-language-dominant households were 61 percent less likely than non-language-minority students.

**Figure 8. Predicted relative odds of being in special education during kindergarten by preschool participation and language background, fall 1998 kindergarteners**



SOURCE: Appendix Table A.4.

#### **4. The Relationship between Preschool and Third Grade Outcomes**

Preschool improves kindergartners' school readiness. But do students who attend preschool prior to entering kindergarten continue to perform better in school? To address this question, we examined differences in a number of cognitive and social outcomes for students four years after they first entered schools, when most were finishing the third grade. In this chapter, we first present descriptive statistics on school outcomes by preschool participation and language background. Then we present results from a series of statistical models that predict the effects of preschool on third grade outcomes after controlling for the effects of other predictor variables that also predict preschool participation.

##### **Cognitive Outcomes**

We examined cognitive outcomes based both on the direct assessments and on assessments conducted by students' third grade teachers. However, due to student mobility and the design considerations of the ECLS-K study that limited access to some students' third grade teachers, there were more valid responses from the direct assessments than from the teacher assessments. Furthermore, virtually all language minority students were proficient in English by third grade.

Reading achievement in the spring of third grade varied by language background and preschool participation. Mean reading scores were about one-third of a standard deviation lower for language minority students than non-language-minority students (Table 17). But this overall difference masks larger differences among language minority subgroups: students from Spanish-dominant households were two-thirds of a standard deviation behind non-language minority students, whereas English-dominant students were only slightly behind, and other-language-dominant students were essentially reading at the same levels.

**Table 17. Mean direct-assessed reading scores and proficiencies in spring 2002 by language background and preschool participation the year before kindergarten, fall 1998 kindergarteners**

	Mean total score	Percent proficient*			
		Words in context	Literal Inference	Extrapolation	Evaluation
Total	0.00	95	78	45	21
Non-language minority	0.07	95	80	48	23
Language minority	-0.27	92	69	48	14
English dominant	-0.05	93	77	43	20
Spanish dominant	-0.63	89	57	18	6
Other dominant	0.10	98	80	49	22
Head Start program	-0.50	90	62	24	7
Non-language minority	-0.49	89	62	25	8
Language minority	-0.53	93	60	22	6
English dominant	-0.53	88	65	26	4
Spanish dominant	-0.56	96	57	18	7
Other dominant	-0.35	93	60	27	15
Non-Head Start program	0.20	97	84	53	28
Non-language minority	0.24	97	85	55	29
Language minority	0.00	96	78	44	21
English dominant	0.17	97	84	50	25
Spanish dominant	-0.48	92	62	23	10
Other dominant	0.29	98	86	59	29
No preschool	-0.16	92	73	39	16
Non-language minority	-0.06	94	76	43	18
Language minority	-0.44	88	64	27	11
English dominant	-0.18	89	71	39	18
Spanish dominant	-0.74	85	55	14	4
Other dominant	0.03	99	80	44	16

\*Proficiency scores represent the percentage of students who correctly answered at least three or four questions related to each specific skill area.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

The reading scores of students who attended non-Head Start programs were .36 SD higher than students who did not attend preschool (.20 – [-.16]), while the reading scores of students who attended Head Start programs were .34 SD lower than students who did not attend preschool (-.50 – [-.16]). There were similar differences across language groups. That is, language minority students who attended non-Head Start programs had higher reading scores than language minority students who did not attend preschool, whereas language minority students who attended Head Start programs had lower reading scores than language minority students who did not attend preschool. The only exception was that Spanish-dominant language minority students who attended Head Start programs had somewhat higher reading scores than Spanish-dominant language minority students who did not attend preschool (.18 = -.56 – [-.74]).

Science and math scores show remarkably similar patterns, although the achievement gap between students from Spanish-dominant households and non-language-minority households is much larger in science than in math (Table 18).

Teachers' assessments of their students' skills also show similar patterns, but the magnitude of the differences was smaller (Table 19). For example, whereas Spanish-dominant students were .70 SD behind (= -.63 – [-.07]) non-language -minority students in mean direct-assessed reading scores (see Table 19)—a relatively large difference per our convention (see p. 37)—they were only .25 SD (= .01 – [-.24]) behind in teacher-assessed reading scores, a small difference. Similarly, whereas the difference in mean direct-assessed reading scores of students who attended non-Head Start programs were .36 SD higher (= .20 – [-.16]) than students who did not attend preschool, the difference in mean teacher-assessed reading scores was only .24 SD higher (= .14 – [-.10]).

**Table 18. Mean direct-assessed science and math scores and proficiencies in spring 2002 by language background and preschool participation the year before kindergarten, fall 1998 kindergarteners**

	Science		Math		
	Mean Total score	Mean Total score	Percent proficient*		
			Multiply and divide	Place value	Rate and measure
Total	0.00	0.00	80	40	13
Non-language minority	0.10	0.04	81	42	13
Language minority	-0.39	-0.17	75	32	10
English dominant	-0.09	0.01	81	38	13
Spanish dominant	-0.82	-0.49	67	20	4
Other dominant	-0.04	0.23	83	54	19
Head Start program	-0.57	-0.58	60	18	3
Non-language minority	-0.55	-0.61	57	17	3
Language minority	-0.68	-0.44	70	20	5
English dominant	-0.61	-0.47	70	20	3
Spanish dominant	-0.76	-0.43	71	19	7
Other dominant	-0.47	-0.30	67	35	5
Non-Head Start program	0.21	0.21	86	47	17
Non-language minority	0.26	0.22	87	48	18
Language minority	-0.07	0.11	82	44	15
English dominant	0.16	0.23	85	48	17
Spanish dominant	-0.66	-0.27	73	29	6
Other dominant	0.13	0.41	85	62	27
No preschool	-0.13	-0.15	77	35	8
Non-language minority	0.00	-0.06	79	39	9
Language minority	-0.56	-0.32	82	26	8
English dominant	-0.22	-0.11	79	33	12
Spanish dominant	-0.92	-0.60	62	16	3
Other dominant	-0.10	0.17	84	49	13

\*Proficiency scores represent the percentage of students who correctly answered at least three or four questions related to each specific skill area.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

**Table 19. Mean teacher-assessed academic skills in spring 2002 by language background and preschool participation the year before kindergarten, fall 1998 kindergarteners**

	Reading	Math	Science	Social studies
Total	0.00	0.00	0.00	0.00
Non-language minority	0.01	0.00	0.02	0.02
Language minority	-0.04	-0.01	-0.09	-0.08
English dominant	0.04	0.07	0.03	0.05
Spanish dominant	-0.24	-0.24	-0.36	-0.34
Other dominant	0.27	0.27	0.27	0.22
Head Start program	-0.40	-0.37	-0.40	-0.36
Non-language minority	-0.46	-0.41	-0.43	-0.37
Language minority	-0.24	-0.25	-0.32	-0.32
English dominant	-0.31	-0.26	-0.30	-0.36
Spanish dominant	-0.17	-0.26	-0.37	-0.31
Other dominant	-0.20	-0.09	-0.07	-0.18
Non-Head Start program	0.14	0.12	0.13	0.14
Non-language minority	0.13	0.11	0.13	0.12
Language minority	0.18	0.22	0.17	0.21
English dominant	0.27	0.30	0.24	0.29
Spanish dominant	-0.12	-0.05	-0.11	-0.12
Other dominant	0.41	0.43	0.36	0.52
No preschool	-0.10	-0.08	-0.08	-0.11
Non-language minority	-0.07	-0.06	-0.03	-0.06
Language minority	-0.18	-0.14	-0.23	-0.26
English dominant	-0.16	-0.15	-0.14	-0.12
Spanish dominant	-0.31	-0.24	-0.46	-0.45
Other dominant	0.24	0.28	0.26	0.00

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

## Social Outcomes

Two types of social outcomes were assessed in third grade. First, teachers were asked to assess the students in the same five areas of social behavior as they did in kindergarten. Second, field assessors asked students a series of questions regarding their attitudes toward school and classmates, and their social behavior.

Teacher-assessed social skills varied somewhat by language background and preschool participation (Table 20). Learning behaviors were similar among language groups except that other-language-dominant students had learning behaviors that were .39 SD higher ( $= .37 - [-.02]$ ) than non-language-minority students. Differences in other social behaviors were much smaller and should be considered inconsequential. Differences in social behaviors between students who attended non-Head Start programs and students who didn't attend any preschool, on average, were inconsequential. However, students who attended Head Start program generally had poorer social behaviors than non-preschool students, although the differences were small (less than .5 SD).

Student reports of their attitudes toward school and their peers, as well as their social behavior, varied little by language background and preschool participation with a few exceptions (Table 21). One was that language minority students from other-language-dominant households reported lower levels of favorable peer relations than non-language-minority students (.16 SD). Two other exceptions concern differences in students' reports of problematic external (anger/distractibility) and internal (sad/lonely/anxious) behaviors. Spanish-dominant language minority students were twice as likely as non-language minority students (30 percent vs. 15 percent) to report often feeling sad, lonely, or anxious; and third grade students who attended Head Start reported higher levels of problematic external and internal behaviors compared to students who did not attend preschool (19 percent vs. 9 percent), with the biggest differences among non-language-minority students.



**Table 20. Mean teacher-assessed social skills in spring 2002 by language background and preschool participation in the year before kindergarten, fall 1998 kindergarteners**

	Mean			Percent reporting often	
	Approaches to learning	Self-control	Interpersonal skills	Externalizing behaviors	Internalizing behaviors
Total	0.00	0.00	0.00	5	4
Non-language minority	-0.02	-0.01	-0.01	6	4
Language minority	0.07	0.06	0.05	4	3
English dominant	0.06	0.06	0.03	3	4
Spanish dominant	-0.01	0.01	0.03	5	2
Other dominant	0.37	0.20	0.21	4	2
Head Start program	-0.30	-0.24	-0.24	9	6
Non-language minority	-0.43	-0.34	-0.33	11	6
Language minority	0.05	0.03	0.01	3	5
English dominant	-0.13	-0.06	-0.17	4	7
Spanish dominant	0.20	0.13	0.17	2	3
Other dominant	0.17	-0.04	-0.02	4	9
Non-Head Start program	0.08	0.03	0.07	5	3
Non-language minority	0.07	0.02	0.05	6	3
Language minority	0.17	0.11	0.10	3	3
English dominant	0.18	0.14	0.13	2	4
Spanish dominant	0.07	0.05	0.04	5	3
Other dominant	0.33	0.03	0.10	7	1
No preschool	-0.03	0.02	-0.01	5	4
Non-language minority	-0.03	0.03	-0.01	4	4
Language minority	-0.01	0.00	-0.01	5	3
English dominant	-0.06	-0.01	-0.03	5	4
Spanish dominant	-0.16	-0.11	-0.08	6	1
Other dominant	0.46	0.42	0.37	0	2

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

**Table 21. Student-reported socio-emotional development in spring 2002 by language background and preschool participation in the year before kindergarten, fall 1998 kindergarteners**

	Reading	Mean			Percent mostly true	
		Math	School	Peer	External behavior	Internal behavior
Total	0.00	0.00	0.00	0.00	10	16
Non-language minority	-0.02	-0.02	-0.03	0.01	10	15
Language minority	0.06	0.08	0.07	-0.03	11	20
English dominant	0.08	0.06	0.01	-0.04	9	16
Spanish dominant	0.05	0.12	0.16	0.00	15	30
Other dominant	0.02	0.07	0.04	-0.15	8	12
Head Start program	0.06	0.11	0.08	0.03	19	30
Non-language minority	0.03	0.09	0.04	0.03	21	31
Language minority	0.15	0.16	0.18	0.02	14	26
English dominant	0.19	0.09	0.17	0.08	13	27
Spanish dominant	0.16	0.22	0.22	-0.01	17	29
Other dominant	-0.16	0.17	0.01	-0.07	10	14
Non-Head Start program	0.01	-0.03	-0.02	0.01	9	13
Non-language minority	0.00	-0.05	-0.04	0.02	8	12
Language minority	0.07	0.09	0.12	-0.02	9	16
English dominant	0.10	0.05	0.07	-0.01	7	12
Spanish dominant	0.00	0.18	0.09	-0.05	14	30
Other dominant	0.05	0.09	0.05	-0.19	7	10
No preschool	-0.03	0.01	0	-0.04	11	19
Non-language minority	-0.05	-0.01	-0.02	-0.02	11	16
Language minority	0.03	0.03	0.10	-0.05	8	15
English dominant	0.02	0.06	0.03	-0.12	13	19
Spanish dominant	0.03	0.02	0.15	0.02	14	30
Other dominant	0.06	0.01	0.06	-0.11	7	15

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

**Table 22. Percent of students below grade level and in special education in spring 2002 by language background and participation in preschool, fall 1998 kindergarteners**

	Percent below grade level	Percent in special education since kindergarten
Total	11	9
Non-language minority	11	9
Language minority	11	6
English dominant	12	8
Spanish dominant	11	6
Other dominant	7	4
Head Start program	16	10
Non-language minority	17	12
Language minority	12	5
English dominant	14	5
Spanish dominant	12	5
Other dominant	11	6
Non-Head Start program	8	7
Non-language minority	8	8
Language minority	9	7
English dominant	10	7
Spanish dominant	9	7
Other dominant	8	4
No preschool	13	10
Non-language minority	14	11
Language minority	12	7
English dominant	14	11
Spanish dominant	12	5
Other dominant	4	3

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

### Retention and Special Education

We also examined differences in retention and referrals to special education by language background and preschool participation (Table 22). There were negligible differences in the percent of students below grade level by language background, but there were somewhat larger differences by preschool participation. Students who attended non-Head Start programs were less likely to be enrolled below grade level, while students who attended Head Start were more likely to be below grade level, compared to students who did not attend preschool the year before

kindergarten, with the largest differences among non-language-minority students. For example, 8 percent of non-language -minority students who attended non-Head Start programs were enrolled below grade level, compared to 16 percent who attended Head Start programs, and 13 percent who did not attend preschool. Differences among language minority students were less pronounced. Language minority students from other-language-dominant households were the least likely to be enrolled below grade level, with the lowest rates among those who did not attend preschool.

Nine percent of all students had been identified as special education since kindergarten, and these rates did not vary widely among language groups and preschool participation. As in the case of retention, the biggest differences were among non-language-minority students, with those who attended Head Start programs having higher rates of identification.

### **Predicting the Effects of Preschool on Third Grade Outcomes**

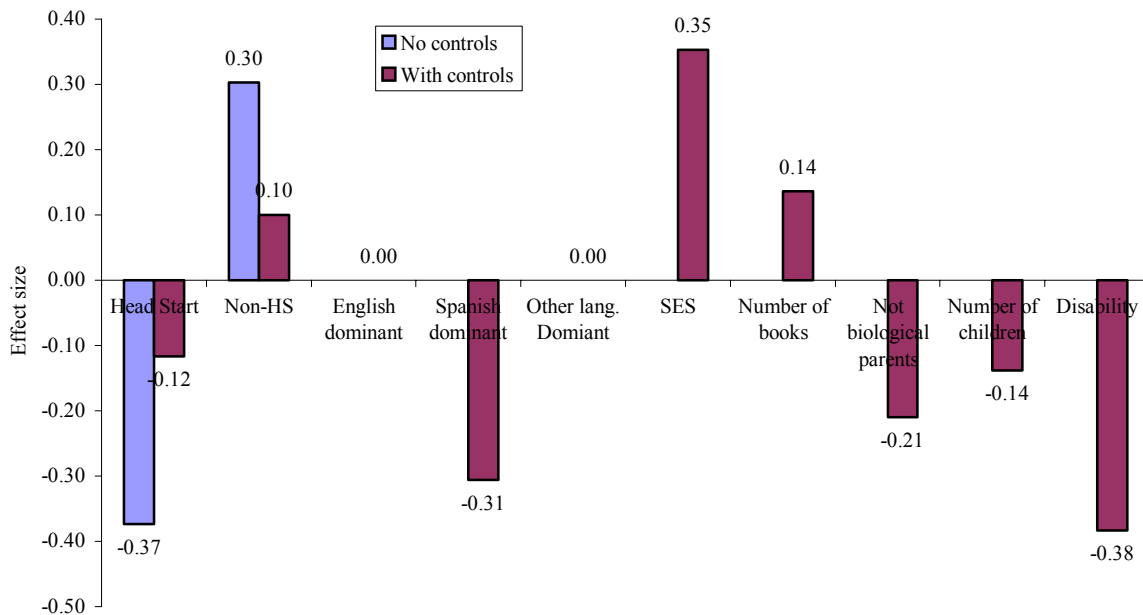
As we pointed out in the previous chapter on school readiness, observed differences in third grade outcomes among students by language background and preschool participation does not mean those differences were “caused” by language background or preschool participation, rather they could be due to other factors that are associated with them, such as family socioeconomic status. To disentangle these effects, we estimated a series of statistical models to predict school outcomes that controlled for some of these other factors (sometimes referred to as covariates) to better determine the effects of language background and preschool on school outcomes in third grade.

For cognitive outcomes, we used the direct assessments in reading, math, and science, rather than the teacher assessments (as we did in kindergarten) because teacher assessments were not available for a number of ECLS students who changed residences and schools from the fall of kindergarten to the spring of third grade.

The first model estimated third grade reading performance. We first estimated a model examining the effects of non-Head Start programs and Head Start programs on reading scores without controlling for any other variables in the model. The results (see Figure 9) show that third-grade students who attended non-Head Start programs had literacy scores that were .30 standard deviations (SD) higher, and students who attended Head Start programs had literacy scores that were .37 SD lower, than students who did not attend any preschool. These results are

similar to what we observed with the descriptive data presented earlier (see Table 16). They are also similar to the predicted effects of preschool on kindergarten literacy scores (see Figure 3). That is, it appears that the benefits of non-Head Start preschool are sustained from the beginning of kindergarten to the end of third grade.

**Figure 9. Predicted effects of preschool and other background variables on direct-assessed reading scores in spring 2002, fall 1998 kindergarteners**



SOURCE: Appendix Table A.5.

However, once we control for the same set of background characteristics that we did in the earlier models, the effects are greatly reduced and become inconsequential. The predicted effect of non-Head Start preschool is reduced from .30 SD to .10 SD and the predicted effect of Head Start is reduced from -.37 SD to -.12 SD.

Some of the achievement differences among language groups also change between kindergarten and third grade. Whereas English-dominant and other-language-dominant students had lower achievement in kindergarten literacy than non-language-minority students, there were no significant differences in reading achievement by third grade. However, Spanish-dominant students continued to lag, although the gap was reduced slightly from .45 SD in kindergarten literacy to .31 SD in third grade reading. Other background variables that had significant effects

on kindergarten literacy had similar or sometimes larger effects on third grade reading. For example, SES had an effect size of .24 SD on kindergarten literacy (Figure 3), but an effect size of .35 SD on third grade reading. Similarly, students who did not live with both biological parents had kindergarten literacy scores that were .13 SD lower than students who lived with both of their biological parents; by third grade, the difference in reading scores was .21 SD. These results suggest that family background continues to influence the achievement of students beyond its effect on school readiness.<sup>17</sup>

We estimated identical models for math and science achievement. These results are displayed in Figure 10. The results are similar to those for reading—after controlling for background variables, the predicted effects of non-Head Start care become inconsequential. The effects of Head Start, however, remain small and negative. Differences among language groups displayed different patterns than they did in reading. Language minority students from English-dominant households had similar math and science scores as non-language-minority students. Spanish-dominant students had lower scores than non-language-minority students, but the gap was much smaller in math (-.12 SD) than in science (-.48 SD).<sup>18</sup> Students from other-language-dominant households had similar science scores compared to students from non-language minority households, but they had significantly higher math scores (.25 SD).

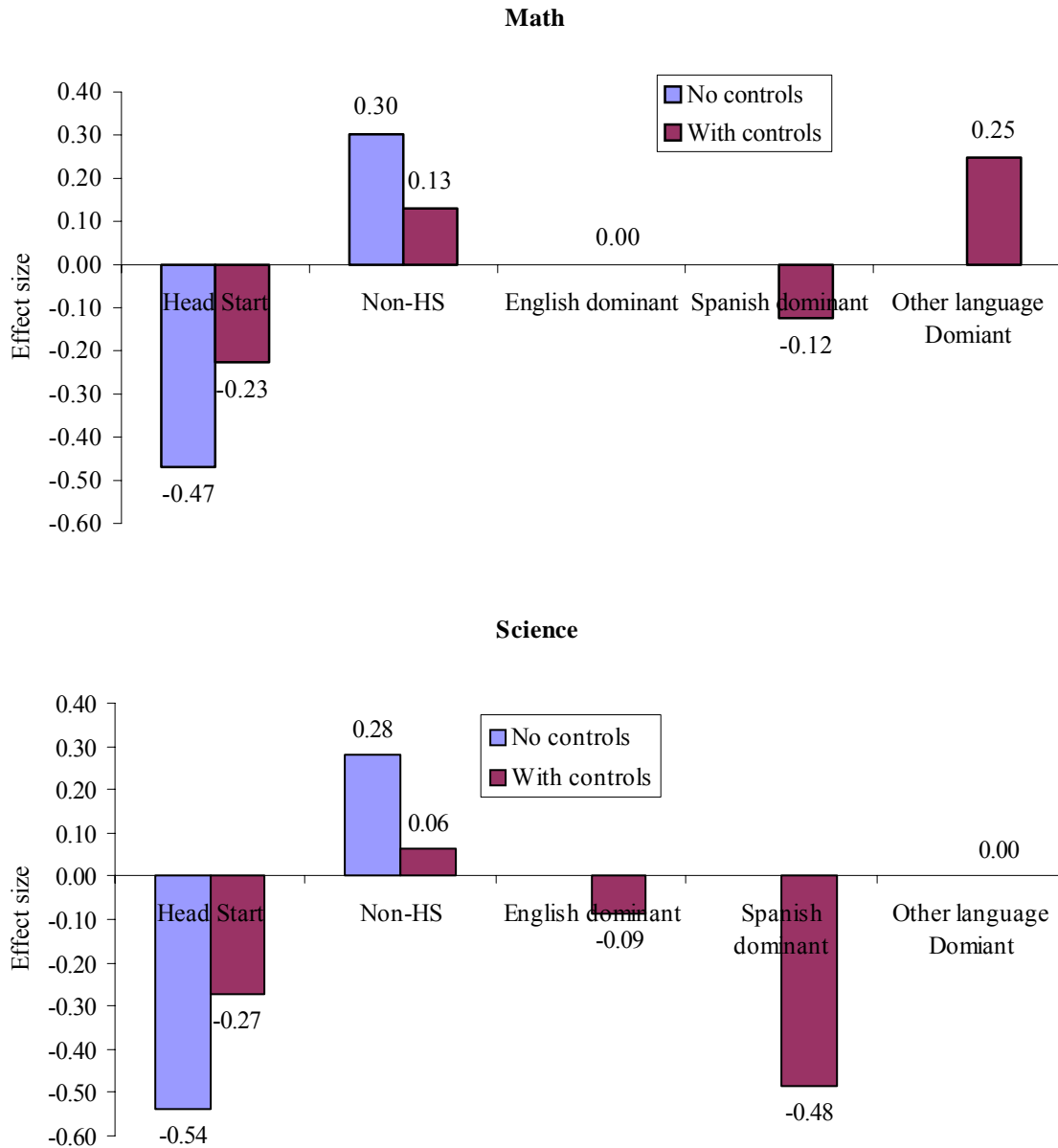
For the most part, the effects of Head Start and non-Head start programs did not vary among language groups. The only exception was that Spanish dominant students who attended Head Start programs had significantly higher achievement than Spanish dominant students who did not attend any preschool. For example, while Spanish-dominant students who did not attend preschool had reading scores that were .31 SD below English-only students who did not attend preschool, Spanish-dominant students who attended Head Start programs had reading scores comparable to English-only students who did not attend preschool. Similar effects were observed in math and science. But no differential effects were found for language-minority students who attended non-Head Start programs.

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<sup>17</sup> Even when we controlled for kindergarten literacy, family background variables remained statistically significant.

<sup>18</sup> This could be due to differences in the linguistic complexity of the items in the different subject areas (Abedi, 2002).

**Figure 10. Predicted effects of preschool and other background variables on direct-assessed math and science scores in spring 2002, fall 1998 kindergarteners**

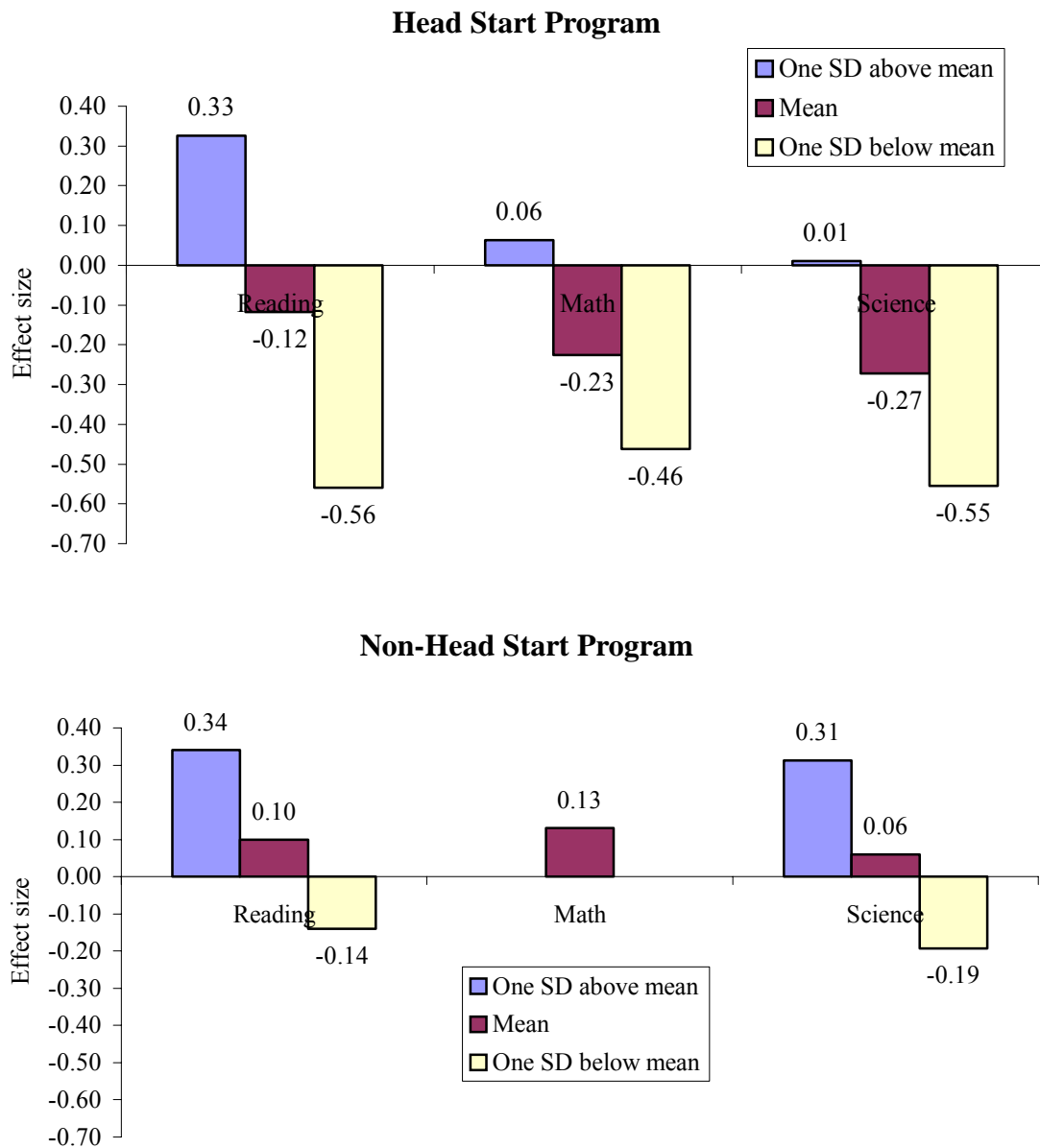


SOURCE: Appendix Table A.5.

Although the average effect of preschool on cognitive development was inconsequential, it is possible that the effects vary by school. To investigate this issue, we modified our statistical model to allow for the two preschool variables—Head Start and non-Head Start programs—to vary between schools. Doing so revealed that there was substantial variation between schools in the estimated effects, especially for Head Start (see Figure 11). In some schools, students who

attended Head Start programs were doing better (+ .33 SD) in reading than students who didn't attend any preschool, while in other schools they were doing substantially worse (-.56 SD). In math and science there was less variation, with virtually no Head Start attendees doing better, but some doing substantially worse. There were similar variations among students who attended non-Head Start programs, although the variation was less.

**Figure 11. Predicted effects of preschool on direct-assessed reading, math, and science scores in spring 2002 with varying school effects, fall 1998 kindergarteners**



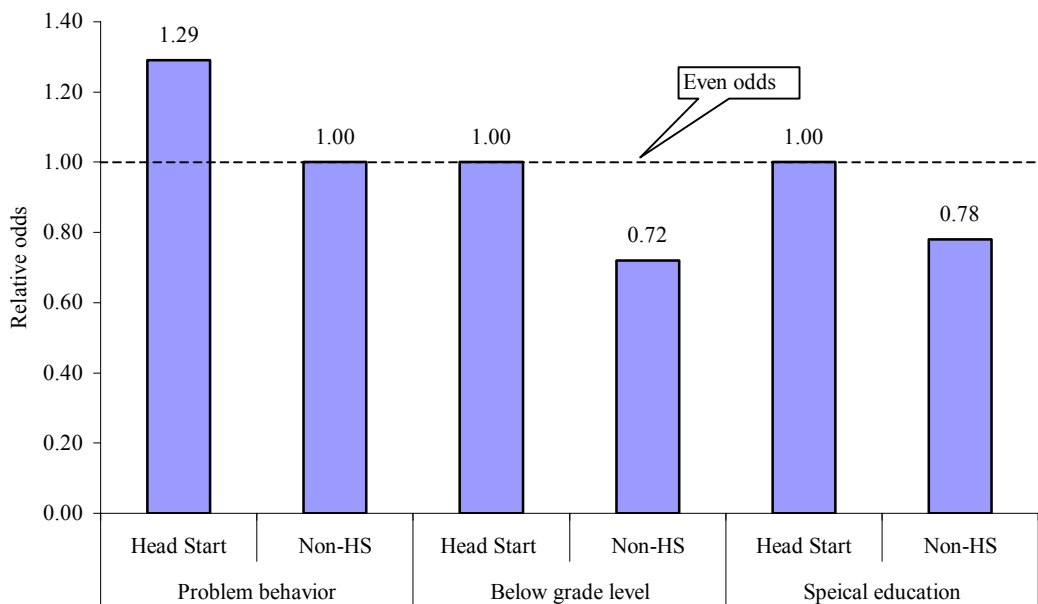
SOURCE: Appendix Table A.5.



We then estimated statistical models for three other third grade student outcomes: student-reported social behavior (those students who rated their externalizing problem(s) as 3 or more, which corresponds to an average rating of “often”), enrolled below grade level, and students identified as special education (with an Individual Educational Plan) since starting kindergarten. After controlling for background characteristics, participation in preschool had small (effect sizes greater than .2 SD) or insignificant effects on these outcomes.

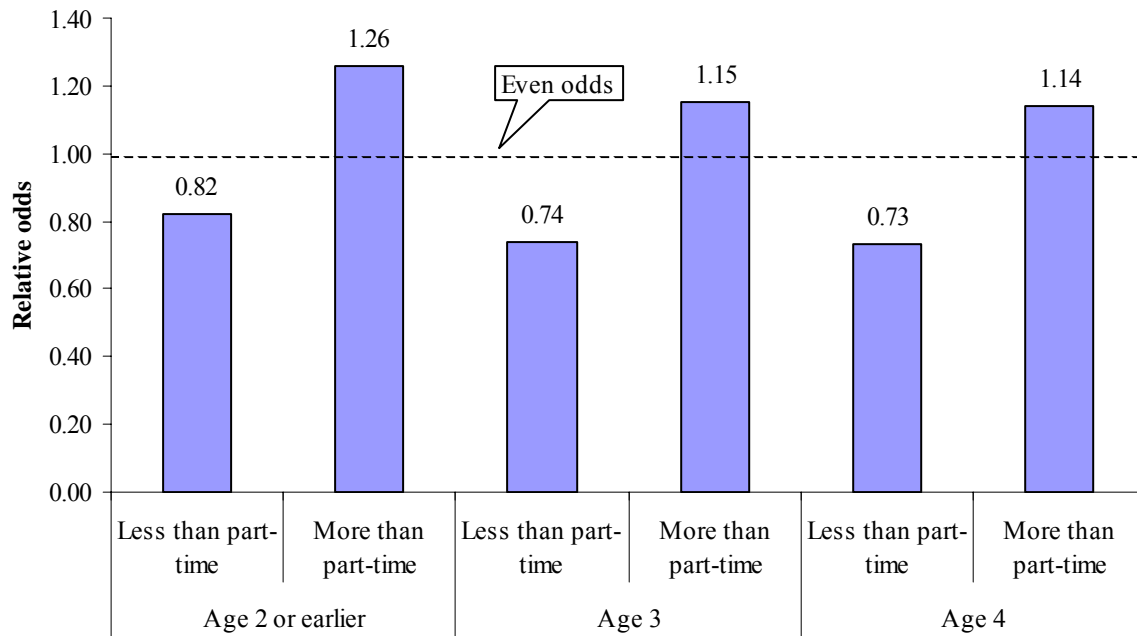
We found statistically significant, but inconsequential, effects of Head Start on problematic behaviors (relative odds equal to 1.29) and no statistically significant effects of non-Head Start preschool programs (see Figure 12). We also found that the effects did not vary by language group, but they did vary by intensity and duration. Students who attended non-Head Start programs part-time were less likely to report having problematic behaviors than students who did not attend preschool (although the effects were small), while students who attended more than part-time were somewhat more likely to report problematic behavior. For example, students who first attended non-Head Start preschool programs at age 4, less than full time, were 27 percent less likely to report problematic behaviors, while students who attended more than part-time were 15 percent more likely to report problematic behaviors (see Figure 13).

**Figure 12. Predicted odds of preschool on non-cognitive outcomes in spring 2002, fall 1998 kindergarteners**



SOURCE: Appendix Table A.5.

**Figure 13. Predicted odds of non-Head Start program on problematic behavior in spring 2002 by duration and intensity, fall 1998 kindergarteners**



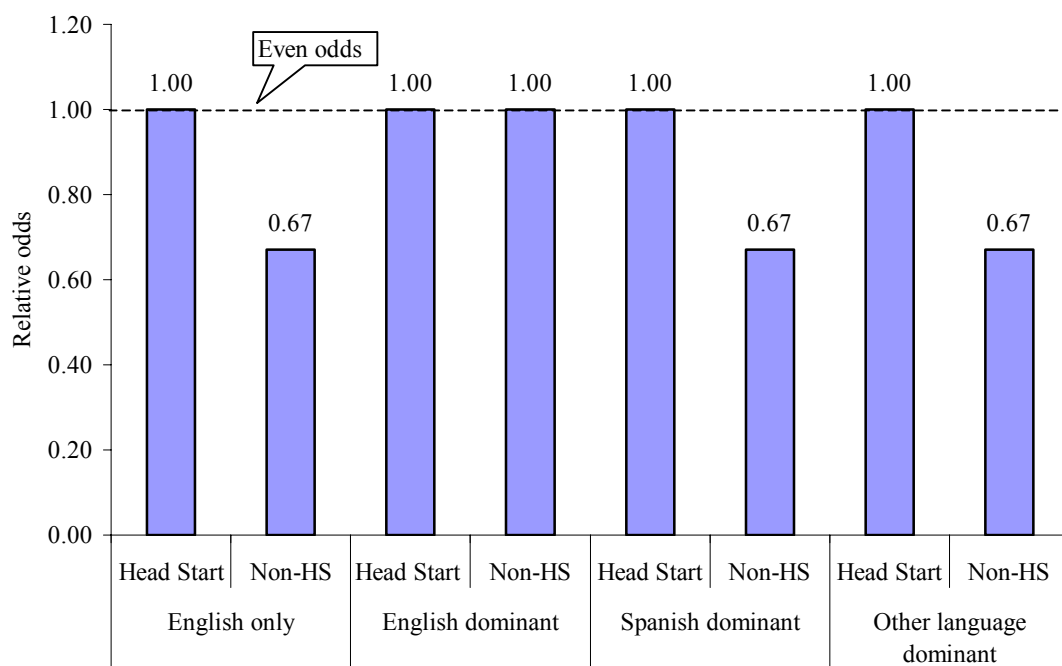
SOURCE: Appendix Table A.5.

Students who attended non-Head Start programs were also 28 percent less likely to be below grade level than students who did not attend preschool (see Figure 12); this too is considered a small effect. There were no significant differences for students who attended Head Start programs. One question that is important to investigate is whether the effects of non-Head Start programs are due to cognitive or non-cognitive impacts on school readiness; that is, does participation in non-Head Start preschool programs reduce the likelihood of retention because it improves cognitive performance in kindergarten or because it improves attitudes and behaviors that reduce the likelihood of retention? To examine this issue further, we added an additional predictor variable in our statistical model—fall kindergarten literacy. When we did so, the estimated effects of non-Head Start preschool were greatly reduced and became insignificant (see Appendix Table A.5). This suggests that attending non-Head Start preschool programs reduces retention because of its positive effects on initial literacy levels in kindergarten.

Further investigation revealed that the effects of non-Head Start center care varied by language groups. Participation in non-Head Start centers reduced the odds of being below grade

level by one-third for all language groups except English-dominant students (see Figure 14). Finally, we examined whether the effects varied by intensity and duration of preschool participation. We found that the odds of being below grade level were half as much for students who first attended non-Head Start centers at age 2 or earlier, compared to students who started at age 3 or later (see Appendix Table A.5). Similar to our earlier analysis, we added a predictor variable, fall kindergarten literacy, to this final model to see whether the effects of non-Head Start center care were attenuated. Unlike the previous model, in this case the effects of non-Head Start preschool were reduced by about one-third, but remained significant. This suggests that the effects of non-Head Start preschool were not due to its effects on kindergarten literacy, but may rather be due to effects on other non-cognitive factors.

**Figure 14. Predicted odds of preschool on being below grade level in spring 2002 by language background, fall 1998 kindergarteners**

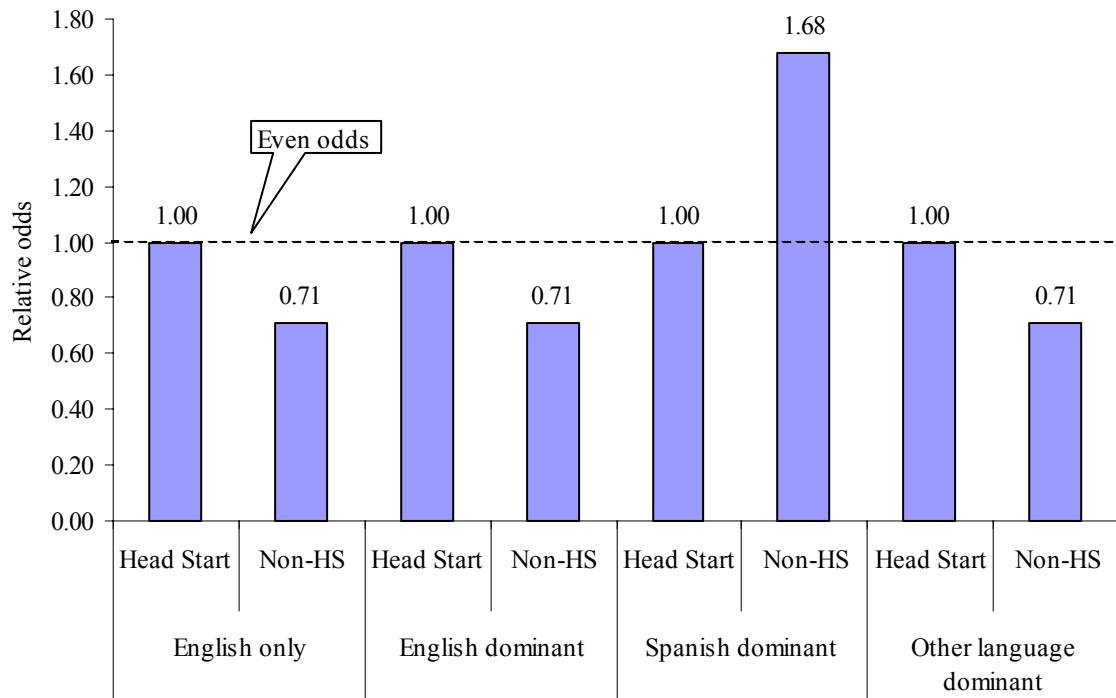


SOURCE: Appendix Table A.5.

In the last analysis, we found that students who attended non-Head Start programs were 22 percent less likely to be identified as a special education student (Figure 12). This effect also appears to be mediated by fall kindergarten literacy (see Appendix Table A5). We also found the impact varied among language groups. Students from all language groups were less likely to

be in special education if they attended non-Head Start preschool programs, with the exception of Spanish-dominant students who were 68 percent more likely to be in special education compared to Spanish dominant students who did not attend preschool (see Figure 15).<sup>19</sup> Finally, we examined whether the effects varied by intensity and duration of preschool participation. We found that the odds of being in special education were lower for students who first attended non-Head Start centers at age 2 or earlier than for students who started at age 3 or later (see Appendix Table A.5).

**Figure 15. Predicted odds of preschool on being in special education in spring 2002 by language background, fall 1998 kindergarteners**



SOURCE: Appendix Table A.5.

<sup>19</sup> Although Spanish-dominant students were also less likely than English-only students to be in special education—see Appendix Table A5.

## 5. Summary and Conclusions

This study examined participation in preschool and its relationship between the cognitive and social development of language minority students. Although there is a large body of research that demonstrates the cognitive and social benefits of attending preschool (Barnett, 1995; Gorey, 2001; National Research Council, Committee on Early Childhood Pedagogy, 2000; Vandell, 2004), very little of this research has included language minority students, or at least those who do not speak English. The present study, based on ECLS-K data, included a representative sample of students and parents who did not speak English. The study examined three issues: participation in preschool, the relationship between preschool participation and school readiness at entry to kindergarten, and the relationship between preschool participation and school performance in third grade.

In this study, the term *preschool* refers to an array of center-based child care programs including day care centers, nursery schools, pre-kindergarten programs, preschools, and Head Start<sup>20</sup> programs. In most of the analyses, we compared students who attended Head Start preschool programs and other (non-Head Start), center-based preschool programs with students who did not attend any preschool programs the year before kindergarten. To better understand the role of language background, we identified three sub-groups of language minorities: students from households where English was the primary language spoken (English dominant), students from Spanish-speaking households where English was NOT the primary language (Spanish dominant), and students from non-Spanish-speaking households where English was NOT the primary language (Other language dominant).

In the remainder of this chapter, we summarize the findings from the study, compare them to results from other studies, and then discuss the study's limitations and conclusions.

### Participation

Consistent with previous studies, we found that the majority of students who entered kindergarten in the fall of 1998 had attended some form of preschool the year before entering kindergarten, but participation among language minority children was lower than among non-

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<sup>20</sup> Head Start refers to the federally-funded program for low-income children (see Currie & Duncan, 1995).

language minority children, with children from Spanish-dominant households having even lower participation rates. Moreover, language minority children were more likely to attend Head Start programs rather than non-Head Start center-based programs. Our statistical models confirmed these results. After controlling for other factors that predicted preschool participation, such as socioeconomic status (SES) and mother's employment, language minority students were still 30 percent less likely to attend non-Head Start programs than non-language-minority students; however, they were just as likely to attend Head Start programs as non-language-minority students. Finally, language minority students, especially those from Spanish-dominant households, were less likely than non-language-minority students to attend non-Head Start programs for more than one year.

### **School Readiness**

We found widespread differences in several cognitive and non-cognitive measures of school readiness by language background and preschool participation. At least some of these differences can be attributed to differences in the characteristics of students and their families that may be related both to participation in preschool and to cognitive development in kindergarten. After controlling for the effects of a number of these characteristics in our statistical models, we found that students who attended preschool, especially non-Head Start programs, had higher levels of school readiness (as evidenced by more advanced cognitive development, reduced likelihood of repeating kindergarten, and reduced likelihood of being identified as having a disability). But preschool participation was also associated with an increased likelihood of exhibiting external behavior problems. These positive and negative associations apply to all students no matter what their language background with only a few exceptions. They also vary by duration and intensity of participation, with earlier and more intensive participation yielding higher cognitive benefits, but also higher likelihood of problematic behaviors.<sup>21</sup>

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<sup>21</sup> This finding is consistent with a recent study of school readiness also based on ECLS (Loeb, Bridges, Bassok, Fuller, & Rumberger, in press).

### Third Grade Outcomes

Differences in cognitive and social development by language background and preschool participation were still observed four years after starting kindergarten, when most students were finishing third grade. Differences in cognitive development by preschool participation remained modest and were similar to those observed in the fall of kindergarten, but when we estimated a statistical model that controlled for the same set of predictors as we did for fall kindergarten scores, the estimated effects of preschool became inconsequential, although still statistically significant. Overall, the cognitive effects of non-Head Start preschool programs were reduced by about half, to inconsequential levels.<sup>22</sup> We did find that the effects of preschool programs, particularly Head Start programs, varied among schools, with preschool-attendees doing better than non-preschool attendees in some schools and worse in others. This finding is consistent with other studies that found Head Start participants in particular are more likely to attend lower quality schools, which may help explain why the cognitive benefits fade over time (Lee & Burkam, 2002; Lee & Loeb, 1995). It is also consistent with one of the findings of the original Coleman study that public schools have a greater effect on disadvantaged than advantaged students (Coleman, 1990).

The modest effects of preschool compare to large disparities in achievement by language background. Entering school, the achievement levels of language minorities were about .4 SD below non-language minority students. The disparities were somewhat smaller by the end of third grade, about .3 SD. But there were also large differences among language groups, in particular, students from Spanish-dominant households entered kindergarten almost .8 SD behind non-language-minority students in literacy skills, and were still .7 SD behind at the end of third grade.

Effects on retention and special education remained small (although larger than the effects on achievement); nonetheless, they did not change appreciably from kindergarten, which suggests they are more likely to be sustained in higher grades.

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<sup>22</sup> The only exception was for Spanish-dominant students who attended Head Start programs.

## Comparisons with Other Studies

The findings from this study are consistent with other studies of preschool. Our estimates of preschool participation are remarkably consistent with national estimates based on other data sources, which confirms that the ECLS data provides a representative sample of the 1998 kindergarten cohort. Our estimates of the effects of non-Head Start preschool programs on school readiness are also consistent with estimates from other studies, which have found effect sizes between .2 and .4 (Vandell, 2004). The results are also consistent with two recent studies based on ECLS-K, which found smaller effect sizes of non-Head Start programs in fall kindergarten based on direct-assessed reading and math scores (which excluded non-English-proficient language minority students) after controlling for a similar, but somewhat larger set of student and family demographic variables (Loeb, Bridges, Bassok, Fuller, & Rumberger, in press; Magnuson et al., 2004).<sup>23</sup>

Our findings—that the cognitive effects of preschool diminished by the end of third grade—are also consistent with an earlier study using ECLS-K that found the estimated effects of attending non-Head Start preschool were reduced by 60 percent between the fall of kindergarten and the spring of first grade (Magnuson et al., 2004). We did find that the non-cognitive effects—particularly retention (being below grade level) and participation in special education—were greater than the cognitive effects and more likely to be sustained, which is also consistent with the literature.<sup>24</sup> The lack of sustainability is also consistent with reviews of a range of experimental preschool interventions that found the cognitive effects of most interventions had become insignificant two to four years after the intervention ended (Caldwell, 1987). The exceptions are long-term, high quality interventions, such as the Carolina Abecedarian Project, where students received full-day care for five years prior to entering kindergarten (Campbell & Ramey, 1994; Gorey, 2001).

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<sup>23</sup> As we explain in the report, the direct-assessed scores excluded about half of the language minority students. Because language minority students were also less likely to attend preschool, as we show in the report, excluding them from the analysis biases the estimated effects of preschool downward. In estimating a model of direct-assessed reading scores identical to the one we estimated for teacher-assessed literacy, the effect size for attending a center was about .06 SD lower for direct-assessed reading scores than for teacher-assessed literacy scores, which accounts for much of the difference between our estimates and those of Magnuson, et al.

<sup>24</sup> In fact, our estimated effects on retention and special education were very consistent with the effects found in the numerous studies reviewed by Karoly and Bigelow (2005, Table 2.4).



## **Limitations**

Although the present study was able to overcome many of the limitations of previous studies by using a dataset that included a representative sample of students and parents who did not speak English and non-English based assessments, the ECLS data still had limitations for conducting a study of preschools. The ECLS data relies on retrospective parent interviews for information on their child's preschool experiences, as such, it is subject to recall error. It also meant there was little information on the quality of the preschools that the child attended, which previous studies have shown impacts student outcomes (NICHD Early Child Care Research Network, 2003). Finally, it meant that it was difficult to control for all of the characteristics of families that could have influenced their decision to send their child to preschool, making it hard to assess the causal impacts of preschool on cognitive and social development.

Another national longitudinal study, the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), is tracking a representative sample of children born in the year 2001.<sup>25</sup> This study will be able to overcome many of the limitations of the ECLS-K dataset by collecting information on preschool participation as it takes place and family characteristics prior to participation. This will allow more accurate estimates of the impact of preschool on children's early childhood development.

## **Conclusions**

The findings from this study suggest that attending preschool can improve the school readiness of language minority students. Currently, however, language minority students are less likely to enroll in preschool, particularly non-Head Start programs that appear to make the biggest educational impact. As a result, preschool attendance fails to reduce the large achievement gap between language minority and non-language minority students that exists at kindergarten entry. Improving access to preschool programs and improving the quality of the programs could help address existing disparities in school readiness (Magnuson & Waldfogel, 2005). Yet because the achievement impact of preschool appears to diminish during the first four years of school, while the achievement gap—especially for Spanish-dominant language minority students—increases, preschool alone may have limited use as a long-term strategy for improving the achievement gap without strengthening the schools these students attend or

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<sup>25</sup> See: <http://nces.ed.gov/ecls/Birth.asp>.

without providing additional support during the school years.<sup>26</sup> In other words, preschool should be viewed as part of a more comprehensive and sustained effort to improve the educational outcomes of language minority students.

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<sup>26</sup> In a study of the Chicago Child Center Program, low-income Black students who received two or three years of support in grades 1-3 had significantly higher achievement than students who had preschool alone (Reynolds, 1994).

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## Appendix A

### Methodology

This appendix describes the methodology used to conduct this study. We first describe the data and variables used in the study and then the statistical methods that were used.

#### Data

Most of the data for this study were taken from several ECLS-K data files:

- ECLS-K Restricted-Use Base Year: Child File, Teacher File, and School File
- ECLS-K Base Year Restricted-Use Student Record Abstract File
- ECLS-K Third Grade Restricted-Use Child File

In addition, data were taken from two U.S. Census files:

- 1997 Economic Census (see: <http://www.census.gov/econ/census02/>)
- 2000 Census (see: <http://www.census.gov/main/www/cen2000.html>)

#### Variables

A number of dependent and independent variables were used in this study. Many of the variables were taken directly from the data files. Others were constructed by the authors. Variable descriptions are provided in Table A1. More detailed information on the construction of the ECLS's variables can be found in the *User's Manual for the Base Year Data Files and Electronic Codebook* and the *User's Manual for the Third Grade Public-Use Data File and Electronic Codebook*.

Table A1. Variable descriptions

	Type	Source	Description (variable name)
<i>Outcome Fall 1998</i>			
Reading	C, D	D	Reading IRT Scale Score (C1RSCALE) and related proficiency scores
Math	C, D	D	Math IRT Scale Score (C1MSCALE) and related proficiency scores
Literacy	C	T	Literacy ARS Score (T1LITARS) and related skills
Math	C	T	Math ARS Score (T1MATHAR) and related skills
Social skills	C, D	T	T1LEARN, T1CONTRO, T1INTERP, T1EXTERN, T1INTERN
Externalizing problem behavior	D	T	(T1EXTERN $\geq$ 3)
Second-time kindergartner	D	P	(P1FIRKDG=2)
Special education	D	S	(U2IEP98=1 & U2IEP91 $\neq$ 1 & U2IEP92 $\neq$ 1 & U2IEP93 $\neq$ 1 & U2IEP94 $\neq$ 1 & U2IEP95 $\neq$ 1 & U2IEP96 $\neq$ 1 & U2IEP97 $\neq$ 1)
<i>Outcome Fall 2002</i>			
Reading	C, D	D	Reading IRT Scale Score (C5R2RSCL) and related proficiency scores
Math	C, D	D	Math IRT Scale Score (C5M2RSCL) and related proficiency scores
Science	C	D	Science IRT Scale Score (C5S2RSCL)
Literacy	C	T	T5 Literacy ARS Score (T5ARSSCI)
Math	C	T	T5 Math ARS Score (T5ARTMAT)
Science	C	T	T5 Science ARS Score (T5ARSLIT)
Social studies	C	T	T5 Social studies ARS Score (T5ARTSOC)
Social skills	C,D	T	T5LEARN, T5CONTRO, T5INTERP, T5EXTERN, T5INTERN
Socio-emotional development	C, D	D	C5SDQRDC, C5SDQMTC, C5SDQSBC, C5SDQPRC, C5SDQEXT ( $\geq$ 3), C5SDQINT ( $\geq$ 3)
Below grade level	D	P	(T5GLVL=1, 2, or 3)
Special education	D	S	(U2IEP01=1 & U2IEP91 $\neq$ 1 & U2IEP92 $\neq$ 1 & U2IEP93 $\neq$ 1 & U2IEP94 $\neq$ 1 & U2IEP95 $\neq$ 1 & U2IEP96 $\neq$ 1 & U2IEP97 $\neq$ 1)
<i>Demographic</i>			
SES	C	P	Continuous SES measure (WKSESL)
Not biological parents	D	P	Not living with both biological parents (TYPARENT=2,3,4, or 5)
Children under 18	C	P	Number of children (P1SHL18)
Number of books	C	P	How many books child has (P1CHLBOO)
Mom working full-time	D	P	(P1HMEMP=1)
Mom working part-time	D	P	(P1HMEMP=2)
Disability	D	P	Child currently has a disability (P1DISABL)—diagnosed problem with learning (P1DIGNO), activity level (P1RESPON), mobility (P1CLIMB), speech (P1COMMU2), hearing (P1DIFFH3), vision (P1VISIO2) or received services prior to this school year (P1THERAP)

Language minority	D	P	Other language used at home (P1ANYLNG=1)
English dominant	D	P	Other language used at home (P1ANYLNG=1) & Primary language at home is English (P1PRMLNG=1)
Spanish dominant	D	P	Other language used at home (P1ANYLNG=1) & Spanish spoken in household (P1LANG12=3) & primary language at home not English (P1PRMLNG≠1)
Other language dominant	D	P	Other language used at home (P1ANYLNG=1) & non-Spanish language spoken in household (P1LANG12=3) & primary language at home not English (P1PRMLNG≠1)
<i>Preschool</i>			
Head Start	D	P	Attended Head Start year before kindergarten (CCQ215=1)
Center	D	P	Attended non-Head Start program the year before kindergarten (CCQ280=1)
Head start quality	D	P	(CHILDHS<15 & ADULTHS>=2)
Head start first enroll less than 4	D	P	(P1HAGEYR<4)
Head start full-time	D	P	(P1HSHRS=3,4, or 5)
Center first enroll less than 3	D	P	(P1CAGEYR<3)
Center first enroll age 4	D	P	(P1CAGEYR =4)
Center full-time	D	P	(P1CHRSPK=20 & P1CMOPK=4)
<i>Community</i>			
Preschools per 1000 children under age 5	C	C	Child day care services establishments (SIC=835)/1000
Community SES	C	P	Mean of continuous SES measure (WKSESL)

Type: C=continuous; D=dummy

Source: D=direct assessment; P=parent questionnaire; T=teacher questionnaire; S=school record; C=Census data

## Statistical Analysis

Two types of statistical analyses were conducted: (1) descriptive analyses of the dependent variables disaggregated by two primary independent variables (a) language background and (b) preschool participation; (2) estimations of statistical models for selected dependent variables. The analyses were conducted on two samples of the ECLS data: (1) a cross-sectional sample from the fall 1998 with valid child, parent, and teacher weights (C1CPTW0, N=17,124) and (2) a longitudinal sample from the spring 2002 with valid K-3 longitudinal child weights (C1\_5FC0, N=12,558). Because language background was a crucial variable in the present study, cases missing the fall 1998 variable, P1ANYLANG, were excluded from the samples. This resulted in a final sample size of 17,071 for the first sample and 11,468 for the second sample.



All the descriptive analyses were generated with weighted data. The statistical models were estimated with weighted data when possible, as we describe below.

### **Descriptive Analyses**

Because the figures produced in this report are based on a sample of kindergarteners in 1998-99, the figures should be considered estimates of the actual population of all kindergarteners. As such, the estimates may differ from estimates that would be produced from other samples of the same population. This type of variability is known as sampling error.

The standard error is a measure of the variability due to sampling when estimating a statistic. Standard errors for estimates presented in this report were computed using a jackknife replication method. Standard errors can be used as a measure for the precision expected from a particular sample. The probability that a complete census count would differ from the sample estimate by less than 1 standard error is 68 percent. The chance that the difference would be less than 1.65 standard errors is about 90 percent, and that the difference would be less than 1.96 standard errors, about 95 percent. Standard errors for all of the estimates are included in Appendix B in this report.

A confidence interval represents the range of possible population values for an estimate based on a sample and for a given probability. For example, Table 4 shows that 68 percent of all 1998 kindergartners attended preschool the year before kindergarten and Appendix Table B.4 shows that the standard error for that estimate is .7. Therefore, the estimated 95 percent confidence interval for this statistic is  $68 \pm (1.96 * .7) = 68 \pm 1.4$ . That is, we are 95 percent certain that the percentage of 1998 kindergarteners who attended preschool the year before kindergarten is between 66.6 and 69.4 percent.

It is also important to consider sampling error in comparing two estimates. A student's *t* statistic can be used to test the likelihood that the difference between two estimates is larger than expected by sampling error, where:

$$t = (\text{Estimate 1} - \text{Estimate 2}) / \text{Square root} [(\text{standard error 1})^2 + (\text{standard error 2})^2]$$

A value of *t* that exceeds 1.96 indicates means that we are 95 percent certain that the difference in the two estimates is greater than the sampling error. For example, Table 4 shows that the estimated difference in preschool attendance between non-language-minority students and

language minority students is 14 percentage points (72 – 58). Using the standard errors from Appendix Table B.4, we find that the  $t$  statistic for this difference is 9 [= 14 / [(0.7)<sup>2</sup> + (1.39)<sup>2</sup>], which greatly exceeds 1.96. Therefore, this difference is statistically significant.

### Statistical Models

A series of hierarchical linear models (HLM) were estimated for this study. Hierarchical models were used to control for effects of clustered sampling. Models with continuous dependent variables (e.g., test scores) were also weighted to control for selection and nonresponse; models with discrete outcomes were not weighted because the software (HLM) used to estimate the models does not allow weighting. All the models were estimated with the same set of student control variables: SES, not living with both biological parents, number of children in the household, number of books, and disability (see Appendix Table A.1).

The first model was a two-level HLM model for continuous variables, such as test scores (Chapters 3 and 4). The level-one model is:

$$Y_{ij} = \beta_{0j} + \beta_{1j} X_{1j} + \dots + \beta_{pj} X_{pj} + r_{ij}$$

where  $\beta_{pj}$  are the level-one predictor variables. The level-two model is:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{pj} = \gamma_{p0}$$

In this model, no level-two variables were included.

The second type of model was used to estimate dichotomous dependent outcomes, such as external problem behaviors, retention, and special education (Chapter 3). For discrete outcomes, it is necessary to specify both a level-one sampling model and a level-one structural model (Raudenbush, & Bryk, 2002, Chapter 10). For binary student outcomes, the level-one sampling model is Bernoulli:

$$\text{Prob}(Y_{ij} = 1 | \beta_j) = \Phi_{ij},$$

and the conditional level-one structural model is:

$$\log[\Phi_{ij} / (1 - \Phi_{ij})] = \eta_{ij} = \beta_{0j} + \beta_{1j} X_{1j} + \dots + \beta_{pj} X_{pj},$$

where the left-hand term serves as a link function (Raudenbush, & Bryk, 2002, pp. 293-294).

The level-two (between-school) structural model is:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{pj} = \gamma_{p0}$$

The third model was a multinomial model used to predict students' primary form of non-parental care the year before kindergarten (P1PRIMPK) with three possible outcomes (1 = student attended Head Start; 2 = student attended non-Head Start center; and 3 = student had some other form of child care (Chapter 2)). For discrete outcomes, it is necessary to specify both a level-one sampling model and a level-one structural model (Raudenbush, & Bryk, Chapter 10). In this case, there is a multinomial sampling model with three probabilities:

$$\text{Prob}(Y_{ij} = 1 | \beta_j) = \Phi_{1ij},$$

$$\text{Prob}(Y_{ij} = 2 | \beta_j) = \Phi_{2ij},$$

$$\text{Prob}(Y_{ij} = 3 | \beta_j) = \Phi_{3ij} = 1 - \Phi_{1ij} - \Phi_{2ij},$$

To specify all three possible outcomes it is necessary to estimate only two probabilities, with category 3 serving as a reference category. Accordingly, two level-one structural models were estimated:

$$\log[\Phi_{1ij} / (1 - \Phi_{3ij})] = \eta_{1ij} = \beta_{0j(1)} + \beta_{1j(1)} X_{1j} + \dots + \beta_{pj(1)} X_{pj},$$

$$\log[\Phi_{2ij} / (1 - \Phi_{3ij})] = \eta_{2ij} = \beta_{0j(2)} + \beta_{1j(2)} X_{1j} + \dots + \beta_{pj(2)} X_{pj},$$

where  $\beta_{pj}$  represent the level-one predictor variables.

The unit of analysis for the level-two model was the zip code of the student's home in the fall of 1998. There are two sets of level-two structural models:

$$\beta_{0j(1)} = \gamma_{00(1)} + \gamma_{01(1)} \text{Preschools}_{1j} + \gamma_{02(1)} \text{MeanSES}_{2j} + u_{0j(1)}$$

$$\beta_{pj(1)} = \gamma_{p0(1)}$$

$$\beta_{0j(2)} = \gamma_{00(2)} + \gamma_{01(2)} \text{Preschools}_{1j} + \gamma_{02(2)} \text{MeanSES}_{2j} + u_{0j(2)}$$

$$\beta_{pj(2)} = \gamma_{p0(2)}.$$

Due to missing values, the samples used to estimate the various models varied somewhat. Descriptive statistics for all the variables used in the models are shown in Appendix Table A.2. Parameter estimates are shown in Appendix Tables A.3-A.5.

Table A2. Sample means (and standard deviations)

	Participation	School readiness		Third grade outcomes	
	(N=16,291)	Literacy (N=15,388)	Other (N=12,349)	Cognitive (N=10,982)	Other (N=8,683)
<i>Level-one variables</i>					
P1 ECE	2.38				
T1 literacy		0.04 (1.00)			0.10 (0.97)
T1 external behavior		0.05			
C1 retention		0.04			
IEP98		0.04			
C5 reading				0.08 (0.97)	0.12 (0.95)
C5 math				0.10 (0.97)	0.13 (0.95)
C5 science				0.08 (0.99)	0.12 (0.97)
T5 below grade					0.07
IEP01					0.07
C5 external behavior					0.10
English dominant	0.11	0.11	0.11	0.11	0.11
Spanish dominant	0.08	0.08	0.07	0.08	0.07
Other dominant	0.04	0.05	0.04	0.05	0.04
SES	0.03	0.07 (1.01)	0.10 (1.00)	0.07 (0.79)	0.08 (0.78)
Children under 18	2.44 (1.03)	2.25 (1.04)	2.44 (1.03)	2.44 (1.01)	2.43 (1.00)
Not biological parents	0.32	0.33	0.32	0.28	0.27
Books	74.44 (59.74)	73.85 (59.63)	75.94 (59.89)	77.19 (60.06)	78.54 (60.04)
Disability	0.14	0.14	0.14	0.13	0.13
Mom works full-time	0.46				
Mom works part-time	0.22				
Head Start		0.14	0.14	0.12	0.12
Center		0.58	0.58	0.60	0.60
HS_ED		0.02	0.02	0.02	
HS_SP		0.02	0.02	0.02	
HS_OD		0.01	0.01	0.01	
Center_ED		0.06	0.06	0.06	0.06
Center_SP		0.02	0.02	0.02	0.02
Center_OD		0.02	0.02	0.02	0.02
Center_FT		0.29	0.29	0.28	0.28
Center_Age2		0.19	0.20	0.20	0.19

Center_Age3		0.20	0.20	0.21	0.21
<i>Level-two variables</i>	(N=2,129)				
Preschools per 1000	2.86				
children	(3.38)				
Mean SES	0.23				
	(0.81)				

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Table A3. Estimated parameters for school participation (multinomial logistic HLM) models

<b>Head Start</b>				
Intercept	-2.063 (0.050)	-2.396 (0.076)	-2.065 (0.050)	-2.406 (0.078)
Preschools per 100		0.020 (0.012)		0.018 (0.012)
Mean SES		-0.836 (0.094)		-0.871 (0.094)
Language minority	0.251 (0.079)	0.064 (0.083)		
English dominant			0.118 (0.095)	0.097 (0.099)
Spanish dominant			0.310 (0.114)	-0.186 (0.124)
Other dominant			0.506 (0.173)	0.483 (0.164)
SES		-0.406 (0.060)		-0.422 (0.060)
Children under 18		0.123 (0.031)		0.124 (0.030)
Not biological parents		0.478 (0.068)		0.476 (0.069)
Books		-0.003 (0.001)		-0.003 (0.001)
Disability		0.484 (0.089)		0.487 (0.089)
<b>Non-Head Start program</b>				
Intercept	0.050 (0.027)	0.138 (0.041)	0.053 (0.027)	0.144 (0.041)
Preschools per 100		0.017 (0.007)		0.016 (0.007)
Mean SES		0.305 (0.042)		0.297 (0.042)
Language minority	-0.442 (0.050)	-0.295 (0.050)		
English dominant			-0.279 (0.061)	-0.252 (0.062)
Spanish dominant			-0.883 (0.868)	-0.422 (0.088)
Other dominant			-0.289 (0.096)	-0.239 (0.096)
SES		0.483 (0.035)		0.476 (0.036)
Children under 18		-0.179 (0.019)		-0.179 (0.018)
Not biological parents		-0.121 (0.041)		-0.126 (0.041)
Books		0.002 (0.000)		0.002 (0.000)
Disability		0.115 (0.052)		0.114 (0.052)

Table A4. Estimated parameters for school readiness models

	Literacy		Problem behavior		Second time kindergartner	Special Education	
Intercept	-0.132 (0.022)	0.057 (0.021)	0.046 (0.016)	-3.662 (0.010)	-3.583 (0.090)	-3.067 (0.083)	-3.709 (0.102)
English dominant		-0.102 (0.027)	-0.074 (0.023)	-0.109 (0.266)	-0.463 (0.150)	0.077 (0.120)	-0.091 (0.222)
Spanish dominant		-0.407 (0.036)	-0.391 (0.034)	-0.272 (0.333)	-0.591 (0.251)	0.292 (0.164)	-0.251 (0.230)
Other dominant		-0.191 (0.044)	-0.222 (0.036)	-0.223 (0.472)	-0.593 (0.262)	-0.220 (0.275)	-0.905 (0.399)
SES		0.211 (0.010)	0.202 (0.010)	-0.142 (0.045)	-0.174 (0.043)	-0.126 (0.048)	-0.276 (0.049)
Children under 18		-0.088 (0.008)	-0.089 (0.007)	-0.087 (0.040)	-0.060 (0.041)	0.067 (0.035)	0.093 (0.042)
Not biological parents		0.108 (0.018)	-0.115 (0.015)	0.531 (0.086)	0.491 (0.087)	0.296 (0.083)	-0.069 (0.094)
Books		0.002 (0.000)	0.002 (0.000)	-0.003 (0.001)	-0.003 (0.001)	-0.022 (0.001)	0.000 (0.001)
Disability		-0.309 (0.021)	-0.291 (0.020)	0.676 (0.093)	0.673 (0.093)	0.881 (0.089)	1.938 (0.087)
Head Start	-0.176 (0.024)	-0.036 (0.024)	-0.034 (0.022)	0.535 (0.123)	0.464 (0.111)	-0.301 (0.115)	0.220 (0.132)
Center	0.349 (0.017)	0.211 (0.018)	0.159 (0.021)	0.620 (0.099)	0.015 (0.137)	-0.505 (0.081)	-0.271 (0.103)
HS_ED				0.077 (0.356)			-0.058 (0.355)
HS_SP				-0.661 (0.377)			-0.926 (0.405)
HS_OD				-1.515 (0.958)			-0.006 (0.668)
Center_ED				-0.776 (0.314)			-0.018 (0.295)
Center_SP				-0.374 (0.313)			-0.001 (0.377)
Center_OD				-0.318 (0.551)			-0.074 (0.580)
Center_FT			0.040 (0.019)		0.438 (0.108)		
Center_Age2			0.079 (0.024)		0.488 (0.124)		
Center_Age3			0.052 (0.021)		0.279 (0.124)		
Variance							
Student-level <sup>a</sup>	0.737						

<sup>a</sup>Estimate from unconditional model



Table A5. Estimated parameters for third grade models

	Reading		Math		Science	
Intercept	-0.103 (0.021)	0.120 (0.024)	-0.076 (0.023)	0.103 (0.021)	-0.079 (0.023)	0.156 (0.023)
English dominant		-0.004 (0.032)		0.028 (0.029)		-0.064 (0.033)
Spanish dominant		-0.230 (0.045)		-0.094 (0.036)		-0.352 (0.045)
Other dominant		0.078 (0.051)		0.189 (0.055)		-0.073 (0.054)
SES		0.336 (0.022)		0.323 (0.013)		0.318 (0.020)
Children under 18		-0.104 (0.011)		-0.051 (0.008)		-0.105 (0.011)
Not biological parents		-0.158 (0.026)		-0.161 (0.019)		-0.167 (0.023)
Books		0.002 (0.000)		0.002 (0.000)		0.002 (0.000)
Disability		-0.289 (0.029)		-0.244 (0.023)		-0.187 (0.034)
Head Start	-0.281 (0.028)	-0.088 (0.038)	-0.357 (0.038)	-0.172 (0.027)	-0.391 (0.039)	-0.198 (0.027)
Center	0.229 (0.019)	0.075 (0.024)	0.230 (0.024)	0.099 (0.019)	0.203 (0.022)	0.045 (0.019)
Variance						
Student-level <sup>a</sup>	0.566		0.578		0.531	
School-level						
Head Start <sup>b</sup>		0.111**		0.048*		0.042*
Center <sup>b</sup>		0.033**		0.017		0.036*

<sup>a</sup>Estimate from unconditional model

<sup>b</sup>Estimate from unweighted model. For Head Start estimate, Center coefficient was fixed; for Center estimate, Head Start coefficient was fixed.

\*\*P-value for Chi-square statistic < .01.

\*P-value for Chi-square statistic < .05.

Table A5. Estimated parameters for third grade models (continued)

	Problem behavior		
Intercept	-2.514 (0.073)	-2.527 (0.073)	-2.500 (0.073)
Fall K literacy		-0.190 (0.042)	
English dominant	-0.141 (0.118)	-0.169 (0.118)	-0.149 (0.119)
Spanish dominant	-0.049 (0.130)	-0.134 (0.133)	-0.060 (0.130)
Other dominant	-0.203 (0.185)	-0.268 (0.184)	-0.213 (0.185)
SES	-0.407 (0.056)	-0.361 (0.057)	-0.418 (0.057)
Children under 18	0.080 (0.034)	0.060 (0.034)	0.094 (0.034)
Not biological parents	0.425 (0.083)	0.408 (0.083)	0.393 (0.084)
Books	-0.003 (0.001)	-0.003 (0.001)	-0.003 (0.001)
Disability	0.438 (0.093)	0.389 (0.093)	0.430 (0.093)
Head Start	0.257 (0.107)	0.256 (0.106)	0.260 (0.107)
Center	-0.035 (0.080)	0.010 (0.081)	-0.313 (0.114)
Center_FT			0.439 (0.109)
Center_age2			0.110 (0.126)
Center_age3			0.016 (0.123)

Table A5. Estimated parameters for third grade models (continued)

	Below grade level				Special education			
Intercept	-2.519 (0.079)	-2.818 (0.086)	-2.476 (0.080)	-2.786 (0.089)	-2.699 (0.081)	-2.856 (0.083)	-2.645 (0.083)	-2.807 (0.085)
Fall K literacy		-1.015 (0.050)		-1.017 (0.050)		-0.692 (0.049)		-0.690 (0.049)
English dominant	-0.111 (0.118)	-0.252 (0.123)	-0.356 (0.155)	-0.489 (0.157)	-0.096 (0.128)	-0.174 (0.128)	-0.273 (0.179)	-0.345 (0.178)
Spanish dominant	-0.354 (0.160)	-0.819 (0.162)	-0.451 (0.178)	-0.897 (0.179)	-0.322 (0.162)	-0.620 (0.163)	-0.636 (0.179)	-0.911 (0.181)
Other dominant	-0.497 (0.179)	-0.813 (0.178)	-0.5261 (0.222)	-0.824 (0.221)	-0.459 (0.241)	-0.717 (0.246)	-0.457 (0.309)	-0.683 (0.304)
SES	-0.344 (0.060)	-0.113 (0.062)	-0.342 (0.060)	-0.125 (0.062)	-0.209 (0.063)	-0.028 (0.066)	-0.205 (0.063)	-0.042 (0.067)
Children under 18	0.181 (0.034)	0.119 (0.034)	0.182 (0.034)	0.125 (0.034)	0.099 (0.036)	0.048 (0.036)	0.100 (0.036)	0.053 (0.036)
Not biological parents	0.284 (0.082)	0.199 (0.081)	0.280 (0.082)	0.190 (0.081)	0.094 (0.088)	0.030 (0.087)	0.089 (0.088)	0.015 (0.087)
Books	-0.003 (0.001)	-0.001 (0.001)	-0.003 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)
Disability	0.407 (0.093)	0.170 (0.099)	0.403 (0.093)	0.164 (0.099)	1.198 (0.089)	1.050 (0.092)	1.190 (0.090)	1.048 (0.093)
Head Start	0.080 (0.112)	0.070 (0.115)	0.083 (0.112)	0.060 (0.115)	-0.060 (0.112)	-0.054 (0.119)	-0.057 (0.119)	-0.062 (0.120)
Center	-0.327 (0.079)	-0.093 (0.080)	-0.486 (0.112)	-0.306 (0.112)	-0.253 (0.082)	-0.105 (0.081)	-0.341 (0.088)	-0.191 (0.119)
Center-ED			0.503 (0.203)	0.491 (0.203)			0.329 (0.253)	0.346 (0.250)
Center_SD			0.306 (0.270)	0.263 (0.274)			0.857 (0.333)	0.825 (0.328)
Center-OD			0.038 (0.338)	0.0082 (0.319)			-0.038 (0.481)	-0.061 (0.491)
Center_FT				-0.001 (0.106)				-0.115 (0.109)
Center_age2				0.301 (0.128)				0.286 (0.138)
Center_age3				0.158 (0.119)				-0.127 (0.133)

**Appendix B  
Standard Errors**

**Table B1. Standard errors of ECLS samples by language background**

	Number and (standard errors for percent distribution*)			
	Fall K Sample		K-3 Sample	
	Sample size	Population	Sample size	Population
Non-language minority	13,104 (0.32)	2,987,459 (1.15)	8,771 (0.40)	2,789,547 (1.08)
Language minority	3,967 (0.32)	867,214 (1.15)	2,697 (0.40)	696,964 (1.08)
English dominant	1,852 (0.24)	406,447 (0.69)	1,252 (0.29)	331,670 (0.65)
Spanish dominant	1,343 (0.21)	352,193 (0.67)	923 (0.25)	289,463 (0.67)
Other dominant	772 (0.16)	108,574 (0.23)	522 (0.19)	75,832 (0.21)
Language background unknown	53	11,272	1,090	357,096
<b>Total</b>	<b>17,124</b>	<b>3,865,946</b>	<b>12,558</b>	<b>3,843,607</b>

\*Excluding system missing.

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99. Weighted N based on fall kindergarten weight (C1CPTW0) and K-3 child assessment panel weight (C1\_5FC0).

**Table B2. Race and Ethnicity by Language Background, Fall 1998 Kindergarteners**

	Population (Number)	Language background (percent distribution)				
		Non- language minority	Language minority			
			Total	English dominant	Spanish dominant	Other dominant
<b>Total</b>	<b>3,854,673</b>	<b>1.15</b>	<b>1.15</b>	<b>0.69</b>	<b>0.67</b>	<b>0.23</b>
<b>Ethnicity</b>						
Asian	111,177	0.08	0.96	0.82	0.01	3.76
Black	604,352	1.28	0.43	0.78	0.14	1.08
Hispanic	743,516	0.49	2.25	3.02	0.29	0.87
White	2,208,972	1.46	1.19	2.08	0.25	3.24
Other	186,656	0.60	2.15	3.92	0	1.80

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B3. Standard Errors of family income, poverty, and socioeconomic status by language background, fall 1998 kindergarteners**

	Total	Language background			
		Non-language minority	Language minority		
			Total	English dominant	Spanish dominant
Mean Family income (standard deviation)	2.30	2.30	4.30	1.40	4.20
Percent below poverty	2.56	1.49	1.59	1.88	0.39
Mean Socioeconomic status (standard deviation)	2.50	3.00	4.50	3.20	6.60

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

**Table B4. Standard Child Care Arrangements by Language Background, Fall 1998 Kindergarteners**

(Percent reporting)

	Relative Care	Non-Relative Care	Preschool		
			Total	Head Start	Non-HS
Ever received or attended					
Total	0.67	0.76	0.69	1.04	1.00
Non-language minority	0.75	0.88	0.70	1.15	1.06
Language minority	1.12	0.82	1.39	1.55	1.47
English dominant	1.71	1.30	1.23	2.54	2.35
Spanish dominant	1.29	1.56	1.79	1.63	1.47
Other dominant	2.18	1.49	2.51	2.35	3.10
Received or attended the year before kindergarten					
Total	0.62	0.56	0.73	1.03	1.07
Non-language minority	0.71	0.63	0.81	1.15	1.19
Language minority	0.97	0.66	1.31	1.54	1.49
English dominant	1.49	1.06	1.29	2.53	2.44
Spanish dominant	1.10	0.88	1.75	1.70	1.47
Other dominant	1.83	1.05	2.50	2.23	3.06

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B5. Type of Non-Head Start Program Attended Most the Year Before Kindergarten by Language Background, Fall 1998 Kindergarteners**

(Percent distribution)

	Day Care Center	Nursery school	Preschool	Pre-K program
Total	0.73	0.48	1.23	1.16
Non-language minority	0.82	0.48	1.31	1.13
Language minority	1.05	0.71	2.18	2.30
English dominant	1.35	1.02	2.17	2.13
Spanish dominant	2.11	0.81	4.28	4.68
Other dominant	2.29	1.27	3.21	2.81

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B6. Primary Type of Non-Parental Child Care Arrangement the Year Before Kindergarten by Language Background, Fall 1998 Kindergarteners**

(Percent distribution)

	Parental care only	Relative Care	Non- Relative Care	Head Start	Non-HS	Two or more
Total	0.50	0.41	0.46	0.81	0.93	0.22
Non-language minority	0.54	0.44	0.52	0.90	1.04	0.25
Language minority	1.15	0.90	0.53	1.24	1.39	0.38
English dominant	1.15	1.35	0.93	1.91	2.30	0.62
Spanish dominant	1.67	1.14	0.68	1.48	1.36	0.52
Other dominant	2.09	1.53	0.51	2.12	2.55	1.04

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B7. Hours per Week in Preschool the Year Before Kindergarten by Language Background, Fall 1998 Kindergarteners**

	(Percent distribution)				
	Hours per week				
	1-10	11-20	21-29	31-40	41+
Head Start					
Total	0.98	2.89	2.24	3.65	0.43
Non-language minority	1.08	3.27	2.37	4.58	0.49
Language minority	2.18	4.23	3.54	1.89	0.56
English dominant	2.96	4.55	5.39	2.05	0.97
Spanish dominant	3.44	5.86	3.02	3.09	0.70
Other dominant	2.89	7.67	5.69	5.21	0
Center					
Total	1.19	1.15	0.68	0.84	0.39
Non-language minority	1.32	1.12	0.75	0.92	0.45
Language minority	1.59	2.33	1.14	1.34	0.67
English dominant	1.88	2.25	1.46	1.93	0.99
Spanish dominant	2.65	4.37	2.05	1.91	1.29
Other dominant	2.86	2.74	1.68	2.47	1.84

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B8. Months Attended Non-Head Start Programs the Year Before Kindergarten by Language Background, Fall 1998 Kindergarteners**

	(Percent distribution)			
	Months			
	1-2	3-5	6-8	9-12
Total	0.17	0.22	0.53	0.57
Non-language minority	0.16	0.25	0.61	0.65
Language minority	0.53	0.51	0.92	1.11
English dominant	0.60	0.70	1.35	1.58
Spanish dominant	1.24	1.04	1.71	2.30
Other dominant	0.84	1.27	2.12	2.83

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B9. Age first attended preschool by language background: Fall 1998  
Kindergarteners**

		(Percent distribution)						
		Age (in years)						
		0	1	2	3	4	5	6
Head Start program								
Total				0.21	1.81	1.75	0.49	
Non-language minority				0.25	1.93	1.87	0.48	
Language minority				0.58	3.17	2.96	1.11	
English dominant				1.17	3.59	3.60	1.97	
Spanish dominant				0.48	4.88	4.47	1.25	
Other dominant				1.02	5.48	6.45	1.91	
Non-Head Start program								
Total		0.45	0.40	0.49	0.61	0.90	0.33	0.08
Non-language minority		0.50	0.44	0.54	0.63	0.95	0.32	0.09
Language minority		0.59	0.57	1.05	1.53	1.50	0.78	0.15
English dominant		0.92	0.83	1.35	1.74	1.62	1.01	0.17
Spanish dominant		0.82	1.07	1.46	3.21	3.30	1.61	0.30
Other dominant		0.79	1.12	2.72	2.63	3.09	1.24	0.30

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).



**Table B10. English proficiency by language background and preschool participation: Fall 1998 Kindergartners**

	Percent taking language screener	Percent English Proficient		
		Total	Preschool experience pre-K	
			Head Start	Center
Total	0.78	1.37	1.90	1.82
Non-language minority	0.13	3.62	5.97	5.02
Language minority	2.09	1.48	2.05	1.94
English dominant	1.87	2.56	2.98	2.50
Spanish dominant	1.54	2.46	2.83	2.84
Other dominant	3.02	2.53	3.65	3.01

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B11. Mean direct-assessed reading scores and proficiencies by language background and preschool participation: Fall 1998 kindergarteners**

	Mean Total score	Letter recognition	Reading skills (Percent proficient)			
			Beginning sounds	Ending sounds	Sight words	Words in context
Total	1.90	2.31	1.21	0.93	0.15	0.12
Non-language minority	2.00	2.51	1.37	1.08	0.21	0.16
Language minority	3.40	2.46	1.91	1.17	0	0
English dominant	4.80	3.57	2.83	2.29	0	0
Spanish dominant	3.90	3.30	2.68	1.25	0	0
Other dominant	7.60	6.08	3.45	1.33	0	0
Head Start program	2.60	2.00	0.99	0.81	0.14	0.13
Non-language minority	2.40	2.14	1.15	0.95	0.14	0.14
Language minority	4.70	2.31	1.50	0.96	0.31	0.29
English dominant	6.60	3.52	2.56	1.94	0.67	0.67
Spanish dominant	5.80	2.82	1.97	0.88	0	0
Other dominant	9.80	5.59	3.13	1.44	0.90	0
Non-Head Start program	1.90	0.72	0.91	0.80	0.22	0.12
Non-language minority	2.00	0.71	0.99	0.87	0.22	0.13
Language minority	3.70	1.71	1.45	1.24	0.56	0.31
English dominant	4.50	1.92	2.11	1.71	0.56	0.41
Spanish dominant	7.30	2.16	1.66	1.12	0.68	0.42
Other dominant	10.90	2.71	3.38	3.49	2.22	1.01
No preschool	1.80	0.95	0.68	0.65	0.17	0.08
Non-language minority	1.90	1.07	0.86	0.81	0.23	0.11
Language minority	3.40	1.11	0.82	0.78	0.19	0.11
English dominant	4.90	2.47	1.86	1.76	0.40	0.26
Spanish dominant	5.40	1.54	0.79	0.59	0.14	0.00
Other dominant	7.30	3.08	2.99	2.55	0.72	0.16

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B12. Mean direct-assessed math scores and proficiencies by language background and preschool participation: Fall 1998 kindergarteners**

	Mean	Math skills (percent proficient)				
	Total score	Number and shape	Relative size	Ordinal sequence	Add and subtract	Multiply and divide
Total	1.90	0.57	0.71	0.63	0.20	0.05
Non-language minority	2.10	0.64	0.77	0.74	0.23	0.06
Language minority	2.80	1.09	1.10	0.73	0.30	0.07
English dominant	4.00	1.32	1.72	1.19	0.42	0.09
Spanish dominant	3.40	1.63	1.58	0.57	0.25	0
Other dominant	6.40	2.59	2.58	2.03	1.31	0.41
Head Start program	2.50	1.22	1.22	0.83	0.28	0
Non-language minority	2.70	1.15	1.25	1.10	0.34	0
Language minority	3.20	2.62	1.84	0.83	0.36	0
English dominant	5.60	3.38	3.49	1.03	0.81	0
Spanish dominant	3.80	4.00	2.15	1.37	0	0
Other dominant	13.10	5.35	4.46	2.09	0.80	0
Non-Head Start program	1.80	0.73	0.60	0.70	0.28	0.07
Non-language minority	2.00	0.78	0.62	0.79	0.29	0.09
Language minority	3.80	1.48	1.48	1.17	0.65	0.12
English dominant	4.40	1.96	1.92	1.50	0.73	0.08
Spanish dominant	5.40	2.15	2.71	1.33	0.63	0
Other dominant	9.00	3.66	3.00	3.09	2.52	0.75
Other or only nonparental care	1.90	0.87	0.85	0.70	0.26	0.09
Non-language minority	2.20	0.97	1.07	0.89	0.33	0.12
Language minority	2.80	1.53	1.25	0.76	0.33	0.10
English dominant	4.30	2.27	2.01	1.66	0.63	0.22
Spanish dominant	4.10	2.04	2.13	0.64	0.36	0
Other dominant	7.30	3.74	3.66	2.98	0.49	0.46

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B13. Mean teacher-assessed literacy scores and proficiencies by language background and preschool participation: Fall 1998 kindergarteners**

	Mean Overall score	Literacy skills (percent proficient)				
		Speaking Complex sentence structure	Listening Interprets story	Reading Letters	Reads books	Writing Early writing
Total	2.10	0.54	0.53	0.50	0.27	0.26
Non-language minority	2.40	0.63	0.60	0.57	0.29	0.30
Language minority	2.80	0.54	0.63	0.69	0.40	0.33
English dominant	3.90	0.97	0.98	1.07	0.59	0.53
Spanish dominant	3.20	0.50	0.50	0.56	0.28	0.28
Other dominant	6.60	1.27	1.79	2.07	1.48	1.16
Head Start program	2.70	0.63	0.50	0.80	0.29	0.26
Non-language minority	3.10	0.83	0.67	0.97	0.31	0.33
Language minority	4.80	0.93	0.78	0.60	0.59	0.35
English dominant	7.20	1.74	1.22	1.13	1.19	0.44
Spanish dominant	5.60	1.23	1.28	0.81	0.23	0
Other dominant	10.20	2.54	2.54	1.48	2.55	2.62
Non-Head Start program	2.40	0.69	0.68	0.67	0.41	0.38
Non-language minority	2.50	0.75	0.74	0.72	0.41	0.41
Language minority	3.80	0.92	1.00	1.12	0.70	0.60
English dominant	4.80	1.49	1.43	1.34	0.99	0.91
Spanish dominant	5.10	1.24	1.31	1.38	0.71	0.64
Other dominant	7.40	1.76	2.80	3.47	2.08	1.87
Other or only nonparental care	2.30	0.60	0.57	0.24	0.57	0.22
Non-language minority	3.00	0.80	0.76	0.72	0.30	0.26
Language minority	3.10	0.57	0.68	0.65	0.38	0.32
English dominant	4.70	1.03	1.31	1.32	0.56	0.58
Spanish dominant	4.40	0.67	0.61	0.68	0.30	0.25
Other dominant	10.30	2.29	2.23	1.74	1.83	0.98

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B14. Mean teacher-assessed math scores and proficiencies by language background and preschool participation: Fall 1998 kindergarteners**

	Mean Overall score	Math skills (percent proficient)			
		Sorts math materials	Order objects	Perceives quantity relationships	Solves number problems
Total	2.40	0.66	0.55	0.53	0.35
Non-language minority	2.70	0.73	0.58	0.58	0.36
Language minority	3.30	0.78	0.73	0.61	0.52
English dominant	4.50	1.15	1.13	0.92	0.81
Spanish dominant	4.50	0.61	0.40	0.36	0.38
Other dominant	8.70	1.73	2.31	2.20	1.61
Head Start program	3.10	0.60	0.35	0.37	0.32
Non-language minority	3.40	0.64	0.46	0.47	0.40
Language minority	5.00	1.10	0.52	0.50	0.45
English dominant	7.90	2.32	1.00	0.67	0.63
Spanish dominant	5.00	0.25	0.65	0.48	0.15
Other dominant	11.50	2.58	0.64	2.96	2.78
Non-Head Start program	2.90	0.87	0.74	0.72	0.52
Non-language minority	3.10	0.92	0.73	0.76	0.52
Language minority	4.50	1.17	1.24	1.04	0.88
English dominant	5.00	1.60	1.53	1.27	1.19
Spanish dominant	6.90	1.23	1.02	0.86	0.79
Other dominant	10.50	2.70	3.52	3.14	2.24
Other or only nonparental care	2.70	0.72	0.61	0.58	0.35
Non-language minority	3.50	0.89	0.78	0.72	0.39
Language minority	3.90	0.84	0.69	0.57	0.57
English dominant	5.80	1.41	1.33	1.14	0.99
Spanish dominant	5.50	0.62	0.37	0.37	0.56
Other dominant	11.50	1.71	2.25	2.22	1.83

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B15. Mean teacher-assessed social skills by language background and preschool participation: Fall 1998 kindergarteners**

	Mean		Percent often		
	Approaches to learning	Self-control	Interpersonal skills	Externalizing behaviors	Internalizing behaviors
Total	1.60	1.80	1.60	0.25	0.15
Non-language minority	1.60	1.90	1.80	0.30	0.17
Language minority	2.40	2.80	2.50	0.38	0.31
English dominant	3.40	3.90	3.40	0.60	0.34
Spanish dominant	3.30	3.60	3.70	0.59	0.50
Other dominant	5.10	5.90	5.60	0.81	0.77
Head Start program	2.50	3.00	2.90	0.74	0.42
Non-language minority	2.60	3.20	3.20	0.94	0.45
Language minority	4.90	6.00	4.70	1.24	0.75
English dominant	7.80	10.40	8.40	2.44	1.42
Spanish dominant	6.90	7.50	6.00	1.13	0.96
Other dominant	12.50	13.90	13.10	3.13	0
Non-Head Start program	1.70	2.10	2.00	0.29	0.18
Non-language minority	1.80	2.10	2.00	0.35	0.20
Language minority	3.10	3.60	3.30	0.55	0.38
English dominant	3.90	3.90	3.70	0.52	0.33
Spanish dominant	5.50	7.30	6.00	1.23	0.88
Other dominant	6.90	8.10	7.90	1.41	1.49
Other or only nonparental care	2.20	2.00	2.10	0.36	0.26
Non-language minority	2.60	2.40	2.50	0.43	0.34
Language minority	3.00	3.20	3.50	0.56	0.44
English dominant	4.60	5.10	5.60	1.22	0.59
Spanish dominant	4.20	4.30	4.50	0.63	0.68
Other dominant	7.00	7.50	7.90	1.04	0.44

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten weight (C1CPTW0).

**Table B16. Percent of students below grade level and in special education in kindergarten by language background and participation in preschool, 1998 fall kindergarteners**

	Percent second time kindergartners	Percent in special education since kindergarten
Total	0.27	0.35
Language minority status		
Language minority	0.42	0.37
English dominant	0.50	0.46
Spanish dominant	0.68	0.57
Other dominant	0.93	0.28
Head Start program	0.59	1.48
Non-language minority	0.71	1.82
Language minority	0.80	1.41
English dominant	1.00	1.79
Spanish dominant	1.20	1.71
Other dominant	1.53	1.25
Non-Head Start program	0.26	0.25
Non-language minority	0.27	0.29
Language minority	0.52	0.31
English dominant	0.73	0.39
Spanish dominant	0.95	1.11
Other dominant	1.12	0.41
No preschool	0.43	0.28
Non-language minority	0.51	0.37
Language minority	0.72	0.31
English dominant	0.95	0.46
Spanish dominant	1.12	0.52
Other dominant	1.88	0

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by fall kindergarten child-parent-teacher weight (C1CPTW0).

**Table B17. Mean direct-assessed reading scores and proficiencies in spring 2002 by language background and preschool participation the year before kindergarten, fall 1998 kindergarteners**

	Mean total score	Percent proficient			
		Words in context	Literal Inference	Extrapolation	Evaluation
Total	2.30	0.39	0.78	0.96	0.72
Non-language minority	2.30	0.39	0.78	0.97	0.81
Language minority	4.00	0.98	1.64	1.57	1.07
English dominant	6.10	1.63	2.36	2.17	1.64
Spanish dominant	4.70	1.34	2.06	1.68	11.3
Other dominant	6.40	0.73	2.80	3.33	2.70
Head Start program	5.00	1.34	2.17	1.74	1.04
Non-language minority	5.10	1.35	2.24	2.07	1.26
Language minority	8.70				
English dominant	17.20	5.55	7.86	5.80	1.62
Spanish dominant	9.00	1.34	4.66	4.38	3.05
Other dominant	14.20	3.58	6.65	6.16	5.00
Non-Head Start program	2.20	0.40	0.78	1.11	0.90
Non-language minority	2.30	0.42	0.83	1.13	0.95
Language minority	4.80	1.09	1.73	2.16	1.74
English dominant	5.10	1.20	1.88	2.57	2.12
Spanish dominant	7.70	22.4	3.27	3.40	2.97
Other dominant	9.00	0.92	4.28	4.99	3.67
No preschool	2.90	0.67	1.06	1.30	1.07
Non-language minority	3.20	0.76	1.15	1.43	1.25
Language minority	4.70	1.49	1.98	2.00	1.71
English dominant	8.80	2.91	3.51	3.28	3.48
Spanish dominant	5.00	1.86	2.40	1.77	0.83
Other dominant	10.40	0.41	4.16	6.04	5.61

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).



**Table B18. Mean direct-assessed science and math scores and proficiencies in spring 2002 by language background and preschool participation the year before kindergarten, fall 1998 kindergarteners**

	Science	Math			
	Mean	Mean	Percent proficient		
	Total score	Total score	Multiply and divide	Place value	Rate and measure
Total	2.30	2.40	0.88	0.98	0.53
Non-language minority	2.30	2.60	0.95	1.10	0.59
Language minority	3.70	4.00	1.58	1.70	0.94
English dominant	5.00	5.90	2.25	2.42	1.49
Spanish dominant	4.30	4.40	2.13	1.61	0.93
Other dominant	7.90	7.40	2.83	3.67	3.01
Head Start program	5.90	5.20	2.42	1.00	0.73
Non-language minority	7.20	5.80	2.87	2.01	0.76
Language minority	7.00	8.50	4.36	2.86	1.65
English dominant	13.10	13.80	6.53	4.36	1.12
Spanish dominant	9.60	10.60	5.08	3.92	2.91
Other dominant	12.20	18.90	8.15	8.08	2.20
Non-Head Start program	2.00	2.30	0.72	1.05	0.70
Non-language minority	2.10	2.50	0.79	1.20	0.76
Language minority	4.60	4.90	1.69	2.32	1.57
English dominant	5.40	5.50	1.93	2.81	2.09
Spanish dominant	6.90	7.50	3.04	3.25	2.47
Other dominant	13.00	11.60	4.37	4.76	3.92
No preschool	3.20	2.70	1.07	1.30	0.58
Non-language minority	3.10	3.30	1.22	1.63	0.63
Language minority	5.00	4.90	2.07	1.92	1.27
English dominant	7.40	8.00	3.00	3.23	2.80
Spanish dominant	5.10	6.10	2.88	2.02	0.84
Other dominant	13.40	10.00	3.30	6.22	4.04

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

**Table B19. Mean teacher-assessed academic skills in spring 2002 by language background and preschool participation the year before kindergarten, fall 1998 kindergarteners**

	Reading	Math	Science	Social studies
Total	2.20	2.40	2.30	2.20
Non-language minority	2.50	2.80	2.60	2.50
Language minority	3.40	3.70	4.00	3.80
English dominant	5.20	5.00	4.70	5.10
Spanish dominant	5.40	5.50	6.90	6.60
Other dominant	6.20	7.00	7.80	7.80
Head Start program	4.50	4.80	4.90	4.80
Non-language minority	4.70	5.60	5.60	5.40
Language minority	8.60	6.80	7.70	8.80
English dominant	12.00	11.30	10.30	10.80
Spanish dominant	12.10	10.60	12.60	11.40
Other dominant	23.50	17.90	18.90	18.50
Non-Head Start program	2.10	2.60	2.50	2.50
Non-language minority	2.20	2.90	2.70	2.80
Language minority	5.10	4.80	5.40	5.50
English dominant	5.10	5.60	6.20	5.80
Spanish dominant	11.70	9.20	13.00	14.60
Other dominant	8.00	8.90	11.10	11.60
No preschool	2.90	3.10	3.10	2.90
Non-language minority	3.90	4.10	4.10	4.10
Language minority	5.10	5.70	6.20	4.90
English dominant	9.60	8.50	8.20	7.20
Spanish dominant	8.40	9.10	9.60	7.50
Other dominant	9.90	11.90	16.00	10.70

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

**Table B20. Mean teacher-assessed social skills in spring 2002 by language background and preschool participation in the year before kindergarten, fall 1998 kindergarteners**

	Mean			Percent reporting often	
	Approaches to learning	Self-control	Interpersonal skills	Externalizing behaviors	Internalizing behaviors
Total	1.80	1.80	1.60	0.37	0.31
Non-language minority	2.00	2.00	1.80	0.42	0.34
Language minority	3.50	3.70	3.60	0.59	0.58
English dominant	4.30	4.80	4.70	0.66	1.00
Spanish dominant	6.70	5.50	6.10	0.89	0.63
Other dominant	6.40	7.80	6.10	1.92	0.89
Head Start program	5.20	5.80	4.70	1.18	0.85
Non-language minority	4.30	5.70	4.70	1.49	1.05
Language minority	8.70	9.10	9.40	0.90	1.59
English dominant	8.20	12.40	10.40	1.94	3.39
Spanish dominant	13.40	8.50	12.90	0.69	1.12
Other dominant	15.00	19.90	15.50	3.81	5.47
Non-Head Start program	1.70	1.90	1.80	0.48	0.35
Non-language minority	1.80	2.00	1.80	0.53	0.33
Language minority	4.90	5.00	5.00	0.96	1.03
English dominant	5.90	5.80	5.80	0.78	1.50
Spanish dominant	9.90	8.50	9.70	1.56	1.23
Other dominant	10.50	14.30	10.20	3.89	1.12
No preschool	2.90	3.10	3.10	0.53	0.61
Non-language minority	3.70	3.70	4.00	0.63	0.74
Language minority	5.50	6.10	4.40	0.90	0.81
English dominant	8.50	7.40	7.10	1.23	1.84
Spanish dominant	8.40	9.60	7.40	1.62	0.65
Other dominant	9.80	6.40	7.90	0	1.08

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

**Table B21. Student-reported socio-emotional development in spring 2002 by language background and preschool participation in the year before kindergarten, fall 1998 kindergarteners**

	Reading	Math	Mean School	Peer	Percent mostly true External behavior	Internal behavior
Total	1.80	1.60	1.50	1.40	0.54	0.84
Non-language minority	2.00	1.70	1.60	1.60	0.62	0.85
Language minority	3.00	2.50	2.50	2.20	0.98	1.55
English dominant	3.60	4.30	4.70	3.50	1.15	1.64
Spanish dominant	4.80	3.00	4.20	4.00	1.60	2.51
Other dominant	5.50	5.50	5.70	4.30	1.44	2.36
Head Start program	4.30	4.00	3.80	4.00	1.65	1.94
Non-language minority	4.80	5.00	4.70	4.90	2.03	2.25
Language minority	7.20	5.20	6.20	5.30	2.19	3.21
English dominant	8.20	9.40	12.30	7.50	2.44	4.60
Spanish dominant	11.10	8.50	9.50	8.00	3.96	4.36
Other dominant	10.60	9.80	13.70	13.50	3.24	4.84
Non-Head Start program	1.80	1.80	1.70	1.80	0.54	0.79
Non-language minority	2.00	2.00	1.80	1.90	0.58	0.81
Language minority	3.30	3.90	3.50	4.40	0.96	2.00
English dominant	3.80	5.20	4.30	4.40	1.50	1.89
Spanish dominant	8.30	8.30	10.40	11.40	2.90	4.77
Other dominant	7.40	7.40	8.60	7.00	2.63	3.33
No preschool	2.80	2.50	2.40	2.30	0.84	1.36
Non-language minority	3.60	2.90	2.70	2.80	1.03	1.43
Language minority	4.40	4.90	4.10	3.60	1.54	2.43
English dominant	7.30	8.10	7.20	6.30	2.71	3.22
Spanish dominant	5.90	6.40	6.40	5.10	2.04	3.22
Other dominant	10.50	8.40	9.00	6.60	1.89	3.90

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).

**Table B22. Percent of students below grade level and in special education in spring 2002 by language background and participation in preschool, fall 1998 kindergarteners**

	Percent below grade level	Percent in special education since kindergarten
Total	0.51	0.42
Non-language minority	0.58	0.52
Language minority	1.01	0.67
English dominant	1.72	1.23
Spanish dominant	1.61	0.71
Other dominant	1.95	1.23
Head Start program	1.56	1.14
Non-language minority	1.71	1.46
Language minority	2.53	1.42
English dominant	4.47	2.50
Spanish dominant	3.54	1.75
Other dominant	4.58	3.78
Non-Head Start program	0.55	0.49
Non-language minority	0.59	0.58
Language minority	1.32	0.91
English dominant	1.89	1.47
Spanish dominant	2.07	1.66
Other dominant	3.95	1.49
No preschool	0.98	0.91
Non-language minority	1.24	1.01
Language minority	1.51	1.36
English dominant	2.93	2.96
Spanish dominant	2.27	0.94
Other dominant	1.41	1.52

SOURCE: Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 weighted by the child panel weight (C1\_5FC0).