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The Early Reading and Mathematics Achievement of Children Who Repeated Kindergarten or Who Began School a Year Late

Introduction

Most children enter kindergarten when they are 5 years of age and move into first grade when they are 6. This time period is marked by great developmental change (Sameroff and Haith 1996), and children differ in what they can and cannot do socially, physically, and cognitively. Therefore, parents and educators are concerned whether certain children will have the knowledge and skills at age 5 to succeed in kindergarten. Over the years, policies and practices have emerged that are intended to improve children's early school experiences by giving them more time to develop and mature (e.g., changing age of entry requirements, transitional grades, readiness testing). Two such kindergarten enrollment strategies are retaining children for a second year of kindergarten and delaying the start of their first year of kindergarten. This report uses data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K) to examine the relationship between kindergarten enrollment status (e.g., repeating kindergarten or delaying entry into kindergarten) and children's spring first grade reading and mathematics achievement.

Background

For the most part, children must be 5 years old to enroll in kindergarten (Education Commission of the States 1999). Based on school regulation and the child's development, parents and schools make decisions about when children should begin kindergarten; a child may start kindergarten when age-eligible, wait a year, or start early relative to the age requirements. In addition to timing children's first entry into school, parents and educators make promotion decisions about children at the end of the school year; some children go on to the next grade while others repeat kindergarten. Given these factors, the U.S. kindergarten population can be grouped according to their enrollment status.

- Every school year there are children who *repeat* kindergarten. Some children repeat due to academic and/or social concerns while others are in their second year of a 2-year kindergarten program (e.g., junior kindergarten, developmental kindergarten, kindergarten plus).¹ Children who repeat kindergarten are often older than most of their new classmates who are beginning kindergarten for the first time.
- Some non-repeating children begin their first year of kindergarten a year later than is typical. These children were age-eligible for kindergarten the previous year and were likely held out by their parents to allow an extra year to mature or perhaps because of developmental difficulties. *Delayed entry* kindergartners are beginning their first year in formal schooling; however, since their entry was delayed, they tend to be older than their peers beginning kindergarten on time.

¹At times, schools will refer to a second year of kindergarten with a school-specific term, such as "transition K." If the parent reports this as repeating kindergarten (e.g., a second year of kindergarten) then the children are counted as repeaters in this report.

- The majority of kindergartners (88 percent) begin formal schooling when they are old enough according to age requirements for their school or school district. These first-time, *on-time* kindergartners tend to be born in the months that usually define age eligibility (e.g., the children are five years of age by September, October, November, or December, depending on the cut-off of the state) but could also include children who just missed most schools' or districts' age cut-off for the previous year (meaning, these children may be slightly older than their classmates, but are still considered first-time, on-time kindergartners).

Both repeat (retention) and delayed entry practices are largely grounded in the belief that more time will allow children to arrive better prepared for school academically and socially (Ilg and Ames 1965; Kundert, May, and Brent 1995). For example, if kindergarten children do not achieve the knowledge, skills, and social maturity deemed necessary for first grade, attending a second year of kindergarten will allow them time to gain these skills. This is done in hopes that retaining them in kindergarten will prevent later school failure without negative social consequences (Dennebaum and Kulberg 1994; Shepard 1989). Some parents choose to delay their child's entry to kindergarten so that they will perhaps have an advantage over their on-time, younger classmates (Meisels 1992; Shepard and Smith 1988).

The effectiveness of these practices, retention in particular, however, has been called into question (Dennebaum and Kulberg 1994; Kundert, May, and Brent 1995; Reynolds 1992). Some research has shown kindergarten repeaters perform worse in their second year of kindergarten than promoted peers who were recommended for retention in kindergarten (Dennebaum and Kulberg 1994), perform no differently than delayed-entry children later in school (e.g., second and fifth grade) (Kundert, May, and Brent 1995), and perform worse in reading and mathematics in fourth grade (Reynolds 1992). Other researchers suggest retention may have short-term benefits. Children appear to make larger cognitive gains in the year

they repeat as compared to their first year through a grade (e.g., first-grade retention as studied by Alexander, Entwisle, and Dauber 1994). Recently, a review of the existing research note the need for future research that considers child and program characteristics when evaluating outcomes of retention and delayed entry practices (Jimerson 2001). These research findings have led many investigators to draw competing and even conflicting conclusions regarding grade retention and delayed entry.

Types of Comparisons

Conclusions depend on one's perspective on the practice's intended purpose (e.g., delaying for advantage versus retaining to allow the child to reach grade level achievement). The research on kindergarten retention and delayed entry usually takes one of two approaches—*same age* versus *same grade* comparisons. *Same age* comparisons examine the performance of retained or delayed-entry children relative to “promoted” peers of the same age (i.e., in a different grade). *Same grade* comparisons investigate how retained or delayed-entry children are performing relative to their peers in the same grade. For example, one study, using both the *same age* and *same grade* approach, found that retaining children or holding them out a year does not produce lasting academic advantages, and retaining children may have potentially negative social consequences (Dennebaum and Kulberg 1994). Since these children perform no differently than children who are promoted or their current classmates, the study's authors concluded that retention and delayed entry practices should be discontinued. In another example, using the *same age* approach, researchers found that children who repeat a grade or whose entry is delayed perform similar to their on-time classmates and promoted peers, albeit 1 year later. In this case, researchers interpreted their findings as support for the effectiveness of these practices (Alexander, Entwisle, and Dauber 1994).

This report uses the *same grade* approach. The *same grade* approach allows comparisons to children's current classmates with whom they

will most likely spend future school years. This permits conclusions concerning the retained or delayed entry child's mastery of material for a given grade level as compared to the majority. The *same grade* approach can also be used to compare children to how their promoted peers did the year previously. If children who repeat kindergarten or whose entry is delayed perform similarly to promoted peers, this provides information on their achievement relative to a grade before moving on. Comparing children to promoted peers in another grade (i.e., *same age* approach) does not provide information on how well children mastered current grade skills.

Same grade comparisons may be more appropriate than *same age* comparisons because they focus on achievement for the same type of material, but these comparisons still have limitations. In this approach, the children being compared are no longer the same age. The child repeating kindergarten or whose entry is delayed is generally 1 year older than his/her current classmates and generally 1 year older than their promoted peers *were* in the previous year when in that grade. The retained child has also had 2 years of exposure to the kindergarten setting and educational materials. Findings using this approach tend to find short-term benefits for retention (e.g., higher performance), with benefits diminishing over time (Peterson, DeGracie, and Ayabe 1987).

This report takes a *same grade* approach by comparing children who repeat kindergarten and children whose entry is delayed to their classmates who are entering kindergarten for the first time, on time (i.e., when age-eligible).

Research Questions

This report is framed around the following research questions:

- How prevalent is kindergarten retention? How prevalent is the practice of delayed kindergarten entry?
- Do children in these different enrollment groups vary in terms of child and family

characteristics (i.e., sex, age at time of assessment, children's race/ethnicity, presence of a diagnosed developmental difficulty, family poverty status, parental education, preschool experience, and kindergarten program type (i.e., half-day or full-day))?

- What is the relationship between children's kindergarten enrollment status and children's first grade reading and mathematics achievement?

Data Source

The ECLS-K is a nationally representative sample of approximately 21,000 children who entered kindergarten in the fall of 1998. The sample reflects all children in kindergarten in the fall of 1998, including children from various racial/ethnic and language backgrounds, children entering kindergarten for the first time, and those repeating kindergarten. Sampling for the ECLS-K was based on a dual frame, multi-stage sampling design. The first stage of sampling involved the selection of 100 primary sampling units (PSU, counties or groups of counties) from a national sample of PSUs. Schools with kindergarten programs were then selected within the PSUs, and children were sampled from the selected schools.

Estimates in this report refer to children who were in kindergarten in the fall of 1998, who were promoted to first grade in the fall of 1999,¹ and since the main dependent variables of interest are reading and mathematics achievement, all children who received the English direct reading and mathematics

¹As initially planned, the ECLS-K followed children in from the 1998-99 school year through the 2003-04 school year, no matter the grade they were in. Most children stayed on grade level (e.g., kindergarten in 1998-99; first grade in 1999-2000); however some children were retained and some skipped a grade. To keep the sample consistent across all analyses presented in this report, this report uses the sample of children in kindergarten in 1998-99 and who were promoted to first grade in 1999-00 (approximately 95 percent of the sample of kindergartners went on to first grade in 1999-00). It should also be noted that children who entered kindergarten early for their age in the fall of 1998 are not included in this report (given their small number (2 percent) and this report's focus of comparing children who entered on time, were retained, and those who were delayed).

assessment in the fall of kindergarten, spring of kindergarten, and spring of first grade.²

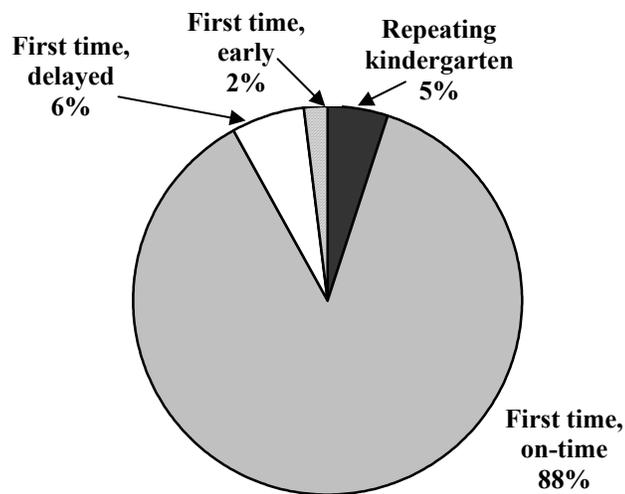
Findings

Findings are presented according to the research questions. For more information on the statistical approaches utilized in this report, please see the *Methodology and Technical Notes* section.

Prevalence

In the fall of 1998, 5 percent of all children in kindergarten were repeating kindergarten, and 6 percent were attending kindergarten for the first time even though they were age-eligible to do so a year earlier (i.e., delayed entry) (data not shown in tables) (figure 1).³

Figure 1. Percent of children, by kindergarten enrollment status: Fall 1998



NOTE: Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, (ECLS-K), Longitudinal Kindergarten-First Grade Public-Use Data File.

²As mentioned, the ECLS-K sample reflects all children in kindergarten in the fall of 1998; this includes children from all backgrounds and all languages in the United States. Information was collected from children, their parents, teachers, and schools no matter their language background. However, this report uses information from the direct child assessment. The ECLS-K direct child reading assessment was administered in English. To be sensitive to the needs and capabilities of all children in the sample, an English language proficiency screener was administered if the school records indicated that the child's primary language was not English. If it was determined that a child was not English language proficient, the child was not administered the direct reading and mathematics assessment. Therefore, children who were not English proficient at kindergarten entry are not included in this analysis.

³Prevalence estimates are based on the weighted statistics from the analytic sample created for this report.

Difference in Enrollment Status by Child and Family Characteristics

Children who *repeated* kindergarten are less likely to have attended preschool the year prior to kindergarten (63 versus 71 percent) than children who entered kindergarten on time (table 1). Children who repeated kindergarten compared to children who began on time are more likely to be male (66 versus 49 percent); more likely to have diagnosed developmental difficulties by the end of first grade (22 versus 9 percent); more likely to live in a family considered to be in poverty (19 versus 11 percent); and more likely to have parents with less than a high school education (17 versus 7 percent). They are also more likely than children who entered on time to be in full-day kindergarten programs during their retention year (i.e., second year of kindergarten) (73 versus 56 percent). These findings are consistent with previous research (Zill, Loomis, and West 1997). While earlier research suggests that children who repeat kindergarten may be more likely to be racial/ethnic minorities, the current analyses found detected no differences in the extent to which Black children were represented among repeaters compared with the on-time group (table 1).^{4,5}

Children whose kindergarten entry was *delayed* are more likely than children who started on time to be male (60 versus 49 percent); more likely to be White (72 versus 64 percent) (consistent with earlier findings in Zill, Loomis, and West 1997); and are less likely to have attended preschool the year prior to kindergarten (65 versus 71 percent) (table 1). They are more likely than children who began kindergarten on time to have parents with a bachelor's degree or higher (38 versus 31 percent) (table 1). Previous literature has suggested income differences (Meisels 1992), but the current analyses suggests no difference by poverty status between children whose kindergarten entry was delayed and their

⁴In bivariate analysis of ECLS-K data a substantive difference means a difference of 5 percentage points or more between compared groups.

⁵When interpreting potential racial/ethnic differences, it should be kept in mind that the analytic sample was constrained to children assessed in English, reducing the number of Hispanic and Asian Pacific Islander children included in the analysis.

classmates who entered kindergarten on time. There was no difference detected for delayed-entry children when compared to on-time children by whether a child had a developmental difficulty.

Association of Enrollment Status to Children's Spring First Grade Reading and Mathematics Achievement

To investigate the relationship between enrollment status and achievement beyond what may be explained by certain child and family characteristics, the analysis included a series of linear regressions using the characteristics found in table 1 and children's fall kindergarten achievement as control variables,⁶ with enrollment status as the explanatory variable and reading and mathematics achievement as the outcome variables.⁷

Much of the literature and discussion surrounding retention and delayed school entry concerns their effects on children's achievement and development beyond the first year after retention or delayed entry (Peterson, DeGracie, and Ayabe 1987; Shepard and Smith 1988). Therefore, this part of the analysis focuses on children's spring first grade achievement by their kindergarten enrollment status. Achievement is measured by children's overall scale scores and three specific skills in reading and mathematics at the end of first grade.⁸

In reading, children who *repeated* kindergarten

⁶Over 90 percent of children were assessed in a 2-month period at each data collection. Therefore, date of assessment was not included as a control variable in this analysis.

⁷The regression analyses are intended to show how the variables of interest for this study interact in a multivariate setting. Readers should not draw causal inferences from the regression results in this report, since apparent relationships can change based on the particular independent variables examined. Also, the current study does not allow the examination of how delayed-entry children would have performed in kindergarten one year earlier when they were eligible to start school.

⁸The ECLS-K cognitive battery was designed as a kindergarten-first grade assessment. As the present analyses focuses on first grade achievement, this report examines only those specific reading and mathematics skills that the majority of children tend to acquire across the first grade year (i.e., ending sounds, sight words, words in context, ordinality, addition/subtraction, and multiplication/division).

are behind their classmates who began kindergarten on time by the end of first grade. When such factors as children's initial achievement, sex, age, family poverty status, and kindergarten program type (e.g., full-day) are controlled,⁹ children who repeated kindergarten demonstrate lower overall reading knowledge and skills (table 3). Children who repeated kindergarten also appear less likely to possess specific reading skills that are typical of first grade (i.e., understanding the letter-sound connection at the end of word, sight-word recognition, and understanding words in context) (table 3). Similar associations exist in mathematics by enrollment status (table 4). Children who repeated kindergarten demonstrate lower overall mathematics knowledge and skills (table 3). Children who repeated kindergarten also appear less likely to possess specific mathematics skills that are typical of first grade (i.e., ordinality, addition and subtraction, multiplication and division) (table 4).

In reading, at the end of first grade, when such factors as children's initial achievement, sex, age, family poverty status, and kindergarten program type (e.g., full-day) are controlled,¹⁰ children whose kindergarten entry was *delayed* demonstrate slightly higher overall reading knowledge and skills (table 3). Children whose kindergarten entry was delayed also appear more likely to possess certain specific reading skills, typical of first-graders (i.e., understanding the letter-sound connection at the end of word and understanding words in context) and less likely to possess others (i.e., sight word recognition) (table 3). In mathematics in the spring of first grade, opposite associations exist than described in reading. In mathematics, in the spring of first grade, children whose kindergarten entry was delayed demonstrate lower overall mathematics

knowledge and skills (table 4). Children whose kindergarten entry was delayed also appear less likely to possess certain specific mathematics skills that are typical of first-graders (i.e., ordinality, addition and subtraction, multiplication and division) (table 4).

Summary

Previous reports from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K) document the differing abilities and early experiences of kindergartners and first graders (Denton and West 2002; West, Denton, and Germino Hausken 2000; West, Denton, and Reaney 2001). The current report focuses on differences in child characteristics and academic achievement by kindergarten enrollment status. It once again highlights the diverse nature of children who constitute the kindergarten population. Among the findings in this report are:

- The percentage of children who repeat kindergarten or experience delayed school entry appears consistent with previous estimates (Graue and DiPerna 2000; Zill, Loomis, and West 1997), with approximately 5 percent of children repeating kindergarten and 6 percent starting kindergarten a year later when first age-eligible.
- Children who repeat kindergarten, start kindergarten late, and who start on time differ in several important ways:
 - Children who repeat kindergarten are more likely to come from less advantaged backgrounds; more likely to have parents with less than a high school education; more likely to be living in poverty; less likely to have attended preschool; more likely to have attended full-day kindergarten programs during the 1998–99 school year; and, are more likely to have a diagnosed developmental difficulty than children who entered kindergarten on time (table 1).

⁹Controls included children's sex and age at school entry in fall 1998, their race/ethnicity, the presence of a diagnosed developmental difficulty, highest parental education, family poverty level, fall kindergarten achievement, preschool experience (center-based or Head Start), and fall 1998 kindergarten program type (i.e., full day versus half day).

¹⁰Controls included children's sex and age at school entry in fall 1998, their race/ethnicity, the presence of a diagnosed developmental difficulty, highest parental education, family poverty level, fall kindergarten achievement, preschool experience (center-based or Head Start), and fall 1998 kindergarten program type (i.e., full day versus half day).

- Children who started kindergarten late (i.e., delayed entry) were more likely to be male; more likely to be White; more likely to have more educated parents (i.e., bachelor's degree or higher); and less likely to have attended preschool than children who entered on time (table 1).
- At the end of first grade, children who repeated kindergarten have lower reading and mathematics knowledge and skills than those who started on time (tables 3 and 4).
- At the end of first grade, children whose kindergarten entry was delayed demonstrate slightly higher reading knowledge and skills than those who started on time (table 3). In mathematics at the end of first grade, children whose kindergarten entry was delayed kindergarten are behind their classmates who began kindergarten on time (table 4).

Retaining children for a second year of kindergarten is based on the belief that the additional time will allow children to gain the cognitive and social skills necessary for first grade and later elementary school. However, by as early as the end of first grade, children who repeated kindergarten demonstrate reading and mathematics knowledge and skills below their non-retained kindergarten classmates.

Similar to kindergarten retention, delaying children's entry to school can be viewed as providing children with extra time to develop socially and cognitively for school.

Future Analyses of the ECLS-K Data

Continued investigation of these children's academic achievement and educational experiences using the ECLS-K data can further clarify the association of these early practices to subsequent achievement in school. For example, consistent with findings presented in this Statistics in Brief, Hong and Raudenbush (2005) suggest that kindergarten retention may not improve children's early academic outcomes. Using the ECLS-K data, Hong and Raudenbush

modeled what retained kindergartners' achievement would have been had they been promoted to first grade on time and found that retention in kindergarten may leave retainees even further behind. Hong and Raudenbush also suggest that advancing children to the next grade would have increased their chances and opportunities for learning more and achieving higher academic scores.¹¹

Methodology and Technical Notes

Survey Methodology

The Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), is being conducted by Westat for the U.S. Department of Education, National Center for Education Statistics (NCES). It is designed to provide detailed information on children's early school experiences. The study began in the fall of the 1998-99 school year. As initially planned, the children participating in the ECLS-K are being followed longitudinally through the fifth grade. NCES has revised the original kindergarten through fifth grade design, and the ECLS-K will now follow children through their 8th grade year in school.

Sample Design

A nationally representative sample of 21,260 children enrolled in 1,277 kindergarten programs during the 1998–99 school year was selected to participate in the ECLS-K. The children attended both public and private kindergartens that offered full-day and half-day programs. The sample included children from different racial/ethnic and socioeconomic backgrounds, and included oversamples of Asian and Pacific Islander children, private kindergartens, and private kindergartners.

¹¹This Statistics in Brief looked at children who were retained during the 1997-98 school year and were in kindergarten for the second time in 1998-99 and at their actual performance in first grade. The Hong and Raudenbush (2005) article looked at children who were retained during the 1998-99 school year and at their actual performance in their second year of kindergarten (1999-2000) and their modeled potential performance had they been promoted to first grade in 1999-2000.

Sampling for the ECLS-K involved a dual-frame, multistage sampling design. The first stage of sampling involved the selection of 100 primary sampling units (PSU) from a national sample of PSUs. The PSUs were counties and county groups. Public and private schools were then selected within the PSUs, and children were sampled from the selected schools. Public schools were selected from the Common Core of Data, a public school frame, and private schools were selected from a private school frame developed from the Private School Survey.¹² Approximately 23 kindergartners were selected on average in each of the sampled schools.

The first grade sample included children who had participated at least once during the base year. Participation was defined as having a completed parent interview or a direct child assessment. All students still enrolled in their base-year schools were recontacted; a 50 percent subsample of base-year students who had transferred from their kindergarten school was followed. For information on subsampling of transfer children (i.e., movers), refer to the *ECLS-K First Grade Public-Use Data Files User's Manual*.

Analytic Sample

Estimates in this report are based on data collected from and about children who were in kindergarten during the 1998-99 school year, who did not enter early, who were promoted to first grade in the fall of 1999, and who were administered the direct child assessment in English in the fall and spring of kindergarten and in the spring of first grade. A total of 12,495 children in the ECLS-K sample satisfied these conditions and were used in the analyses conducted for this report.

Approximately 93 percent of the sample was promoted to first grade on time in the fall of 1999. Approximately 69 percent of Hispanic children and 84 percent of Asian children were

assessed in English in the fall and spring of kindergarten and the spring of first grade.

Response Rates

A total of 944 of the 1,277 originally sampled schools participated during the base year of the study. This translates into a weighted school response rate of 74 percent for the base year of the study. The school response rate during the spring of the base year (74 percent) was higher than during the fall (69 percent), due to some of the schools that originally declined to participate deciding to participate in the spring. Nearly all (99 percent) of the schools that participated in the fall of the base year also participated in the spring.

The child base-year completion rate was 92 percent (i.e., 92 percent of the children were assessed at least once during kindergarten). The parent base-year completion rate was 89 percent (i.e., a parent interview was completed at least once during kindergarten). Thus, the overall base-year response rate for children was 68 percent (74 percent x 92 percent), and the base-year response rate for the parent interview was 66 percent (74 percent x 89 percent). About 95 percent of the children and 94 percent of the parents who participated in the fall of kindergarten also participated in the spring. About 88 percent of the children and 85 percent of the parents who were eligible for the spring first grade collection participated.

A nonresponse bias analysis was conducted to determine if substantial bias is introduced due to school nonresponse. The results of these analyses are summarized in the *ECLS-K Base Year Public-Use Data Files User's Manual* and the *ECLS-K First Grade Public-Use Data Files User's Manual*.¹³ Findings from these analyses suggest that there is not a bias due to school nonresponse.

¹²During the spring of 1998, Westat identified new schools that were not found on either frame. A sample of these schools was included in the ECLS-K school sample.

¹³For more information, also refer to Rock and Pollack (2002).

Data Reliability

Estimates produced using data from the ECLS-K are subject to two types of error, sampling and nonsampling errors. Nonsampling errors are errors made in the collection and processing of data. Sampling errors occur because the data are collected from a sample rather than a census of the population. A detailed discussion of these types of errors can be found in *America's Kindergartners* (West, Denton, and Germino Hausken 2000).

Standard Errors and Weights

In order to produce national estimates from the ECLS-K data collected during the kindergarten and first-grade years, the sample data were weighted. Weighting the data adjusts for unequal selection probabilities at the school and child levels and adjusts for school, child, teacher, and parent nonresponse. The approach used to develop weights for the ECLS-K is described in the *ECLS-K Base Year Public-Use Data Files User's Manual* and the *ECLS-K First Grade Public-Use Data Files User's Manual*.

The child panel weight (C124CW0) is the weight used to produce all estimates found in this report. Only those cases with completed child assessments¹⁴ in both fall and spring of kindergarten and spring of first grade are included in this weight. It sums to the population of all children who attended kindergarten in the fall of 1998. However, in this report it sums to the population of children who attended kindergarten in the fall of 1998 and were promoted to first grade in the fall of 1999 and were assessed in English in all three rounds of data collection.

In addition to properly weighting the responses, special procedures for estimating the statistical significance of the estimates were employed because the data were collected using a complex sample design. Complex sample designs, like that used in the ECLS-K, result in data that violate the assumptions that are normally

¹⁴A completed child assessment is an assessment in which the child has height or weight or a scoreable reading, mathematics, or general knowledge assessment within the given round (i.e., fall kindergarten, spring kindergarten, spring first grade).

required to assess the statistical significance of the results. Frequently, the standard errors of the estimates are larger than would be expected if the sample was a simple random sample and the observations were independent and identically distributed random variables.

Replication methods of variance estimation were used to reflect the actual sample design used in the ECLS-K. A form of the jackknife replication method (JK2) using 90 replicates was used to compute approximately unbiased estimates of the standard errors of the estimates in the report, using WesVar version 4.2. The jackknife methods were used to estimate the precision of the estimates of the reported national percentages and means.

Statistical Procedures

Comparisons made in the text were tested for statistical significance to ensure that the differences are larger than might be expected due to sampling variation. When comparing estimates at one point in time (e.g., fall kindergarten cognitive achievement) or between categorical groups (e.g., sex, race/ethnicity, preschool experience, family poverty status), *t* statistics were calculated. The formula used to compute the *t* statistic was

$$t = \text{Est}_1 - \text{Est}_2 / \text{SQRT}[(\text{se}_1)^2 + (\text{se}_2)^2]$$

where Est_1 and Est_2 are the estimates being compared and se_1 and se_2 are the corresponding standard errors.

Ordinary least squares regression analysis was used to examine the association of enrollment status to achievement controlling for certain variables. Analyses focused on B (unstandardized coefficients) and statistical significance of the B coefficient tested by the *t* statistic.

All differences cited in the text of this report were significant at the .05 level. For the bivariate analysis, differences reported represent both a statistical difference and a difference at least 5 percentage points. This guideline for bivariate differences, of reporting differences

when they are both statistically significant and 5 percentage points different, is typical of NCES reports and presentations using information from the ECLS-K.

Constructs and Variables Used in the Analyses

Family and Child Characteristics

Parents/guardians were asked to provide key information about their children on subjects such as family demographics (e.g., age, relation to child, race/ethnicity), family structure (household members and composition), experiences in early care and education, and parental education. A computer-assisted interview was conducted with the sampled child's primary caregiver (usually the child's mother). Most of the interviews were conducted by telephone, though some were conducted in-person when respondents did not have a telephone or were reluctant to be interviewed by telephone. The same instrument was used regardless of the mode of interview.

Children's Cognitive Knowledge and Skills

The ECLS-K direct child cognitive assessment was administered using computer-assisted personal interviewing (CAPI), administered one-on-one with each child. The assessment included two cognitive domains (reading and mathematics). The ECLS-K battery was a two-stage assessment approach, in which the first stage in each domain contained a routing test that determined a child's approximate skills. According to the child's performance on the routing test, the child was administered the appropriate skill level assessment for that domain (the second stage). The reading and mathematics assessments had three skill levels. In each round, children were administered the routing stage and the appropriate skill level stage in the fall of kindergarten, the spring of kindergarten, and the spring of first grade. (For more information on the cognitive assessment refer to Rock and Pollack 2002).

To be sensitive to the needs and capabilities of the children in the sample, an English language proficiency screener, called the Oral Language Development Scale (OLDS), was administered if school records indicated that the child's home language was not English. The child had to demonstrate a certain level of English proficiency to be administered the cognitive assessment in English. The cognitive knowledge and skills estimates in this report are based on those children who were assessed in English in both the fall and the spring of kindergarten, and the spring of first grade. For the analytic sample utilized in this report (kindergartners in the 1998–99 school year who did not start early and were promoted to first grade in the fall of 1999), in terms of English assessment by race/ethnicity, approximately 69 percent of Hispanic children and 84 percent of Asian children were assessed in English in fall and spring of kindergarten and spring of first grade.¹⁵ For more details, see the *ECLS-K Base Year Public-Use Data Files User's Manual* and the *ECLS-K First Grade Public-Use Data Files User's Manual*.

Scale scores. Item Response Theory (IRT) was employed to calculate scores that could be compared regardless of which second stage form a child took. The items in the routing test, plus a core set of items shared among the different second stage forms, made it possible to establish a common scale. IRT uses the pattern of right, wrong, and omitted responses to the items actually administered in a test, and the difficulty, discriminating ability, and "guess-ability" of each item, to place each child on a continuous ability scale. It is then possible to estimate the score the child would have achieved if all of the items in all of the test forms had been administered. The reliability of the estimates of

¹⁵Based on the analytic sample used in this report (i.e., children on the kindergarten and first grade longitudinal file with a valid full sample weight (C124W0) and who were promoted to first grade in 1999-00)—approximately 48 percent of Hispanic children did not receive the OLDS and went directly to the English direct cognitive assessment (i.e., school records did not indicate the need for the OLDS), approximately 52 percent of Hispanic children received the OLDS (21 percent passed the OLDS; 31 percent did not pass the OLDS); and, approximately 46 percent of Asian children did not receive the OLDS and went directly to the English direct cognitive assessment, approximately 54 percent of Asian children received the OLDS (40 percent passed the OLDS, 14 percent did not pass the OLDS).

reading and mathematics in all three data collections are as follows (IRT-based theta): reading = .9, mathematics = .9.

Proficiency probability scores. Proficiency scores provide a means of distinguishing status or gain in specific skills within a content area from the achievement measured by the IRT scale scores. Clusters of four test questions having similar content and difficulty were included at several points along the score scale of the reading and mathematics tests. A child was assumed to have mastered a particular level of proficiency if at least three of the four items in the cluster were answered correctly, and to have failed at this level if two or more items were wrong. Clusters of items provide a more reliable test of proficiency than do single items because of the possibility of guessing. It is very unlikely that a child who has not mastered a particular skill would be able to guess enough answers correctly to pass a four-item cluster. These scores are computed using performance in each subject. The nature of the two-stage test is that not all children receive all items. To calculate proficiency estimates for all children, an IRT model was employed. For the purpose of IRT calibration, the item clusters were treated as single items. The hierarchical nature of the skill sets justified the use of the IRT model in this way. Gains in probability of mastery at each proficiency level allow researchers to study not only the amount of gain in total scale score points but also where along the scale different children are making their largest gains in achievement during a particular time interval.

In reading, the proficiency levels are named as follows: (1) letter recognition, (2) beginning sounds, (3) ending sounds, (4) sight words, and (5) words in context. *Letter recognition* is as it sounds—the ability of children to recognize their letters. *Beginning sounds* and *ending sounds* refer to children’s ability to understand the letter-sound relationship at the beginning and at the ending of words. *Sight words* refer to children’s ability to recognize whole words by sight and read them aloud. *Words in context* refer to children’s ability to read simple short passages of text with a missing word, and insert the correct missing word.

In mathematics, the proficiency levels are named as follows (their names reflect the most complex mathematical construct contained in the proficiency): (1) number and shape, (2) relative size, (3) ordinality and sequence, (4) add/subtract, and (5) multiply/divide. *Number and shape* refers to children’s ability to recognize single-digit numbers and basic shapes. *Relative size* refers to children’s ability to count beyond 10, recognize the sequence in basic patterns, and compare the relative size of objects. *Ordinality and sequence* means that children can recognize two-digit numbers, identify the next number in a sequence, and identify the ordinal position of an object. *Addition and subtraction* means children can perform simple addition and subtraction problems. *Multiplication and division* refers to children’s ability to perform simple multiplication and division operations. The addition, subtraction, multiplication, and division items are presented in the form of word problems with picture support and in numerical statements.

Derived Variables

A number of variables used in this report were derived by combining information from one or more questions in the ECLS-K parent questionnaire or from other study sources. The derivation of key variables is described in this section. If the actual variable exists on the ECLS-K Public-Use Data file, the name of the variable is presented after the description in all capital letters within brackets. If the variable was derived specifically for this report, that is also noted in brackets.

1998 kindergarten enrollment status. This variable was created through information collected in the Parent Involvement with the Child’s School section of the fall kindergarten parent interview. It is based on (a) year of kindergarten attendance (e.g., first, second) (P1FIRKDG) and (b) timing of school entry (e.g., waited, when old enough) (P1WHENEN; PIQ070). P1FIRKDG is a recoded variable from question PIQ080, collapsing year of kindergarten attendance into a dichotomous yes/no variable for whether the child is a first-

time kindergartner. If the parent reported that this was the child's second or greater year of kindergarten (P1FIRKDG=2), the child's enrollment status was defined as *repeating* kindergarten. If it was the child's first year of kindergarten (P1FIRKDG=1), the timing question (i.e., PIQ070) was examined. For these first-time kindergartners, if parents reported waiting to enroll their child in kindergarten, the child's enrollment status was defined as *delayed entry*; if parents reported enrolling their child when old enough, the child's enrollment status was defined as *on time*.¹⁶ [variable derived for this report, not presented on data file]

Children's sex. This variable was constructed by comparing information provided by the parents as part of the parent interview and information from staff in the field (via the field management system) who administered the direct assessments. If parent interview information was missing, this variable was completed by relying on information from the field management system. [GENDER]

Children's age at entry to kindergarten (fall 1998). This variable used two variables—month and year of birth—to determine the child's age at the beginning of the 1998–99 school year. For first-time kindergartners (i.e., those who entered on time or who experienced a delayed entry), this variable refers to their age at entry into kindergarten. For children repeating kindergarten, this variable refers to their age at the start of their second year of kindergarten. The month and year of birth variables were combined to form five categories: children age 4

¹⁶Independent information collected from parents during the kindergarten year children's teachers provided information on their classrooms. One of the pieces of information the teacher provided was a description of the classroom in terms of grade. Teachers could indicate whether the classroom was a regular kindergarten classroom, the first year of a two-year kindergarten program, the second year of a two-year kindergarten program, transitional kindergarten, transitional first grade, ungraded class, and/or multigraded class. This report relied on parent information and did not include or exclude children from certain definitions the parent provided based on the teacher's description of the classroom. In terms of the analytic sample used in this report, of the 12,495 children, about 82 children (unweighted) were classified by the teacher as attending a transitional kindergarten program (first year of a two year program; second year of a two year program; a transitional program) or a transitional first grade program. Of these 82 children, 25 were classified by their parents as being retained, 7 as delayed, and 50 as on time.

years, 8 months through 4 years, 11 months (born September–December 1993) when they entered kindergarten; children age 5 years, 0 months through 5 years, 3 months (born May–August 1993) when they entered kindergarten; children age 5 years, 4 months through 5 years, 7 months (born January–April 1993); children age 5 years, 8 months through 5 years, 11 months (born September–December 1992); and children age 6 years, 0 months through 6 years, 7 months (born January 1992–August 1992). When deriving this variable, September 1, 1998 was assumed to be the school start date for all children. [variable derived for this report, not presented on data file]

Children's race/ethnicity. The race/ethnicity composite (RACE) was constructed from two parent-reported variables: ethnicity and race. New Office of Management and Budget guidelines (1997) were followed under which a respondent could select more than one race. Thus, each respondent had to identify whether the child was Hispanic, and then select one or more races. The following are the five composite race/ethnicity categories presented in this report: White non-Hispanic, Black non-Hispanic, Hispanic, Asian, and Other (which includes Pacific Islanders, American Indians, Alaska Natives, and multiracial children). When race/ethnicity differences are presented in this report, White refers to White, non-Hispanic and Black refers to Black, non-Hispanic. Each child belongs to only one of these five categories. [variable derived for this report, not presented on data file]

Developmental difficulty. The variable used in this report is based on the recommended revision of the ECLS-K P4DISABL composite variable presented on the file. It was derived from information collected in the Child Health and Well-Being section of the spring first grade parent interview. Questions in the parent interview asked about the child's ability to pay attention and learn, overall activity level, ability to communicate, difficulty hearing and understanding speech, and eyesight if not correctable with eyeglasses. For each condition, a question was asked about whether a diagnosis was obtained. Additionally, a question was also

asked about receipt of therapy services. The composite variable was coded 1 (Yes) if any of the diagnosis variables or therapy services were coded 1 (Yes). [variable derived for this report, not presented on data file]

Poverty status. In this report, poverty status reflects being below the federal poverty threshold in both the kindergarten (WKPOV_R) and first grade (WIPOVRTY) years. The poverty variables were created using household income and family size. Income was compared to Census poverty thresholds, which vary by household size. Households whose income fell below the appropriate threshold were classified as poor. The thresholds in the kindergarten year were based on 1998 Census information, where a household of four with a total household income below \$16,655 was considered to be in poverty. The thresholds in the first-grade year were based on 1999 Census information, where a household of four with a total household income below \$17,029 was considered to be in poverty. If children were living below the federal poverty threshold in both kindergarten (WKPOV_R=1) and first grade (WIPOVRTY=1), their poverty status was defined as below poverty threshold. If children were living at or above the threshold at either kindergarten or first grade or at both rounds, children's poverty status was defined as at or above poverty threshold. [variable derived for this report, not presented on the data file]

Parental education. This variable was constructed using the questions on the highest grade the child's mother or female guardian or father or male guardian had completed, and whether the mother or female guardian or father or male guardian had obtained a high school equivalency degree if he or she did not complete high school. This report uses the data gathered during the kindergarten year as analyses included children's achievement during the kindergarten year. This information was collapsed into four categories: less than high school, high school or equivalent, some college including vocational/technical training, and bachelor's degree or higher. [WKPARED]

Preschool experience. This variable was created through information in the fall kindergarten Child Care section of the parent interview. Preschool experience was defined as children's participation in either a center-based arrangement or Head Start program in the year prior to kindergarten. The preschool experience variable was coded yes if either one or both of the child care variables (P1CPREK, P1HSPREK) were yes (1). [variable derived for this report, not presented on data file]

Fall 1998 kindergarten program type. This report refers to two types of kindergarten programs: full-day (or all day) and half-day (AM only or PM only). This variable was created using two composites that collected information on class type (AM, PM, or all-day). One composite derived class type from the fall kindergarten teacher questionnaire part A (A1CLASS). A second composite derived class type from the field management system that was used by field staff to schedule in-school child assessments (F1CLASS). Fall kindergarten program type was coded full-day if A1CLASS was 3 (all-day kindergarten) and was coded half-day if A1CLASS was 1 or 2 (AM or PM kindergarten). If A1CLASS was missing for a child, then F1CLASS was used to code fall kindergarten program type. If A1CLASS was missing and F1CLASS was 3 (all-day), kindergarten program type was coded full-day. If A1CLASS was missing and F1CLASS was 1 or 2 (AM or PM), kindergarten program type was coded half-day. [variable derived for this report, not presented on data file]

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For More Information

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Table 1. Percent of children, by 1998 kindergarten enrollment status, child, family, and school characteristics: Fall 1998

Characteristic	All children	On-time entry	Repeated ¹	Delayed entry
Sex				
Male	51	49	66	60
Female	49	51	34	40
Age at kindergarten entry (fall 1998)				
4 yrs, 8 mos – 4 yrs, 11 mos	7	2	3	2
5 yrs, 0 mos – 5 yrs, 3 mos	31	24	4	5
5 yrs, 4 mos – 5 yrs, 7 mos	31	33	10	10
5 yrs, 8 mos – 5 yrs, 11 mos	25	34	32	47
6 yrs, 0 mos – 6 yrs, 7 mos	6	7	51	36
Race/ethnicity				
White, non-Hispanic	64	64	61	72
Black, non-Hispanic	17	17	19	14
Hispanic	13	13	14	9
Asian	2	2	1	2
Other	4	4	5	3
Developmental difficulty²				
No	90	91	78	87
Yes	10	9	22	13
Family poverty status³				
Not below poverty threshold	88	89	81	89
Below poverty threshold	12	11	19	11
Highest parental education				
Less than high school	7	7	17	6
High school diploma/GED	27	27	24	21
Some college, including vocational-technical	34	35	33	34
Bachelors' or higher	31	31	26	38
Preschool experience⁴				
Yes	71	71	63	65
No	29	29	37	35
Fall 1998 kindergarten program type				
Half-day	44	44	27	51
Full-day	56	56	73	49

¹For children who repeated kindergarten in the 1998-99 school year, estimates for age of school entry and kindergarten program type are for the year they repeated kindergarten, not their first year in kindergarten.

²A child with a developmental difficulty is defined as one whose parents noted by first grade obtaining a diagnosis from a professional for problems related to attention, activity, communication, hearing, or sight that could not be corrected with eyeglasses.

³Poverty status here refers to the child's family status for both kindergarten and first grade. Below poverty threshold includes children whose family household income is below the federal poverty threshold in both the kindergarten and first-grade years.

⁴Preschool experience was defined by children's attendance in either a center-based arrangement or in Head Start during the year prior to kindergarten.

NOTE: Estimates are for kindergartners from the 1998-99 school year who did not enter school early that year and who were promoted to first grade. Estimates are based on only those children who were given the ECLS-K direct cognitive assessment in English. Details may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, (ECLS-K), Longitudinal Kindergarten-First Grade Public-Use Data File.

Table 1a. Standard errors for the percent of children, by 1998 kindergarten enrollment status, child, family, and school characteristics: Fall 1998

Characteristic	All children	On-time entry	Repeated ¹	Delayed entry
Sex				
Male	0.5	0.6	2.8	2.6
Female	0.5	0.6	2.8	2.6
Age at kindergarten entry (fall 1998)				
4 yrs, 8 mos – 4 yrs, 11 mos	0.6	0.6	1.7	.6
5 yrs, 0 mos – 5 yrs, 3 mos	0.5	0.6	1.3	1.1
5 yrs, 4 mos – 5 yrs, 7 mos	0.7	0.7	1.9	1.2
5 yrs, 8 mos – 5 yrs, 11 mos	0.7	0.8	2.6	2.5
6 yrs, 0 mos – 6 yrs, 7 mos	0.4	0.2	3.9	2.3
Race/ethnicity				
White, non-Hispanic	1.4	1.5	3.7	2.4
Black, non-Hispanic	0.9	1.0	2.8	1.8
Hispanic	0.9	0.9	2.2	1.5
Asian	0.2	0.2	0.4	0.5
Other	0.7	0.6	1.9	1.1
Developmental difficulty²				
No	0.4	0.5	2.4	1.4
Yes	0.4	0.5	2.4	1.4
Family poverty status³				
Not below poverty threshold	0.8	0.8	2.9	1.4
Below poverty threshold	0.8	0.8	2.9	1.4
Highest parental education				
Less than high school	0.4	0.5	2.4	1.4
High school diploma/GED	0.8	0.9	2.4	1.9
Some college, including vocational-technical	0.7	0.8	2.8	2.4
Bachelors' or higher	1.0	1.0	3.7	2.3
Preschool experience⁴				
Yes	0.9	1.0	2.8	2.6
No	0.9	1.0	2.8	2.6
Fall 1998 kindergarten program type				
Half-day	2.7	2.7	4.3	3.2
Full-day	2.7	2.7	4.3	3.2

¹For children who repeated kindergarten in the 1998-99 school year, estimates for age of school entry and kindergarten program type are for the year they repeated kindergarten, not their first year in kindergarten.

²A child with a developmental difficulty is defined as one whose parents noted by first grade obtaining a diagnosis from a professional for problems related to attention, activity, communication, hearing, or sight that could not be corrected with eyeglasses.

³Poverty status here refers to the child's family status for both kindergarten and first grade. Below poverty threshold includes children whose family household income is below the federal poverty threshold in both the kindergarten and first-grade years.

⁴Preschool experience was defined by children's attendance in either a center-based arrangement or in Head Start during the year prior to kindergarten.

NOTE: Estimates are for kindergartners from the 1998-99 school year who did not enter school early that year and who were promoted to first grade. Estimates are based on only those children who were given the ECLS-K direct cognitive assessment in English. Details may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, (ECLS-K), Longitudinal Kindergarten-First Grade Public-Use Data File.

Table 2. Children’s mean scale scores and percentage demonstrating specific reading and mathematics knowledge and skills in spring first grade, by 1998 kindergarten enrollment status: Spring 2000

Characteristic	All children	On-time entry	Repeated	Delayed entry
Reading, fall kindergarten				
Mean overall scale score	23	23	25	24
Mathematics, fall kindergarten				
Mean overall scale score	20	20	21	23
Reading, spring first grade				
Mean overall scale score	57	57	52	59
Percentage demonstrating specific reading knowledge and skills				
Ending sounds	94	94	88	95
Sight words	82	82	68	85
Words in context	47	47	33	51
Mathematics, spring first grade				
Mean overall scale score	44	44	42	46
Percentage demonstrating specific mathematics knowledge and skills				
Ordinality	95	96	92	97
Addition and subtraction	76	76	69	80
Multiplication and division	27	27	23	34

NOTE: Estimates are for kindergartners from the 1998–99 school year who did not enter school early that year and who were promoted to first grade. Estimates are based on only those children who were given the ECLS-K direct cognitive assessment in English. Details may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, (ECLS-K), Longitudinal Kindergarten-First Grade Public-Use Data File.

Table 2a. Standard errors for children's mean scale scores and percentage demonstrating specific reading and mathematics knowledge and skills, by 1998 kindergarten enrollment status: Spring 2000

Characteristic	All children	On-time entry	Repeated	Delayed entry
Reading, fall kindergarten				
Mean overall scale score	0.2	0.2	0.9	0.4
Mathematics, fall kindergarten				
Mean overall scale score	0.1	0.2	0.6	0.4
Reading, spring first grade				
Mean overall scale score	0.3	0.3	1.1	0.7
Percentage demonstrating specific reading knowledge and skills				
Ending sounds	0.3	0.3	1.3	0.6
Sight words	0.6	0.7	2.4	1.2
Words in context	0.9	0.9	3.2	2.0
Mathematics, spring first grade				
Mean overall scale score	0.2	0.2	0.7	0.3
Percentage demonstrating specific mathematics knowledge and skills				
Ordinality	0.3	0.3	1.2	0.5
Addition and subtraction	0.7	0.7	2.3	1.1
Multiplication and division	0.8	0.8	2.3	2.0

NOTE: Estimates are for kindergartners from the 1998–99 school year who did not enter school early that year and who were promoted to first grade. Estimates are based on only those children who were given the ECLS-K direct cognitive assessment in English. Details may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, (ECLS-K), Longitudinal Kindergarten-First Grade Public-Use Data File.

Table 3. Least squares estimates of child characteristics, family characteristics, school experiences, and 1998 kindergarten enrollment status on first grade reading knowledge and skills: Fall 1998 and spring 2000

	Overall				Ending sounds		Sight words		Words in context	
	reading scale score				B	SE	B	SE	B	SE
Intercept	34.20*	0.86	82.90*	1.29	52.49*	2.92	-19.65*	2.87		
Fall 1998 reading scale score	0.86*	0.02	0.37*	0.02	1.13*	0.05	2.42*	0.06		
Sex (Male)										
Female	0.66*	0.26	1.39*	0.31	3.39*	0.72	1.50*	0.90		
Age at 1998 kindergarten entry	0.08*	0.15	-0.24*	0.18	-0.65*	0.41	0.65*	0.52		
Race/ethnicity (White)										
Black, non-Hispanic	-2.68*	0.45	-3.06*	0.59	-7.75*	1.51	-6.18*	1.44		
Hispanic	0.36*	0.52	0.17*	0.55	-1.66*	1.42	1.77*	1.86		
Asian	-0.05*	0.65	-1.12*	0.61	-3.55*	1.82	0.40*	2.29		
Other, non-Hispanic	-1.85*	0.78	-3.40*	1.61	-6.86*	3.01	-4.79*	2.06		
Developmental difficulty (No) ¹										
Yes	-4.23*	0.50	-6.34*	1.23	-12.93*	1.96	-10.85*	1.54		
Family poverty status (Not) ²										
Below poverty threshold	-2.43*	0.49	-3.63*	0.81	-10.76*	1.66	-6.90*	1.46		
Parent education	1.41*	0.17	1.55*	0.21	-9.61*	0.53	4.26*	0.54		
Preschool experience (Yes) ³										
No	-0.55*	0.31	0.21*	0.42	0.38*	0.97	-2.30*	0.79		
Fall 1998 kindergarten program type (Half-day)										
Full-day	0.19*	0.39	0.01*	0.35	-0.14*	0.85	1.17*	1.34		
Enrollment status (On time)										
Repeated kindergarten	-5.21*	0.51	-4.55*	1.06	-13.14*	2.10	-13.79*	2.19		
Delayed kindergarten entry	0.27*	0.46	0.06*	0.62	-0.30*	1.46	0.79*	1.94		

*p<.05.

† Not applicable.

¹A child with a developmental difficulty is defined as one whose parents noted by first grade obtaining a diagnosis from a professional for problems related to attention, activity, communication, hearing, or sight that could not be corrected with eyeglasses.

²Below poverty threshold includes children whose family household income is below the federal poverty threshold in both the kindergarten and first-grade years.

³Preschool experience was defined by children's attendance in either a center-based arrangement or in Head Start during the year prior to kindergarten.

NOTE: In this analysis, the overall ECLS-K kindergarten and first-grade reading scale score has a potential range of 0 to 92. The spring first grade proficiency probabilities Ending Sounds, Sight Words, and Words in Context have a potential range of 0 to 100. For categorical variables, the omitted category is presented in parenthesis in the row headers. B is the unstandardized regression coefficient. SE is the standard error of B (the unstandardized regression coefficient). Data are for kindergartners from the 1998–99 school year who did not enter school early that year and who were promoted to first grade. Estimates are based on only those children who were given the ECLS-K direct cognitive assessment in English.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, (ECLS-K), Longitudinal Kindergarten-First Grade Public-Use Data File.

Table 4. Least squares estimates of child characteristics, family characteristics, school experiences, and 1998 kindergarten enrollment status on first grade mathematics knowledge and skills: Fall 1998 and spring 2000

	Overall mathematics scale score		Ordinality		Addition and subtraction		Multiplication and division	
	B	SE	B	SE	B	SE	B	SE
Intercept	23.12*	0.60	83.80*	1.13	33.43*	2.29	-34.64*	2.35
Fall 1998 reading scale score	0.72*	0.02	0.53*	0.04	1.99*	0.07	2.96*	0.05
Sex (Male)								
Female	-0.69*	0.14	0.23*	0.32	-0.25*	0.58	-5.38*	0.54
Age at 1998 kindergarten entry	-0.12*	0.09	-0.20*	0.17	-0.51*	0.31	-0.22*	0.36
Race/ethnicity (White)								
Black, non-Hispanic	-2.85*	0.30	-2.74*	0.79	-10.29*	1.37	-8.89*	0.95
Hispanic	-0.43*	0.31	-0.14*	0.84	-1.20*	1.18	-2.18*	1.12
Asian	-1.75*	0.51	-1.83*	0.68	-7.73*	2.44	-4.54*	1.73
Other, non-Hispanic	-1.53*	0.38	-1.45*	0.82	-6.83*	1.65	-3.58*	1.26
Developmental difficulty (No) ¹								
Yes	-2.28*	0.39	-5.52*	0.97	-9.65*	1.51	-2.40*	1.12
Family poverty status (Not) ²								
Below poverty threshold	-0.61*	0.30	-1.67*	0.85	-3.91*	1.40	0.84*	0.71
Parent education	0.89*	0.08	0.94*	0.18	2.74*	0.35	3.11*	0.35
Preschool experience (Yes) ³								
No	-0.30*	0.18	-0.21*	0.44	-0.68*	0.70	-1.52*	0.78
Fall 1998 kindergarten program type (Half-day)								
Full-day	0.26*	0.25	0.83*	0.43	1.26*	0.76	-0.12*	1.09
Enrollment status (On time)								
Repeated kindergarten	-1.94*	0.43	-2.68*	1.04	-6.95*	1.80	-4.85*	1.55
Delayed kindergarten entry	-0.75*	0.26	-0.33*	0.46	-2.46*	1.03	-2.67*	1.32

*p<.05.

† Not applicable.

¹A child with a developmental difficulty is defined as one whose parents noted by first grade obtaining a diagnosis from a professional for problems related to attention, activity, communication, hearing, or sight that could not be corrected with eyeglasses.

²Below poverty threshold includes children whose family household income is below the federal poverty threshold in both the kindergarten and first-grade years.

³Preschool experience was defined by children's attendance in either a center-based arrangement or in Head Start during the year prior to kindergarten.

NOTE: In this analysis, the overall ECLS-K kindergarten and first-grade mathematics scale score has a potential range of 0 to 64. The spring first grade proficiency probabilities Ordinality, Addition and Subtraction, and Multiplication and Division have a potential range of 0 to 100. For categorical variables, the omitted category is presented in parenthesis in the row headers. B is the unstandardized regression coefficient. SE is the standard error of B (the unstandardized regression coefficient). Data are for kindergartners from the 1998–99 school year who did not enter school early that year and who were promoted to first grade. Estimates are based on only those children who were given the ECLS-K direct cognitive assessment in English.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99, (ECLS-K), Longitudinal Kindergarten-First Grade Public-Use Data File.