Rathbun, A., West, J., & Germino-Hausken, E. (2004). From kindergarten through third grade: Children's beginning school experiences [Executive summary] (NCES 2004-007). Washington, DC: National Center for Education Statistics.

## **Executive Summary**

Children begin kindergarten with many different levels of reading and mathematics skills and make significant gains in their reading and mathematics achievement over the first 2 years of school (West, Denton, and Germino Hausken 2000; West, Denton, and Reaney 2001; Denton and West 2002). The knowledge and skills children acquire in kindergarten and first grade can serve as a foundation for their later educational success. It is important to explore children's growth and development as they move from the beginning of kindergarten through the elementary school years.

This is the fourth report in a series that provides descriptive information about young children's school experiences, based on data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K). Sponsored by the National Center for Education Statistics (NCES), part of the U.S. Department of Education's Institute of Education Sciences,<sup>1</sup> the ECLS-K selected a nationally representative sample of kindergartners in the fall of 1998 and is following these children through the spring of fifth grade. The study collects information directly from the children and their families, teachers, and schools. The full ECLS-K baseyear sample is composed of 22,782 children who attended 1,277 schools with kindergarten programs during the 1998-99 school year.

The first ECLS-K report, *America's Kindergart*ners (West, Denton, and Germino Hausken 2000), provided a national picture of the knowledge and skills of entering kindergartners. In the second report, *The Kindergarten Year* (West, Denton, and Reaney 2001), children's gains and status in reading and mathematics were explored during their first year of school. The third report in this series, *Children's Reading and Mathematics Achievement in Kindergarten and First Grade* (Denton and West 2002), described children's reading and mathematics achievement in the spring of kindergarten and the spring of first grade.

This fourth report highlights children's gains in reading and mathematics over their first 4 years of school, from the start of kindergarten to the point when most of the children are finishing third grade.<sup>2</sup> The report also describes children's achievement in reading and mathematics at the end of third grade, both in terms of their overall achievement in the two subject areas and in terms of their specific reading and mathematics knowledge and skills. It examines whether differences in reading and mathematics achievement that were identified for certain groups of children in kindergarten and first grade persist 2 or 3 years later. Specifically, comparisons are made by children's sex, race/ethnicity, and the number of family risk factors.<sup>3</sup> Achievement is also compared for children with different early school experiences (i.e., attended full-day vs. half-day kindergarten programs, attended public vs. private vs. both school types from kindergarten through third grade).

Information on two new ECLS-K direct child assessments conducted in the spring of 2002 is included. In the third-grade year, children were administered a science assessment for the first time in

<sup>3</sup>Family risk factors included living below the federal poverty level, primary home language was non-English, mother's highest education was less than a high school diploma/GED, and living in a single-parent household. Values range from 0–4, depending on the number of risk factors present.



<sup>&</sup>lt;sup>1</sup>Several other federal agencies provide support for this study, including the Economic Research Service of the U.S. Department of Agriculture, the Head Start Bureau of the Administration on Children, Youth, and Families of the U.S. Department of Health and Human Services, the National Institute for Child Health and Human Development, and the Office of Special Education Programs, the Office of English Language Acquisition, and the Policy and Programs Studies Service within the U.S. Department of Education.

<sup>&</sup>lt;sup>2</sup>This report refers to data collected in the spring of 2002 as third-grade data and the sampled children as third-graders, although not all children in the analytic sample used for this report were enrolled in third grade. In the spring of 2002, about 89 percent of children in the analytic sample were in third grade, 10 percent were in second grade, and about 1 percent were enrolled in other grades (e.g., first or fourth grade). Analyses are limited to those children who were assessed in English in all rounds. Approximately 68 percent of Hispanic children and 78 percent of Asian/ Pacific Islander children were assessed in English in the fall and spring of kindergarten and in the spring of first grade (Denton and West 2002).



place of the general knowledge assessment, which was used in the kindergarten and first-grade years. In addition, third-graders completed a self-description questionnaire (SDQ) on their perceptions of their competence and interests in reading, mathematics, and school in general. They also rated their popularity with peers and competence in peer relationships, and reported on any internalizing and externalizing problem behaviors that they might exhibit. The SDQ questionnaire provides the first direct information from the ECLS-K children about how they feel about their school experiences.

The purposes of this report are to describe the academic gains children have made from kindergarten through third grade, their achievement status at the end of third grade, and their perceptions about their school experiences. Two types of analyses were used to achieve these purposes. In addition to comparing the overall mean estimates and scores for different groups of children (i.e., bivariate analyses), more complex multivariate analyses (i.e., ordinary least squares regression) were conducted to describe the relationships of different child, family, and early school experience characteristics (e.g., race/ethnicity, number of risk factors, kindergarten program type) with children's achievement and perceptions, while controlling for the other characteristics. One of the limitations of mean comparisons is that they describe children's achievement gains and status for different groups of children without taking into account other factors that may also be related to achievement differences. For instance, family risk factors are related to children's achievement (West, Denton, and Reaney 2001), though the average number of these factors varies by children's race/ethnicity (Zill and West 2001). Bivariate results are included in the report to describe overall, unadjusted mean values for subgroups in the population. Findings from the regression analyses follow the bivariate results within each section of the report and further explain whether bivariate differences hold when other risk factors are taken into account.

This is a descriptive report. 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. The small set of independent variables used in this report's regression analyses were included with the specific purpose of clarifying the descriptive results observed in the multiple bivariate comparisons.

#### **Research Questions**

The report uses data from the ECLS-K to address the following questions:

- What knowledge and skills do children demonstrate in the spring of third grade? How have these changed since they first started school? Do children's knowledge and skills and the gains they have made over time differ by certain child, family, and school characteristics?
- How do third-graders perceive themselves and their relations with other children? Is their academic achievement at the end of third grade related to their perceptions?

The findings in this report are based on children in the ECLS-K sample who entered kindergarten for the first time in 1998 and were administered the direct cognitive assessments in English in fall 1998, spring 1999, spring 2000, and spring 2002.4 Comparisons in the text are tested for statistical significance to ensure that the differences are larger than might be expected due to sampling variation. All differences described are significant at the .05 level. Due to the large sample size, many differences (no matter how substantively minor) are statistically significant. In this report, as in earlier reports in this series, "substantive differences" are defined as mean score differences of one-quarter of a standard deviation or more, and percentage differences of 5 points or greater for specific proficiency levels, unless otherwise noted.

#### Changes Over Time for the ECLS-K Children

Over the first 4 years of school, young children may encounter different early learning experiences. From the start of kindergarten to the end of third grade, many children had changed schools at least one time (table 2).<sup>5</sup> For instance,

<sup>&</sup>lt;sup>4</sup>Estimates in this report are weighted by the ECLS-K Longitudinal full-sample child weight, C1\_5FC0.

<sup>&</sup>lt;sup>5</sup>It is possible that a few students may have switched from one school to another in second grade, then switched back again to the original school at the start of third grade. Since data were not collected in second grade, it is not possible to identify when such instances occurred.

in the spring of 2002, about half of the children remained in the same school they had attended in kindergarten, 39 percent had made one school change, and 10 percent had changed schools two or more times since the start of kindergarten. Some children also changed the type of school they attended. Eighty-one percent of the children had attended public schools for the duration of the study, and 9 percent always attended private schools. Ten percent changed the type of school they attended at least once between kindergarten and the end of third grade. Also, in the spring of 2002, about 89 percent of first-time kindergartners were in third grade, 10 percent were in second grade, and about 1 percent were enrolled in other grades (e.g., first or fourth grade) (data not shown in tables).

#### Overall Gains in Reading and Mathematics Knowledge and Skills From Kindergarten to Third Grade

The ECLS-K reading and mathematics assessments were designed to reflect children's knowledge and skills in both subjects over the duration of the study. The reading assessment captured information on children's basic literacy skills, vocabulary, and comprehension. The mathematics assessment measured children's conceptual understanding of numbers, shapes, patterns, mathematical operations, and processes for problemsolving. From the start of kindergarten to the end of third grade, children's reading scale scores, a measure of their overall reading achievement, increased an average of 81 points, and their mathematics scale scores increased about 63 points (tables A-4 and A-5). Children's spring third-grade reading scale scores were about 8.4 standard deviations higher than their fall kindergarten scores, and their spring third-grade mathematics scale scores were about 7.3 standard deviations higher than their fall kindergarten scores. Thus, one standard deviation in the reading score amounts to a 9.6 point difference in the reading scale score, and one standard deviation in the mathematics score amounts to an 8.6 point difference in the mathematics scale score. It is important to note that the data points represented in the figures and tables in this report cover different time spans (i.e., the kindergarten school year, the full calendar year between spring of kindergarten and spring of first grade, and 2 full calendar years between spring of first grade and spring of third grade). Thus, increases in achievement over time must be interpreted relative to the amount of time between assessments.Between the start of kindergarten and the end of third grade, the reading and mathematics achievement gaps across certain groups of children widened (tables A-4 through A-6). Black children had made smaller gains in reading and mathematics by the end of third grade than White, Hispanic, and Asian/Pacific Islander children.<sup>6</sup> As the number of children's family risk factors (e.g., living in a single-parent household, living below the federal poverty level) increased, children tended to gain less in both subject areas than children with fewer family risk factors (figures A and B). Children's gains in their first 4 years of school did not differ substantively, however, by their sex, the type of kindergarten program they attended (i.e., half-day or full-day), or the type of school they attended (i.e., public school all 4 years, private school all 4 years, both public and private school attendance).

#### Overall Reading, Mathematics, and Science Knowledge and Skills in Third Grade

Consistent with the patterns of differences found in children's achievement gains, children's reading, mathematics, and science status in third grade varied by their race/ethnicity and their number of family risk factors (tables A-4 through A-6, A-8). After controlling for the other child, family, and school characteristics, Black third-graders had lower achievement scores than White, Hispanic, and Asian/Pacific Islander children in all three subjects, and Hispanic third-graders had lower overall achievement scores in science compared with White children (figure C). Those with more family risk factors had lower mean achievement scores in all subjects than those with fewer family risk factors. In addition, third-graders who had always attended private schools from kindergarten through third grade had higher reading achievement scores than those who had always attended public schools. Children's third-grade achievement did not differ substantively by their sex.

<sup>6</sup>White refers to White, non-Hispanic; Black refers to Black, non-Hispanic; and Other refers to Other, non-Hispanic (i.e., American Indian, Alaska Native, or multiracial) for the remainder of the report.







NOTE: Family risk factors included living below the federal poverty level, primary home language was non-English, mother's highest education was less than a high school diploma/GED, and living in a single-parent household. Values range from 0 to 4. Estimates reflect the sample of children assessed in English in all assessment years. The ECLS-K assessment was not administered in 2001, when most of the children were in second grade.

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 and Third Grade Restricted-Use Data File, fall 1998, spring 1999, spring 2000, and spring 2002.

## Figure B. Mean mathematics scale scores for fall 1998 first-time kindergartners, by time of assessment and number of family risk factors: Fall 1998, spring 1999, spring 2000, and spring 2002



NOTE: Family risk factors included living below the federal poverty level, primary home language was non-English, mother's highest education was less than a high school diploma/GED, and living in a single-parent household. Values range from 0 to 4. Estimates reflect the sample of children assessed in English in all assessment years. The ECLS-K assessment was not administered in 2001, when most of the children were in second grade.

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 and Third Grade Restricted-Use Data File, fall 1998, spring 1999, spring 2000, and spring 2002.





NOTE: Estimates reflect the sample of children assessed in English in all assessment years. Although most of the children in the sample were in third grade in the spring of 2002, 10 percent were in second grade, and about 1 percent were enrolled in other grades.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Third Grade Restricted-Use Data File, spring 2002.

#### Specific Reading and Mathematics Knowledge and Skills in Third Grade

In addition to assessing children's overall reading and mathematics achievement, the ECLS-K provides more specific information on the knowledge and skills that children have acquired in both subjects by the end of third grade (tables A-9 through A-12). By the end of third grade, almost all children could identify the ending sounds of words, name sight words, and recognize words in context. They could also demonstrate mathematics concepts of ordinality (e.g., identify ordinal positions of objects) and solve simple addition and subtraction problems. Seventy-eight percent could make literal inferences based on text (e.g., recognize the comparison being made in a simile) and solve simple multiplication and division problems. Forty-six percent were able to use cues to derive meaning from text (e.g., use background knowledge combined with sentence cues to understand the use of homonyms) and 42 percent demonstrated an understanding of place value in integers to the hundreds place. Twenty-nine percent were able to make interpretations beyond what was stated in text

(e.g., make connections between problems in a narrative and similar life problems) and 16 percent could use rate and measurement to solve word problems.

Many of the patterns of differences in children's overall achievement gains and third-grade status were also present when children's proficiency in specific reading and mathematics knowledge and skills was examined (tables A-10 and A-12). After controlling for the other child, family, and early school experience characteristics, Black third-graders were less likely to be proficient in more advanced reading levels (i.e., making literal inferences, deriving meaning from text, and making interpretations beyond text) and mathematics levels (i.e., multiplication and division, place value, and rate and measurement) than White, Asian/Pacific Islander, and Hispanic children. Children with more family risk factors were also less likely to be proficient in these skills than their peers with fewer family risk factors. Hispanic third-graders were less likely to be proficient in deriving meaning from text and making interpretations beyond text than White third-graders, and were less likely than White and Asian/Pacific Islander children to demonstrate mas-



tery of in place value and rate and measurement skills. In addition, children who attended public school from kindergarten through third grade were less likely to demonstrate some of the more advanced reading and mathematics skills and knowledge than those who had attended private schools for some or all of their first 4 years of school (figures D and E). Finally, although overall reading and mathematics achievement status did not differ substantively by children's sex, girls were more likely to demonstrate proficiency in most of the advanced reading skills than boys, and were less likely to exhibit proficiency in most of the advanced mathematics skills than boys.

### Children's Perceptions About Themselves and Their School Experiences

At the end of third grade, children were asked about their perceptions of their competence and interest in reading, mathematics, and school in general, and about their peer relationships and problem behaviors that they may exhibit (details on the measure used to assess children's perceptions are provided in appendix B). On average, children indicated that they were generally interested in and enjoyed school, and that they did not perceive their schoolwork to be too difficult (table A-13). Girls tended to have greater interest and perceived competence in reading than boys, a finding that persisted after controlling for children's race/ethnicity, number of family risk factors, and their early school experiences (tables A-13 and A-14).

On average, children also responded positively regarding their peer relationships, with most indicating that they generally made friends easily and got along well with their peers (tables A-13 and A-14). Black third-graders were more likely to feel this way than Asian/Pacific Islander children, after controlling for other child, family, and school experience factors. Children tended to indicate that they only occasionally exhibited externalizing (e.g., fighting and arguing) or internalizing (e.g., anxiety, sadness, loneliness) problem behaviors. Boys indicated a higher likelihood of exhibiting externalizing behaviors than girls. Black third-graders reported more of both types of problem behaviors than White, Hispanic, and Asian/Pacific Islander third-graders. In addition, as the number of family risk factors increased for third-graders, they were more likely to report internalizing and externalizing problem behaviors (figure F, tables A-13 and A-14).

Third-graders' perceptions about their interest and competence in reading and mathematics were



Figure D. Percent of fall 1998 first-time kindergartners demonstrating specific reading knowledge and skills in spring of third grade, by school type: Spring 2002

NOTE: Estimates reflect the sample of children assessed in English in all assessment years. Although most of the children in the sample were in third grade in the spring of 2002, 10 percent were in second grade, and about 1 percent were enrolled in other grades.

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 and Third Grade Restricted-Use Data File, fall 1998, spring 1999, spring 2000, and spring 2002.

### Figure E. Percent of fall 1998 first-time kindergartners demonstrating specific mathematics knowledge and skills in spring of third grade, by school type: Spring 2002



NOTE: Estimates reflect the sample of children assessed in English in all assessment years. Although most of the children in the sample were in third grade in the spring of 2002, 10 percent were in second grade, and about 1 percent were enrolled in other grades.

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 and Third Grade Restricted-Use Data File, fall 1998, spring 1999, spring 2000, and spring 2002.

# Figure F. Mean scale scores for fall 1998 first-time kindergartners' perceptions of problem behaviors they exhibit in spring of third grade, by number of family risk factors: Spring 2002



NOTE: Family risk factors included living below the federal poverty level, primary home language was non-English, mother's highest education was less than a high school diploma/GED, and living in a single-parent household. Values range from 0 to 4. Scale scores on children's perceptions come from a self-description questionnaire (SDQ). Scores on the SDQ scales ranged from 1 "not at all true" to 4 "very true." Estimates reflect the sample of children assessed in English in all assessment years. Although most of the children in the sample were in third grade in the spring of 2002, 10 percent were in second grade, and about 1 percent were enrolled in other grades.

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 and Third Grade Restricted-Use Data File, fall 1998, spring 1999, and spring 2002.





also associated with their achievement at the end of the school year (tables A-15 and A-16). Those scoring in the highest third on the reading assessment in spring of 2002 expressed greater interest and competency in reading than children scoring in the lower two-thirds. The same pattern of relationships between perceptions and achievement occurred in mathematics. The relationship between children's perceptions and achievement were subject-specific, in that there was no relationship between achievement in one subject area and perceived interest and competence in a different subject area.

#### Conclusion

In summary, the findings from this report are consistent with patterns identified in earlier ECLS-K reports on children's achievement in kindergarten and first grade (Denton and West 2002; West, Denton, and Reaney 2001; West, Denton, and Germino Hausken 2000). The knowledge and skills children demonstrated at the end of third grade continued to differ in relation to their race/ethnicity and number of family risk factors. In addition, this report found that the achievement gaps between disadvantaged and more advantaged children identified at the beginning of school (West, Denton, and Germino Hausken 2000) grew wider over the first 4 years of school attendance.

In the first months of school, private school kindergartners demonstrated higher achievement status in reading and mathematics than public school kindergartners (West, Denton, and Germino Hausken 2000). These unadjusted mean differences were also found in third grade between children who attended public schools for all 4 years and those who attended private schools for part or all of the time, and were also found in terms of children's science achievement. However, when other factors (e.g., race/ethnicity and number of risk factors) were taken into account, some of the substantive schooltype achievement differences did not persist. Also, the achievement gap between public and private school children did not widen substantively over the first 4 years of school, even between those children who always attended the same types of school from kindergarten through third grade.

In earlier ECLS-K reports, findings also indicated that public school children who attended fullday (vs. half-day) kindergarten programs had higher overall achievement at the end of kindergarten in reading and mathematics, after controlling for other characteristics, and were more likely to demonstrate advanced reading skills at the end of the kindergarten year (Walston and West 2004; Denton, West, and Walston 2003). When overall kindergarten achievement was compared for full-day and halfday children from both public and private schools, however, differences in reading and mathematics achievement were not detected (West, Denton, and Reaney 2001). Findings from this report also indicate no substantive differences in reading, science, and mathematics achievement at the end of third grade related to the type of kindergarten program children had attended.

New information collected directly from children at the end of third grade indicates that, on average, they generally enjoyed reading, mathematics, and school in general, and felt competent in their schoolwork in these areas. Children's academic performance in reading and mathematics was positively related to their perceptions of their competence in the corresponding subject area. Third-graders perceived that it was easy for them to make and maintain friendships, and that they only occasionally exhibited internalizing and externalizing problem behaviors in school. However, disadvantaged children were more likely than more advantaged children to indicate that they exhibited problem behaviors.