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REPORT

Kindergartners' Skills at School Entry: An Analysis of the ECLS-K

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INTRODUCTION

Although most American children receive some pre-K child care and education, kindergarten still represents many children's first exposure to formal schooling. Kindergarten supports children's cognitive, social, and emotional skills,[1] leading to rapid gains in knowledge during this first year of education. However, not all children enter kindergarten equally prepared to meet the challenges ahead of them. Researchers have found stark differences in kindergartners' language, literacy, and math abilities as well as their social skills and behavioral approaches to learning.[2] These areas are interdependent, and children who start kindergarten behind in math, reading, and attention-related skills risk being unable to catch up to their peers later on.[3, 4]

The Early Childhood Longitudinal Study, Kindergarten Class of 2010–11 (ECLS-K:2011)

The ECLS-K:2011 follows a nationally representative sample of over 18,000 kindergartners from the fall of kindergarten through 5th grade. The study uses direct child assessments[5] as well as interviews with parents, teachers[6], and school administrators to learn about children's development and their home and school environments. We draw on this information to provide insight into children's abilities as they enter kindergarten for the first time. Because some children repeat kindergarten, this brief is limited to the roughly 15,000 children who were first-time kindergartners in fall 2010. All the data shown are from fall 2010 except for school type and family income, which were not measured until spring 2011.

Using data from a nationally representative sample of kindergartners, we examined children's skills at school entry across several academic and behavioral areas. This brief highlights the areas where attention before kindergarten might benefit all children as well as help close the gaps between more- and less-advantaged children.

Background Characteristics of First-Time Kindergartners.[7] New kindergarten students vary in a number of ways, such as the types of schools they attend, their racial/ethnic background, their home environment, and their family's income. Most of these children attend public schools (87 percent), with the rest attending private schools. Sixty-five percent attend public schools that receive Title I funding, and 22 percent attend non-Title I public schools. Slightly more of the children are male (51 percent) than female (49 percent), and most are white (53 percent), whereas 24 percent are Hispanic, 13 percent are

black, 4 percent are Asian, 4 percent are of two or more races, 1 percent are American Indian or Alaska Native, and less than 0.5 percent are Native Hawaiian or Pacific Islander.

Over three-quarters (76 percent) of children live with two parents, 22 percent live with one parent, and 2 percent live with other guardians. Most speak English at home (84 percent); only 15 percent primarily speak another language at home, and 1 percent live in homes where parents could not choose a primary language. Parents have a wide range of educational backgrounds: 38 percent have a bachelor's degree or higher, 32 percent have completed some college or have a vocational degree, 20 percent have a high school diploma or equivalent, and 9 percent have not completed high school. In terms of poverty, over half of children (52 percent) live in households with incomes over 200 percent of the federal poverty line, 21 percent with incomes between 100 and 200 percent of the federal poverty line, and 27 percent with incomes at or below the federal poverty line.

Some of these characteristics are risk factors for children's development and school outcomes; they are associated with lower achievement, reading and math delays, and more school dropout, for example.[8] This brief focuses on four risks in particular: the child lives in a single-parent household, the child's mother has less than a high school education, the child's household income is below the federal poverty line, and the primary language spoken in the home is not English. Figure 1 shows the distribution of first-time kindergartners by the number of risk factors. The majority of these children (56 percent) do not have any of the risk factors, but 25 percent have one risk factor, 13 percent have two, and 6 percent have three or four.

Figure 1. Risk Factors

Percent of Children with Specified Number of Risk Factors

0 ■ 1 ■ 2 ■ 3 ■ 4

1% 5% 13% 25% 56%
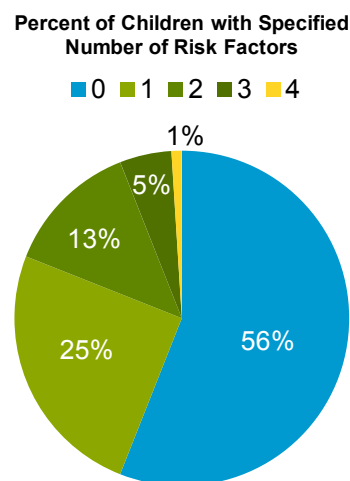
Differences in Children's Skills at School Entry

We used information from direct child assessments and teacher reports to measure children's skills at school entry. The direct child assessments were used to determine whether different groups of children enter kindergarten with different academic (reading and math) abilities and cognitive behavioral skills; we refer to the latter as executive function (working memory and cognitive flexibility) skills.[9] The teacher reports included ratings of reading and math skills as well as each student's approaches to learning and classroom behaviors. We used these teacher reports to examine profiles of children's skills as they enter kindergarten.

Level of risk. For first-time kindergartners in fall 2010, the more risk factors a child had, the lower his or her direct assessment scores—or level of performance—on reading,[10] math,[11] working memory,[12] and cognitive flexibility.[13] Figures 2 and 3 clearly show these scores falling as the number of risk factors rises, moving from left to right (cognitive flexibility follows the same pattern).

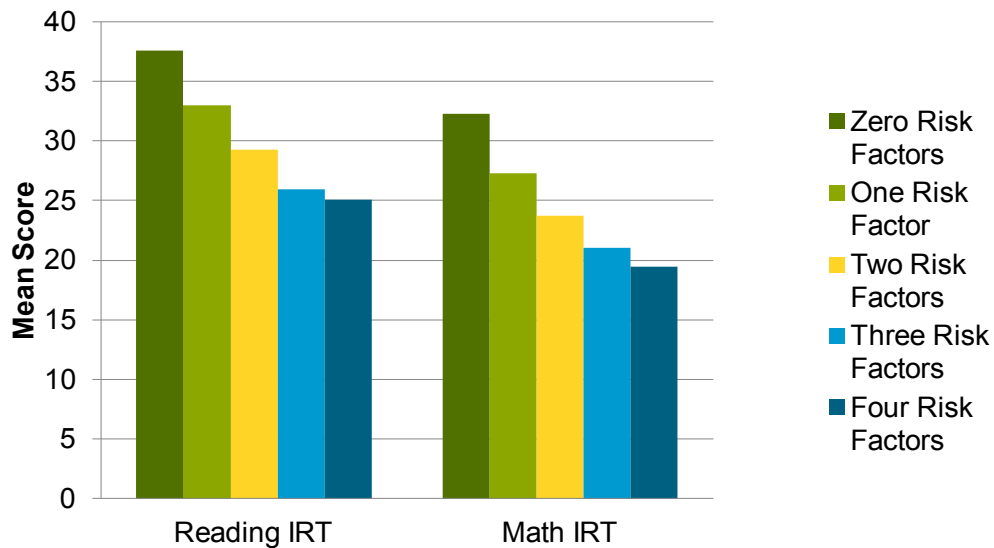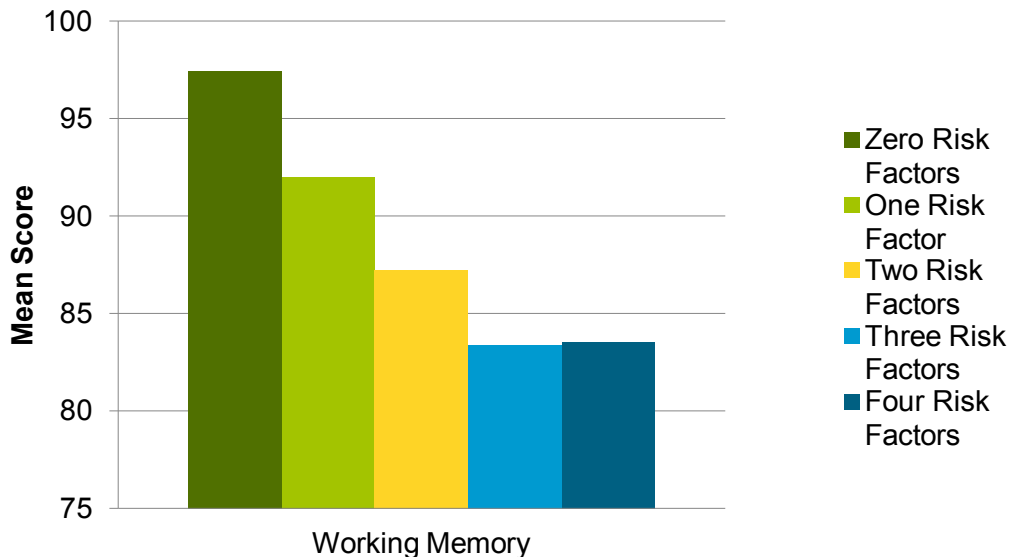**Figure 2. Directly Assessed Academic Skills by Number of Risk Factors**

Figure 3. Directly Assessed Working Memory by Number of Risk Factors

One way to provide context for these results is to compute their effect size, a measure of the magnitude of a particular phenomenon. Looking at the differences between high- and low-risk children in terms of effect size allows us to compare information on a common metric. For example, we might want to know how an average child's reading scores might increase over a year compared with the difference in kindergarten entry scores of (1) children with zero risk factors and (2) children with four risk factors. In the ECLS-K:2011, the average effect size of a child's growth in reading scores from fall to spring of kindergarten is 1.26. At kindergarten entry, the effect size of the difference between reading scores for children with zero risk factors compared to children with four risk factors is 1.07. That means that the difference between the reading scores of low- and high-risk children at kindergarten entry is nearly as large as the gains an average child might make over his or her kindergarten year. To catch up, high-risk children would need to make almost twice as much progress during kindergarten as low-risk children.

As seen in Table 1, the effect size of the difference between children with zero versus four risk factors on the assessments of reading, working memory, and cognitive flexibility is smaller than for the math assessment. But these differences are still larger than the amount of progress the average child makes between fall and spring. In short, children with higher levels of family risk are starting kindergarten significantly and meaningfully behind their more advantaged peers.

Table 1. Effect Size Comparisons

	Difference Between Kindergarten Entry Scores for Children with 0 Versus 4 Risk Factors (effect size)	Difference Between Fall and Spring Kindergarten Scores (effect size)
Reading	1.07	1.26
Math	1.20	1.16
Working memory	.85	.10
Cognitive flexibility	.76	.32

Race/ethnicity. As seen in Table 2, there are significant racial and ethnic disparities in children's academic and executive function scores. Many of these disparities are likely due to differences in rates of poverty and other risk factors for which did not control. For example, 76 percent of white children have zero risk factors, compared with only 33 percent of black children and 29 percent of Hispanic children. Black, Hispanic, Native Hawaiian/Pacific Islander, and American Indian/Alaska Native children have significantly lower reading scores than white children, whereas Asian children have significantly higher reading scores than white children. These patterns remain for math, where children of two or

more races also score significantly lower than white children. In addition, Asian children have higher working memory scores than white children, who in turn score significantly higher than black, Hispanic, and American Indian/Alaska Native children. Unlike in reading, math, and working memory, Asian children score lower than white children on cognitive flexibility, as do black, Hispanic, and Native Hawaiian/Pacific Islander children.

Table 2. Direct Assessment of Children's Skills by Race/Ethnicity and School Type at Kindergarten Entry: Fall 2010

	Mean			
	Reading IRT Scale Score	Math IRT Scale Score	Executive Function: Numbers Reversed Standard Score	Executive Function: Card Sort Score
All Children	34.70	29.30	94.04	8.45
Race/Ethnicity				
White, Non-Hispanic	36.61	31.75	96.96	8.98
Black/African American, Non-Hispanic	32.93	25.80	88.89	7.68
Hispanic	30.26	24.74	88.54	7.66
Asian, Non-Hispanic	40.48	34.55	99.96	8.42
Native Hawaiian/Pacific Islander, Non-Hispanic	31.49	27.39	92.07*	7.39
American Indian/Alaska Native, Non-Hispanic	31.07	26.34	92.80	8.40*
Two or More Races, Non-Hispanic	36.17*	30.49	96.24*	8.74*
School Types				
Public School, Received Federal Title I Funds	32.79	27.41	91.72	8.25
Public School, Did Not Receive Federal Title I Funds	38.33	32.93	98.00	9.06
Private School	37.89	32.98	100.19	8.70

NOTE: Statistics are weighted to represent children who attended kindergarten in the United States in the 2010-11 school year (weighted using W1_2P0).

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011) Restricted-Use Kindergarten Data File.

* Unless noted by an asterisk, significant differences ($p \leq .05$) were found when comparing White, Non-Hispanic to each of the other Race/Ethnicity groups. Significant differences ($p \leq .05$) were found when comparing children in public schools receiving Title I funding to children in private schools and children in public schools not receiving Title I funds on all measures reported in this table.

School type. Just as children enter school with a wide range of skills and knowledge, the schools they attend are also quite varied. ECLS-K:2011 children attended private schools, public schools receiving Title I funding, and public schools not receiving Title I funding. As shown in Table 2, children in Title I public schools enter kindergarten with lower reading, math, and executive function skills than children in non-Title I public schools and in private schools. Because Title I funding is targeted to schools serving low-income children, these differences in skills suggest that Title I funding is indeed reaching the schools where first-time kindergartners have the greatest need. However, given the lower direct assessment scores among these children, it is clear that even with these additional resources, children most at risk have a very steep climb to catch up with their peers.

## Teacher Ratings of Children's Skills at School Entry

We used teacher ratings to create overall indicators of children's academic and behavioral skills at kindergarten entry,[14] with multiple items used as indicators of children's skills in reading,[15] math,[16] approaches to learning[17] (for example, their ability to pay attention and adapt to changes in their routines), and social-emotional/executive function[18] (including self-control, interpersonal skills, externalizing or internalizing problem behaviors, attentional focus, and inhibitory control). 27 percent of children were rated by their teachers as "in progress" or above (3 or above on a 5-point scale) in most reading skills, as were 27 percent of children in math. Teachers gave 43 percent of children a middle rating or higher on most approaches-to-learning items, and a slightly larger share—46 percent—received a middle rating or higher on social-emotional/executive function items.

To describe children's skills across domains, we also looked at children who received higher and lower skill ratings,[19] focusing on children who:

- Were most academically and behaviorally ready for kindergarten (28 percent of children). These children were rated as "in progress" or above on most items in at least one academic category (reading and/or math) and at least one behavioral category (approaches to learning and/or social-emotional/executive function).

- Needed the most support (34 percent of children). These children were not rated by their teachers as "in progress" or above in any category.

Slightly over one-third of children begin kindergarten in the "need support" category—with lower ratings on most items in reading, math, approaches to learning, and social-emotional/executive function. These children tend to have more risk factors than their higher-rated peers, a result we also saw in the data from the direct child assessments. As shown in Figure 4, as the number of risk factors increases, the number of children needing support also increases.

Figure 4. Teacher-Reported Skills by Number of Risk Factors
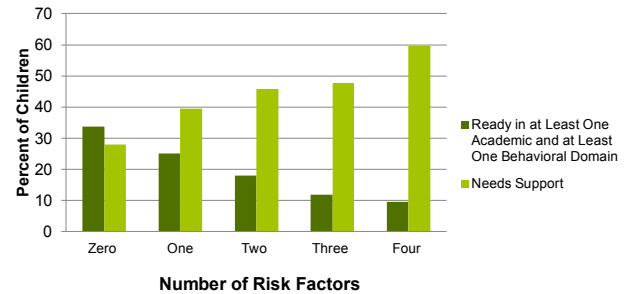
DISCUSSION AND IMPLICATIONS

Based on direct assessments of children's reading, math, and executive function skills, it is clear that kindergartners start school with a wide array of abilities. Children with few risk factors tend to start with stronger skills than children with more risk factors—a disparity we also see when we compare children by race and school type. Better supporting children's development before they enter kindergarten is one way to reduce these gaps, which often remain or even grow over a child's time in school.

In the teacher reports, less than one-third of new kindergartners were rated "in progress" or better on most reading or math items. More children were rated highly on one or both of the behavioral domains (approaches to learning and social-emotional/executive function), but there is still room for improvement before children reach kindergarten. In fact, these skills and behaviors are what enable children to focus well enough to learn academic skills such as reading and math, and change across the kindergarten year in these skills is limited, making it vitally important to support development of these skills before children reach school age. If these behaviors lay the foundation for later learning and achievement, it is vital to do all we can to equip children with these skills before they start kindergarten.

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ENDNOTES

[1] West et al. (2000).

[2] Wertheimer et al. (2003).

[3] National Center for Children in Poverty and Abt Associates, Inc. (2008).

[4] Duncan et al. (2007).

[5] Direct child assessments refer to questions and tasks that trained staff administer to children to test their knowledge and skills directly (as opposed to a parent or teacher reporting on whether a child has a certain skill).

[6] Teacher interviews included child-specific reports of students' skills and behaviors.

[7] All estimates use W1_2P0, and significance tests use the same weight and its replicates to account for the ECLS-K:2011's complex sampling.

[8] Magnuson (2007), McLanahan and Sandefur (1997), Hernandez and Napierala (2012), and Duncan and Brooks Gunn (1999).

[9] The direct child assessments provide four indicators of children's skills at kindergarten entry: a reading item response theory (IRT) scale score, a math IRT scale score, and two measures of executive function: Numbers Reversed, which measures working memory, and the Dimensional Card Sort, which measures cognitive flexibility. These indicators are discussed in detail in the next four footnotes.

[10] The ***reading IRT scale score*** is a measure of children's reading skills drawn from an assessment that addresses basic skills, such as letter recognition, and more complex processes, such as interpreting questions.

[11] Similar to the reading IRT, the ***math IRT scale score*** provides information on children's math skills and also addresses simple items, such as number sense, as well as more complex concepts, such as operations. Both the reading and math assessments use a two-stage approach, with the first-stage questions used to determine whether to route children into second-stage questions of low, middle, or high difficulty (Tourangeau et al. 2013). The reading assessment has 20 first-stage questions, and the math assessment has 18. Between the first stage and all three sets of second-stage questions, the reading assessment has a total of 83 items, and the math assessment has 75 items. No child would have received all these items, however, because they would be routed into only one of the three sets of second-stage questions for each assessment.

[12] The ***Numbers Reversed*** task measures working memory and has the child repeat, backwards, a span of numbers that the assessor reads to the child (Mather and Woodcock 2001). The span increases by one digit at a time, up to eight digits, depending on how the child is doing (once a child gets three spans incorrect in a row, the task ends). Numbers Reversed provides a standard score, with a mean of 100 and a standard deviation of 15 (at kindergarten entry, children have a mean of 94 and a standard deviation of 16 on the measure).

[13] The ***Dimensional Card Sort*** measures cognitive flexibility by having children sort cards into trays based on rules that change in the middle of the task (Zelazo 2006). The rules are based first on shape or color and then reverse, resulting in the card-sort Postswitch score, which is the number of cards correctly sorted after the switch. For children who pass a set threshold on the first rules switch, the rules are changed again, and whether the child sorts by shape or color depends on whether a given card has a border or not. This yields the card-sort Border Game score, or the number of cards correctly sorted after adding the border rule. The card-sort Postswitch score and the card-sort Border Game score are then added together to give us the main score for analysis. The average main score is 8.5, indicating that children tended to score high enough on the first part of the assessment to move to the Border

Game section. Each section had a maximum possible score of 6, so scores over 6 indicate that a child was administered both the color/shape portion of the assessment as well as the Border Game portion.

[14] We used teacher ratings to develop a set of indicators that report children's skills dichotomously. Teacher reports of children's abilities at school entry are derived from items that address skills and behaviors in four domains: reading, math, approaches to learning, and social-emotional/executive function.

[15] The teacher-reported *reading* variable is drawn from six items on which teachers indicate a child's skill in various aspects of language and literacy.

[16] Similar to the reading variable, the teacher-reported *math* variable is drawn from five items on which teachers rate the child's skill in areas of math ability. Each item is rated on a five-point scale ("not yet" = 1, "beginning" = 2, "in progress" = 3, "intermediate" = 4, and "proficient" = 5). Children rated "in progress" or higher on at least 80 percent of items in a domain are considered to have many of the skills that will be most helpful in their kindergarten learning. For example, a child rated by her teacher as "in progress" or "proficient" on five of the six math items would meet the criteria for the math variable.

[17] The *approaches-to-learning* variable, which is based on teacher reports, is derived using a similar process to the reading and math measures reported by teachers but is based on seven items using a four-point response scale. The items measure factors such as children's ability to pay attention and adapt to changes in their routines. Teachers indicate whether a child never, sometimes, often, or very often shows a behavior. (They can also select "no opportunity to observe," which is collapsed into the "never" category for this brief.) Children who show at least 80 percent of the behaviors often or very often are considered to have the approaches-to-learning skills important for school success.

[18] Item-level data are not available for the components of the teacher-reported *social-emotional/executive function* variable. This measure is drawn from six scales: self-control (four items), interpersonal skills (five items), externalizing problem behaviors (five items), internalizing problem behaviors (four items), attentional focus (six items), and inhibitory control (six items). The first four scales are 4-point response scales ranging from "never" to "very true," and the last two are 7-point scales ranging from "extremely untrue" to "extremely true." Scores on externalizing and internalizing behaviors were reversed so that higher scores indicated better behavior. To be considered most ready for kindergarten on the social-emotional/executive function variable, children had to score higher than the midpoint on 80 percent of the scales (for the four-item scales, above a 3, and for the seven-item scales, above a 4).

[19] The four teacher-reported skills (reading, math, approaches to learning, and social-emotional/executive function) are used to develop profiles of children's school readiness: academically and behaviorally ready, and needing support. A child with "in progress" or higher ratings on the majority of items in at least one academic domain (reading and/or math) *and* at least one behavioral domain (approaches to learning and/or social-emotional/executive function) are considered to be the most *academically and behaviorally ready* to learn in kindergarten. Children who are not rated as "in progress" or higher on the majority of items in any of the four domains are those who most likely *need support* in their kindergarten learning.

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