Reading on Grade Level in Third Grade: How Is It Related to High School Performance and College Enrollment?

A Longitudinal Analysis of Third-Grade Students in Chicago in 1996-97 and their Educational Outcomes

A Report to the Annie E. Casey Foundation

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Contents

Executive Summary

Learning to read is one of the most important skills in modern society. Not only does reading serve as the major foundational skill for school-based learning, but reading ability is strongly related to opportunities for academic and vocational success. For children, a critical transition takes place during elementary school: until the end of third grade, most students are *learning to read*. Beginning in fourth grade, however, students begin *reading to learn.*[1] Students who are not reading at grade level by third grade begin having difficulty comprehending the written material that is a central part of the educational process in the grades that follow. Meeting increased educational demands becomes more difficult for students who struggle to read.

The study described here uses longitudinal administrative data to examine the relationship between third-grade reading level and four educational outcomes: eighth-grade reading performance, ninth-grade course performance, high school graduation, and college attendance. Using third-grade national percentile rankings on the Iowa Tests of Basic Skills (ITBS) to place a focus cohort of 26,000 Chicago Public Schools (CPS) students into *below* (0-24th national percentile), *at* (25th-74th national percentile) and *above* grade level (75th-100th national percentile) groupings, we find correlational evidence that students who were at and above grade level in third grade graduate and attend college at higher rates than their peers who were below grade level in third grade.[2] The results of this study do not examine whether low reading performance causes low future educational performance, or whether improving a child's reading trajectory has an effect on future educational outcomes. Future research to investigate this question is necessary.

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[1] This transition and the importance of early reading ability are highlighted in the Annie E. Casey Foundation's 2010 Kids Count Special Report: *Early Warning! Why Reading by the End of Third Grade Matters*

[2] The focus cohort of students for this report is first-time third-grade students who took the reading portion of the ITBS test in the 1996–97 school year.

To conduct this research, the focus cohort was followed through administrative data from third-grade (1996-97) through potential college enrollment (as late as 2007-08). Five key findings, outlined below, highlight the relative contribution of third-grade reading performance for predicting future educational outcomes. In these analyses, we also identified those students who spent time in foster care at any point during their childhood. Previous research at Chapin Hall has shown that students involved with the child welfare system read at levels below their peers and have slower improvement over time (Smithgall, et al., 2004).

1. **The proportion of students who are below grade level is highest for male students, for African American students, and for students who ever spent time in the foster care system.**

In the overall sample of CPS students, 38 percent were below grade level for reading, 50 percent were at grade level, and 12 percent were above grade level in third grade. However, there is variation within subgroups of students. Forty-two percent of male students were below grade level (compared to 34 percent of females), 44 percent of African American students and 33 percent of Latino students were below grade level (compared to 18 percent of white students), and 52 percent of students who ever spent time in foster care were below grade level (compared to 38 percent of the overall population).

2. **Students who are above grade level for reading in grade 3 graduate and enroll in college at higher rates than students who are at or below grade level.**

Nearly 80 percent of students in our sample who were reading above grade level in third grade graduated high school within five years, well above average CPS graduation rates of about 55 percent. Reading below grade level in third grade did not determine high school or college graduation for this sample of CPS students by itself, however. Nearly half (45 percent) of below-grade-level students and 60 percent of at-grade-level students in our sample graduated in five years. The pattern remains for college enrollment when considering all ninth graders in the sample. Fewer than 20 percent of students who were below grade level in third grade attended college, compared to about a third of students who were at grade level, and nearly 60 percent of students who were reading above grade level. Even among high school graduates, almost three-quarters of students who were above-grade-level for reading in third grade attended college, compared to about 55 percent of students in the at-level group and about 40 percent of students in the below-level third grade group.

3. Third-grade reading level is a significant predictor of eighth-grade reading level.

Although third-grade reading level does not completely determine eighth-grade performance, there is a strong correlation (r=0.67) between third- and eighth-grade ITBS reading scores. In other words, students who were at or above grade level in third grade are more likely to be at or above grade level in eighth grade. Of the students who were below grade level in third grade, about 40 percent were also below grade level in eighth grade. Multilevel regression models that take into account third-grade school effects and demographic characteristics of students affirm the importance of third-grade reading level. Even after controlling for the covariates, the difference in eighth-grade performance of the three third-grade groups (*below, at,* and *above* grade level) remain.

4. Eighth-grade reading achievement and the ninth-grade school that a student attends account for many of the differences in performance among the *below*, *at*, and *above* level groups in ninth grade.

Eighth-grade achievement is an important educational milestone for students. For students in this sample, eighth-grade test scores play a large role in determining the high school they will attend. Students who meet certain academic and attendance requirements are eligible to attend schools across the city, regardless of where they live. As a result, high-performing students tend to attend high-performing high schools. Similarly, low-performing students tend to enroll in lower-performing high schools. As a result of this high school sorting process, eighth-grade performance is extremely important.

Multilevel regression models reveal that third-grade reading performance is related to ninth-grade course performance (as measured by absences, number of course failures, and GPA), but that the difference in ninth-grade performance of students who were in the *below*, *at*, and *above* grade reading levels in third grade is mostly explained by a student's eighth-grade reading test score and the ninth-grade school they attend. Third-grade reading level is still a significant predictor of ninth-grade course performance, but the majority of the differences between the ninth grade performance of students in the below, at, and above level groups can be explained by eighth-grade reading achievement and the ninth-grade school they attend. Conceptually, third-grade reading level is related to eighth-grade reading level, and eighth-grade reading level is related to ninth-grade school enrollment and course performance.

5. Eighth-grade reading achievement and the ninth-grade school a student attends explain differences in graduation and college enrollment rates.

Eighth-grade reading achievement, ninth-grade school characteristics and individual ninth-grade course performance explain most of the differences in high school graduation and college enrollment rates for

students who were in the *below*, *at*, and *above* grade level groups in third grade. When ninth-grade performance is included as a predictor in multilevel regression models, being above grade level in third grade continued to have a significant relationship only when predicting college attendance among graduates. Merely achieving *at*-grade-level status in third grade did not account for any additional variance in predicting college attendance beyond ninth-grade course performance. In other words, for students who were below- or at-grade-level in third grade, third-grade reading level influences eighth-grade reading level, eighth-grade reading level influences ninth-grade course performance, and ninth-grade course performance influences high school graduation rates and college attendance. However, being above grade level in third grade was a significant predictor of college attendance. Compared to below-grade-level students, students who were above-grade-level in third grade were more likely to attend college, even after accounting for demographic characteristics, eighth-grade reading performance, ninth-grade school effects, and ninth-grade course performance.

Results from this study support the idea that implementing programs that support struggling students before high school is essential. Students who are better prepared for a successful ninth grade year are more likely to have positive future outcomes, regardless of third grade reading status. The sooner that struggling readers are targeted for supports, the easier it will be to ensure that students are progressing on course toward strong performance in ninth grade, high school graduation, and college enrollment.

Introduction

Without question, learning to read is a necessity in our increasingly literate society. For children, it is also a critical skill for success in school. The traditional age/grade progression of students from elementary to middle to high school and beyond assumes that after a certain age (typically third or fourth grade), all students will be able to read at increasingly higher levels of proficiency. As a result, students who do not possess the expected reading skills for their grade level often fall behind their peers, making it difficult to regain lost ground without intensive intervention.

When students have difficulty mastering reading concepts early in their schooling, they are at much higher risk for reading difficulties later in their careers. Researchers have found that 75 percent of students identified with reading problems in the third grade still struggle with reading in the ninth grade (Francis, 1996; Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992), and that students with poor word identification skills in the third grade were unlikely to significantly improve their reading skills by the end of eighth grade (Felton & Wood, 1992).

Falling behind in school has serious consequences for life outcomes. Adults with lower levels of literacy and education are more likely than adults with higher levels of literacy and education to be unemployed or to earn an income that falls below the poverty level (Kutner et al., 2007). Furthermore, adults without a high school diploma or postsecondary education are more likely to be incarcerated than adults with higher levels of education (Harlow, 2003). In short, literacy represents a key determinant of academic, social, and economic success (Snow, Burns, & Griffin, 1998).

The Annie E. Casey Foundation's 2010 Kids Count Special Report: *Early Warning! Why Reading by the End of Third Grade Matters* highlights an important literacy learning transition that takes place during elementary school: until the end of third grade, most children are *learning to read*. Beginning in fourth grade, however, the focus shifts as students begin *reading to learn*. Not surprisingly, students who read

below grade level will have difficulty comprehending curriculum materials written for their grade level, affecting their ability to keep pace with their on-level peers. Meeting increased educational demands as they move from grade to grade is increasingly difficult for students who struggle with reading.

Reading serves as the major foundational skill for school-based learning, and is strongly related to future opportunities for academic and vocational success. Research has found that, because of its visibility and importance, when students have difficulty learning to read, their love of learning and motivation diminishes rapidly (Stanovich, 1986). Similarly, longitudinal studies that have followed both good and poor readers from kindergarten to adulthood have found that by the end of first grade, children who have not been able to master reading skills at the same rate as their classmates experience substantial decreases in their self-esteem, self-concept, and motivation to learn to read (Armbruster et al., 2001). As a struggling reader progresses through elementary, middle, and high school, even otherwise bright students may miss out on opportunities to learn science, math, history, and literature if they cannot read the grade-level textbooks. By the later grades, the child's potential—and motivation—for entering college is very low, and motivation, self-esteem, and self-concept follow suit (Armbruster et al., 2001).

Early intervention can make a big difference for struggling readers. The research of Armbruster, Lehr, and Osborn (2001) found that for 85 to 90 percent of poor readers, prevention and intervention programs implemented before third grade can increase reading skills to the average grade levels. However, if intervention is delayed until 9 years of age, approximately 75 percent of children will continue to have difficulties learning to read throughout high school and their adult years. Because the critical time period for supporting early reading occurs in the early grades, most commercial prevention efforts are focused on grades K-3, when learning to read is the primary goal of schooling. For struggling readers in third grade and higher, remedial intervention programs are less successful, but remain crucial supports for improving current reading skills as well as future reading performance trajectories when implemented with fidelity (Lesnick, 2006).

In this study, we examine whether third grade reading level can be used as an indicator of potential performance on four future educational outcome measures: eighth-grade reading level, ninth-grade course performance, high school graduation, and college attendance. Recognizing that there are a variety of factors that influence student performance, we investigate whether third grade reading level can be a proxy for understanding how all of the factors influencing a student's performance may influence later outcomes. We use administrative data from the Chicago Public Schools (CPS) to follow one focus cohort of nearly 26,000 students from third grade through high school completion and into college to analyze the effect of reading ability on future achievement. We define reading *below grade level* as the equivalent of

scoring at or below the 24th national percentile on the Iowa Tests of Basic Skills (ITBS), the annual achievement test used by CPS in 1997.[3] Reading *at grade level* is equivalent to earning a reading score that falls between the 25th–74th national percentile, and reading *above grade level* is equivalent to a score that falls at or above the 75th national percentile.

A special focus on students who ever spent time in foster care is included in the analyses because previous research at Chapin Hall has shown that children in foster care test far behind their peers and are more likely to drop out, repeat grades, be in special education classes, and be suspended or expelled (Courtney et al., 2004). Furthermore, students who remained in foster care during their elementary years were not only reading at levels below their third-grade peers, but also had growth trajectories that were slower than other low-performing students (Smithgall et al., 2004). Because of these prior findings and the higher prevalence of low performance, we consider students who ever spent time in foster care separately, as well as part of the "all students" group.

In the next section, we describe the research methods employed for the study, including a description of the sample, the analytic approach, and the ITBS test used for determining reading level. The results section follows, describing the five key findings. Student performance on each of the educational outcomes are presented as they occurred and adjusted for demographic characteristics, foster care involvement, concentration of neighborhood poverty, and school-level effects. The final section provides a summary of the research study and findings, highlighting the fact that our findings are consistent with existing literature that emphasizes the importance of early reading ability for future educational success.

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[3] The Iowa Tests of Basic Skills (ITBS) was used to measure elementary student and school performance in the Chicago Public Schools (CPS) for several decades. In the late 1990s, schools were held accountable for their ITBS scores by being placed on or off probation based on the percentage of students who scored at or above national norms. ITBS scores were also used to determine which students needed to attend mandatory summer school and which were eligible for promotion to the next grade. During the 2005–2006 school year, the Illinois Standards Achievement Test (ISAT) replaced the ITBS as the primary standardized testing mechanism in CPS. (Easton, Correa, Luppescu, et al., 2003). The ITBS national percentiles used in these analyses result from a renorming of the test scores in 2000.

Methods

The work presented here is part of a larger research agenda aimed at understanding the importance of reading at grade level in the early years. The primary research goal of this portion of the work is to examine the relationship between a child's third-grade reading level and subsequent educational outcomes—specifically high school graduation and college attendance.

Students who were first-time third graders in Chicago Public Schools (CPS) during the 1996–97 school year comprise the focus cohort for this research study. The third-largest school district in the United States, CPS serves approximately 410,000 students in more than 600 schools. In the 2009-10 school year, eighty-six percent of students in CPS were eligible for free or reduced-price lunch, and the majority of the student population was either African American (45%) or Latino (41%). Historically, CPS students have scored lower on standardized tests as compared to their national peers. For example, on the 2009 National Assessment of Education Progress (NAEP) administration of the Trial Urban District Assessment, 16 percent of fourth-grade students and 17 percent of eighth-grade students in CPS scored at or above the NAEP proficient level for reading, compared to 31 percent of fourth-grade students and 29 percent of eighth-grade students nationwide.[4]

Table 1 shows the general grade progression for the focus cohort from the 1996–97 school year through the 2007–08 school year. In addition, it shows how the number and percent of actively enrolled students changes from year to year (bottom two rows).

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[4] http://nationsreportcard.gov/reading_2009

Table 1. The Grade 3 Focus Cohort: Active Students and Grade Levels by School Year

		School Year											
		96–97	97–98	98–99	99–00	00–01	01–02	02–03	03–04	04–05	05–06	06–07	07–08
Grade	3	**26015**	4761	655									
	4		**19,204**	4,053	517								
	5			**17,917**	4,028	486							
	6				**16,759**	4,590	550						
	7					**15,244**	3,619	227					
	8						**15,371**	3,761	144				
	9							**13,474**	4,843	1,060	286	82	21
	10								**11,027**	3,784	851	191	37
	11									**9,355**	2,202	220	35
	12										**9,009**	1,888	204
Active Students from Original Sample		26,015	24,041	22,698	21,443	20,513	19,749	17,625	16,152	14,380	12,353	2,382	300
Percent of sample lost from previous year			7.6%	5.6%	5.5%	4.3%	3.7%	10.8%	8.4%	11.0%	14.1%	80.7%	87.4%

Notes:
1. Numbers that appear in boldface indicate a students' expected grade given yearly promotion after third grade.
2. Prior to age 17, students who are inactive have left the district. After age 17 (which can occur anytime from grade 9-12), inactive students also include students who have dropped out and students who have graduated.

Student retention and missing data influence the analyses conducted for this study. Because our analyses examine the relationship between third-grade reading level and future educational milestones (grade 8, grade 9, graduation, and college enrollment), it was necessary to allow for different years of test taking, ninth-grade entry, and completion. For example, if a student was retained in grade 3, then s/he will take the grade 8 reading test a year after students who have not repeated a grade. Similarly, the graduation rate is calculated based on whether the student ever graduated, regardless of when the student entered ninth grade).

Table 2 shows the attrition of our original third grade cohort at each of the key milestones. First, 25,948 first-time third graders with ITBS reading test scores comprise the beginning cohort. Of those students, 17,176 have eighth-grade ITBS reading scores, and 18,222 entered ninth grade in the fall of 2001, 2002, 2003, or 2004. Of those students, 14,044 students have the following ninth-grade course performance information: absences, number of course failures, and GPA (charter schools are not required to provide grade or absence information to CPS, so this information is not contained in the datafiles). Removing

students who leave the district after ninth grade and before graduation, 58 percent of students from the original third-grade cohort graduated within five years. Finally, of the students from the focus cohort who graduated from CPS, 54 percent of students enroll in college within one year of high school graduation.

Table 2. Available Data for the Third-Grade Focus Cohort at Five Milestones

Time 1 Grade 3 ITBS Reading	Time 2 Grade 8 ITBS Reading	Time 3 Grade 9 Course Performance	Time 4 HS Graduation (within 5 years)	Time 5 College Attendance
25,948 first-time 3rd graders with ITBS reading scores from the level 9 (on-grade) test	17,289 students with 8th-grade ITBS reading scores	18,222 students enter 9th grade in fall 01, 02, 03, or 04 *14,044 students have course performance information	9,794 students (out of 17,016 active students) graduate in 5 years	5,270 students (out of 9,794 graduates) enroll in college within one year of graduation

The composition of the sample changed slightly over time. For the first three time points (third-grade, eighth-grade and ninth-grade), the proportion of most groups of students remains fairly consistent: just less than half of students are male, about 65 percent of students are African American, and 3 percent of students are of Asian descent. Fewer white students are in the sample in eighth grade than in third grade (8 percent compared to 12 percent) although the proportion of white graduates and college attendees increases later in time. More female students than male students in this sample graduated and attended college. Figure 1 shows the percent of male students and students in each of the major racial/ethnic categories at each time point.

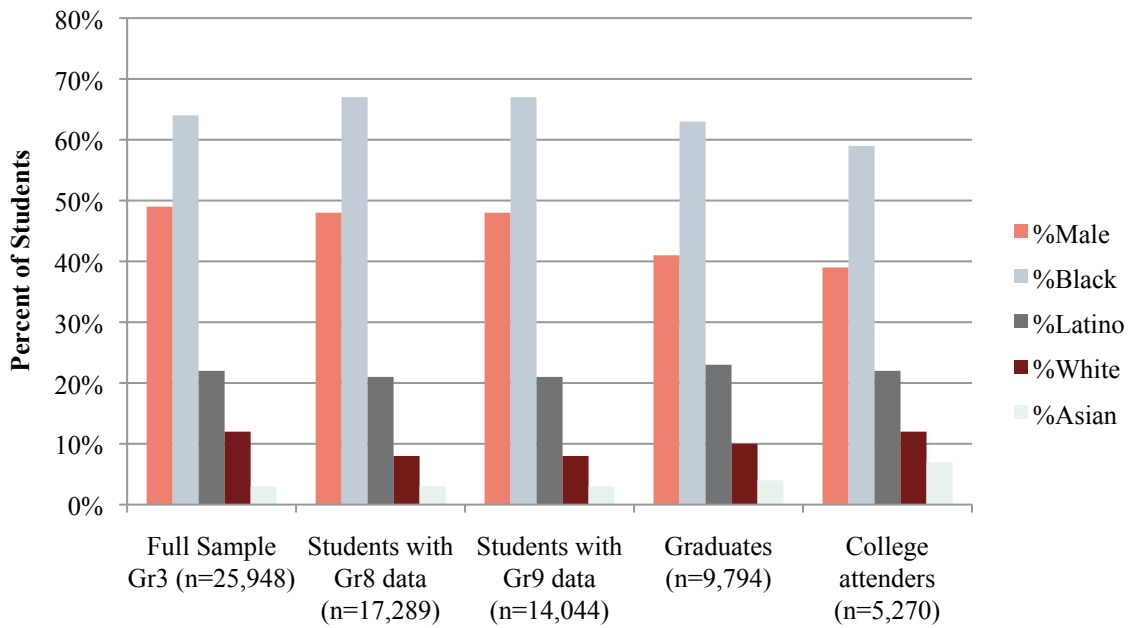Figure 1. Demographic Composition of the Original 3rd Grade Cohort Given Attrition Over Time


Figure 2 displays other changes in the sample over time. Fewer students with cognitive disabilities[5] and students who were ever in foster care are in the high school graduate sample as compared to the ninth-grade sample, which is generally similar to the third-grade sample. Furthermore, even fewer students with cognitive disabilities attend college.

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[5] Cognitive disabilities include the following special education categories: autism, emotional/behavioral disturbance, educably mentally handicapped, learning disability, severe/profound handicapped, speech/learning disability, traumatic brain injury, and tranable mentally handicapped.

Figure 2. The Percent of Students with Cognitive Disabilities and Foster Care Involvement Decreases in the Original 3rd Grade Cohort Over Time

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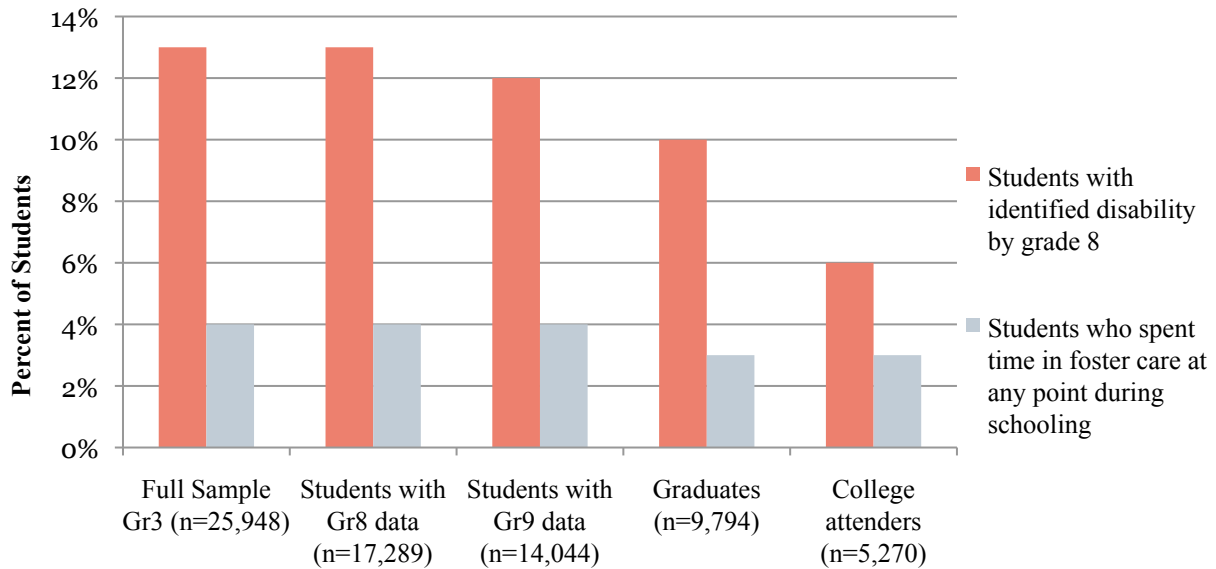
Analytic Approach

We first use descriptive statistics to show the performance of all students and students in foster care at five time points: grade 3, grade 8, grade 9, high school graduation, and college enrollment. First, crosstabs are used to describe the relationship between third-grade reading performance and: (1) high school graduation, (2) college enrollment, and (3) eighth-grade reading level, without accounting for any additional student or school characteristics. Next, multilevel regression models (students nested within schools) are used to estimate the gap in high school graduation rates, college enrollment rates, levels of ninth-grade course performance, and eighth-grade reading levels for students in the *below*, *at*, and *above-grade* reading level categories in third grade. Finally, we examine how this performance gap changes once we take into account differences in background characteristics, foster care involvement, neighborhood concentration of poverty, academic achievement (as measured by eighth-grade test scores and retention), and school effects.

Defining "On Grade Level"

For this analysis, we use two measures of performance from the Iowa Tests of Basic Skills (ITBS Tests). First, to define "on grade level," we rely on the national percentile ranks provided as part of the ITBS score reports. A student's national percentile rank reports the percent of students nationwide that received

lower raw scores. It shows the student's relative performance to a group of students who were in the same grade and who were tested at the same time of year as the student. Table 3 shows that students whose performance was lower than 75 percent of third graders nationwide (below the 25th percentile) were defined as *below grade level*. Students who fell in the middle or average range of national performance (25th-74th percentile) were defined as *at grade level*. Students scoring better than three-quarters of their peers on the level 9 version of the ITBS test were defined as *above grade level*.

Table 3. Defining Third-Grade Performance Using National Percentile Rankings

National Percentile Ranking	Grade Level Definition	Percent of All Students in Grade 3 Focus Cohort* (*n*=25,489)	Percent of Students in Foster Care in Grade 3 Focus Cohort* (*n*=1,103)
0-24	Below	38%	52%
25-74	At	50%	42%
75-100	Above	12%	6%

*Percentages do not add to 100% because of rounding.

Figure 3. The proportion of students who are *below*, *at*, and *above* grade level for reading varies for students in foster care, by gender and by race
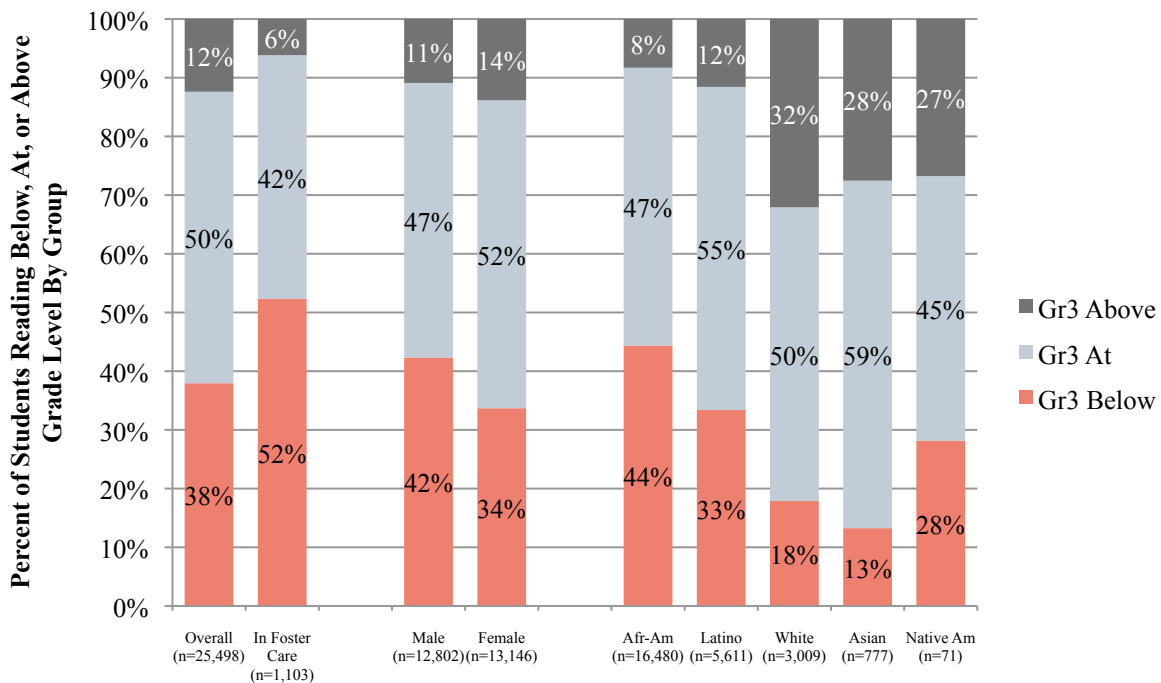
Although the number of actively enrolled students and the availability of data at key milestones decreases over time, and the proportion of students who are *below*, *at*, and *above* grade level is different by

subgroup (Figure 3), the proportion of students who are *below*, *at*, and *above* grade level who remain in the sample is consistent. Students leave the district from the *below*, *at*, and *above* reading level groups in fairly equal proportions. It is not until students leave as dropouts that the proportions of *below, at,* and *above* level active students begins to change.

Comparing Reading Performance Over Time

The second way that reading performance is measured in this work is by converting ITBS reading scores into Rasch scores. Rasch scores provide a more precise estimation of student performance and are in a scale that allows the measurement of academic growth over time. Rasch scores are independent of grade level, and range from third grade to eighth grade. Table 4 displays average student performance in Rasch scores. Rasch scores are in logits and difficult to interpret, but just by comparing the two means, it is clear that students in eighth grade are performing at a much higher level than students in third grade.

Table 4. Measuring Reading Performance using Rasch Scores

|	**Mean**	**SD**	**Min**	**Max**
Grade 3 Rasch Reading Score	-1.314	0.982	-3.958	3.161
Grade 8 Rasch Reading Score	1.397	1.155	-5.564	5.904

Unfortunately, we are unable to align ITBS scores with NAEP (National Assessment of Educational Progress) levels of proficiency in this work due to differences in test objectives, design, and scoring. ITBS is a battery of norm-referenced multiple choice tests given to students grades 3-8. Scores are based on the number of correct answers. NAEP tests contain both multiple choice and constructed response items given to a national sample of students in grades four and eight. Proficiency is based on criteria on which experts agree and define as an "overall achievement goal for American students," not "at grade" performance, according to the National Assessment Governing Board (NAGB), which oversees NAEP policies. The tests overlap in content, but are not aligned.

Results

## Relationships between Grade 3 Reading Level, High School Graduation, and College Enrollment

We began by looking descriptively at the experiences of third graders in our focus cohort to identify patterns of high school graduation and college attendance. Each set of bars in Figure 4 represents one of the three groups of students by third-grade reading level: students reading *below* grade level, *at* grade level, or *above* grade level and their outcomes for high school graduation. The first two bars on the left contain all of the students who were reading below grade level in third grade who were still in CPS as high school students. Approximately 45 percent of third-grade below-grade level students graduated in five years, compared to more than 60 percent of students who read at grade level in third grade and nearly 80 percent of students who read above grade level in third grade (orange bars). Nearly 55 percent of third-below-grade level students, 38 percent of at-grade-level students, and 20 percent of above-grade-level students did not graduate (gray bars).

Figure 4. Students at and above grade level for reading in grade 3 graduate at higher rates than students below grade level (Sample: 17,016 students active through high school).
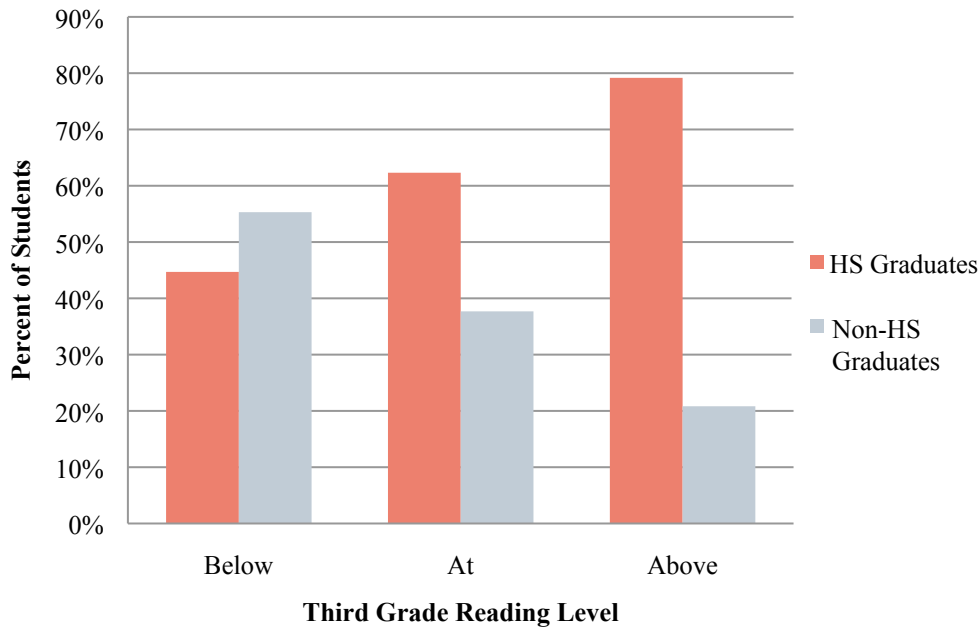
Similarly, Figure 5 shows that fewer than 20 percent of students who were below grade level in third grade enrolled in college, compared to about a third of students who were at grade level in third grade, and nearly 60 percent of students who were reading above grade level in third grade.   Given that the probability of attending college is much higher for students who graduate from high school, the gray bars in Figure 5 shows the relationship between third-grade reading level and college attendance only for CPS graduates. Even when looking only at high school graduates, students who were at or above grade level for reading in third grade still enrolled in college at higher rates than did students who were below grade level.

Figure 5. For both ninth graders and high school graduates, students at and above grade level for reading in grade 3 attended college at higher rates than students below grade level.
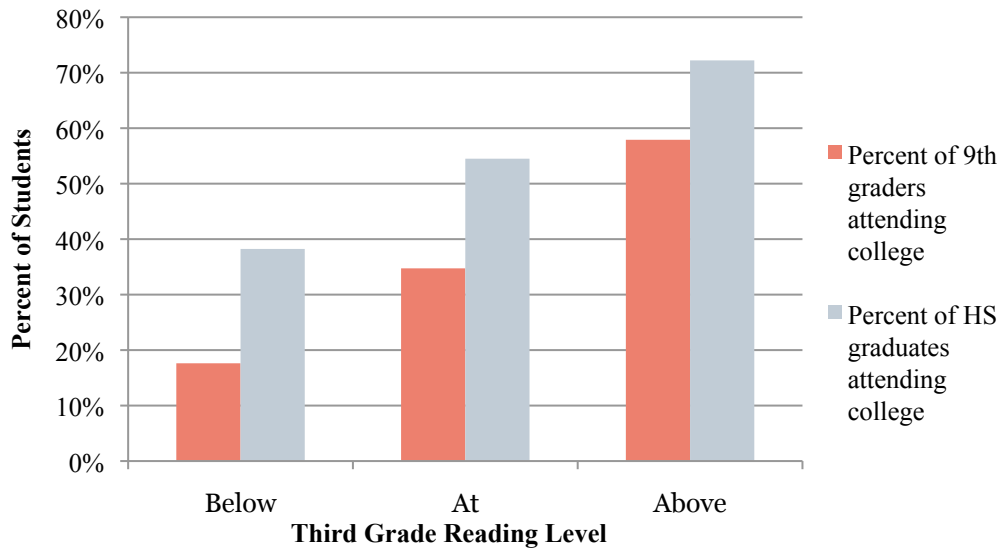
These results show an association between third-grade reading performance, high school graduation, and college attendance. In the next section, we explore the pathway by which third-grade performance influences graduation and college attendance. We present descriptive statistics followed by a series of multilevel models using third-grade reading level to predict eighth-grade reading performance, ninth-grade course performance (absences, course failures, and GPA), high school graduation, and college attendance, controlling for a series of covariates.

Using Third-Grade Performance to Predict Educational Outcomes

In the previous section, we saw that a child's third-grade reading level is related to future educational performance. Specifically, students who are above-grade-level in third grade in our sample graduated high school and attended college at higher rates than their peers who were at- or below-grade-level. In this section, we use multilevel regression models to examine the lasting effect of third-grade reading level on four educational outcomes, above and beyond the effect of demographic characteristics, foster care involvement, school effects, retention effects (repeating a grade or more in school), and eighth-grade reading performance (for outcomes 2-4 only). The four educational markers are: (1) eighth-grade reading level; (2) ninth-grade course performance (absences, GPA, and course failures); (3) high school graduation; and (4) college attendance.

Third-Grade Reading Level Is a Significant Predictor of Eighth-Grade Reading Performance

Although third-grade reading level does not determine eighth-grade performance, students in our sample who were at or above grade level in third grade were more likely to be at or above grade level in eighth grade. Of the students who were below grade level in third grade, about 40 percent were also below grade level in eighth grade. Correlational analyses between third- and eighth-grade reading scores reveal similar findings. Third- and eighth-grade Rasch reading scores for students in this sample are correlated at r=0.67. In other words, students with higher third-grade scores also have higher eighth-grade scores, and the strength of this relationship is moderately strong, as shown in Figure 6.

Figure 6. Most students who were below-grade-level in third grade were either below grade-level or at-grade level in eighth grade. (Sample: 17,289 students with 8th grade ITBS data)
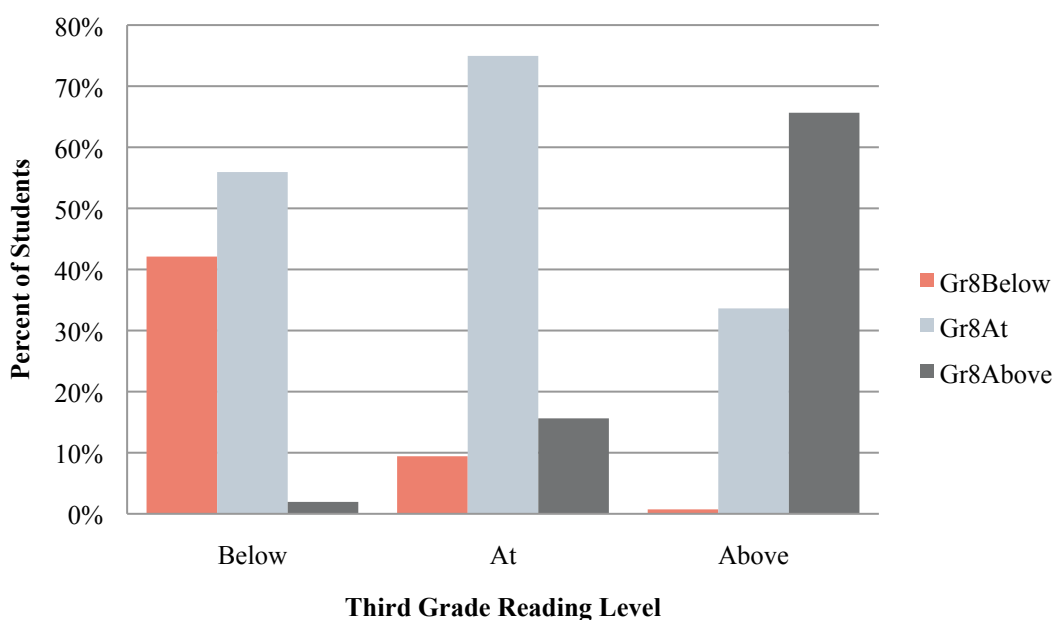

This finding is consistent with our understanding of the cumulative nature of education—a student's experience in each grade builds on experiences of the previous year. There is some movement in terms of improvement or decline for students who were at grade level in third grade, but little movement for students at the extremes. For example, the left set of bars shows that students who were below grade level in third grade were primarily below grade level (orange bar) or at grade level (light gray bar) in eighth grade. The far right set of bars shows that students who were above grade level in third grade were primarily above grade level in eighth grade as well (dark gray bar). Very few students in the eighth grade below-grade-level group fell from being above grade level in third grade (dark gray bar) and similarly,

very few students who were below grade level in third grade were above grade level in eighth grade (orange bar).

The next set of analyses utilized multilevel regression models with students clustered within schools. Using this approach, we found that third grade reading level is a significant predictor of eighth grade reading level even after controlling for demographic characteristics (sex, race, cognitive disability status, and foster care involvement) and the clustering of students in the school they attended in third grade. Figure 7 shows how the gap in eighth-grade reading scores for students in the *below, at,* and *above* grade groups decreases after controlling for school effects[6] and for demographic characteristics, but that significant differences in eighth-grade reading scores for students in the third grade *below*, *at*, and *above* grade level groups remain.[7]

Figure 7. Third-grade reading level remains a significant predictor of eighth-grade reading scores, even after controlling for third-grade school effects and demographic characteristics.

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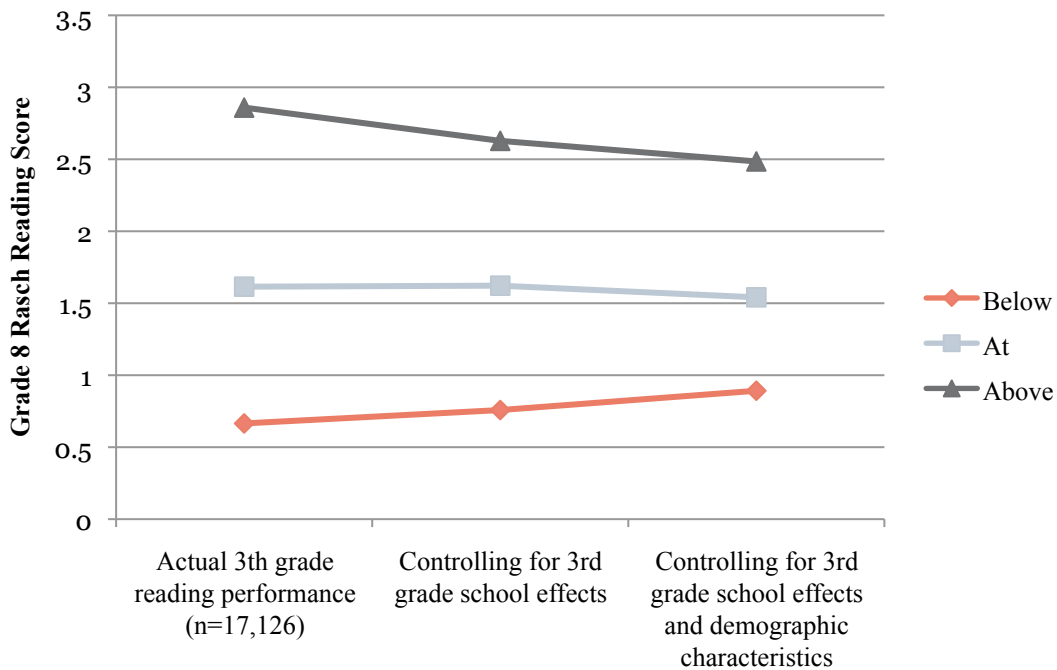
[6] In this study, we do not examine the specific characteristics of schools that may account for the differences in student performance across schools, but rather acknowledge that between-school differences exist and that the school that a student attends influences current and future performance.

[7] A description of the statistical models used and the results of the full models for all of the outcomes presented here can be found in Appendix A.

Eighth-Grade Reading Achievement and Ninth-Grade School Effects Account for Many of the Differences in Ninth-Grade Student Performance

Eighth-grade achievement is an important educational milestone for students. For students in this sample, eighth-grade test scores play a large role in determining which high school a student attends. Students who meet certain academic and attendance requirements are eligible to attend schools across the city, regardless of where they live. As a result, high-performing students (regardless of their elementary school location) tend to attend high-performing high schools. Similarly, low-performing students tend to enroll in lower-performing high schools. As a result of this high school sorting process, eighth-grade performance is extremely important.

In the next set of analyses, we show that third-grade reading performance is related to ninth-grade course performance, but differences in ninth-grade performance of students who were in the *below*-, *at*-, and *above-grade* reading levels in third grade can be explained by a student's eighth-grade reading test score and the ninth-grade school they attend. Figure 8 shows the differences in ninth-grade absences for students according to their third-grade reading level. Students who were reading *below grade level* in third grade (first orange diamond) missed an average of 15 days of school (or 3 weeks) per semester in ninth grade. Students who were *on grade level* in third grade (first light gray square) missed an average of 9 days per semester (about 2 weeks), and students who were *above grade level* in third grade (first dark gray triangle) missed an average of 1 week per semester. After we adjust these absence rates for demographic characteristics, the gap between the groups decreases slightly (second set of points). However, once we account for eighth-grade test performance, the gap in the number of absences between groups nearly disappears (third set of points), and once we account for ninth-grade school effects (the far right set of points), the difference between third-grade groups is completely explained.

Figure 8. Differences in demographic characteristics, eighth-grade reading scores, and ninth-grade school effects all contribute to explaining the difference in ninth-grade absences among students grouped by third-grade reading level.
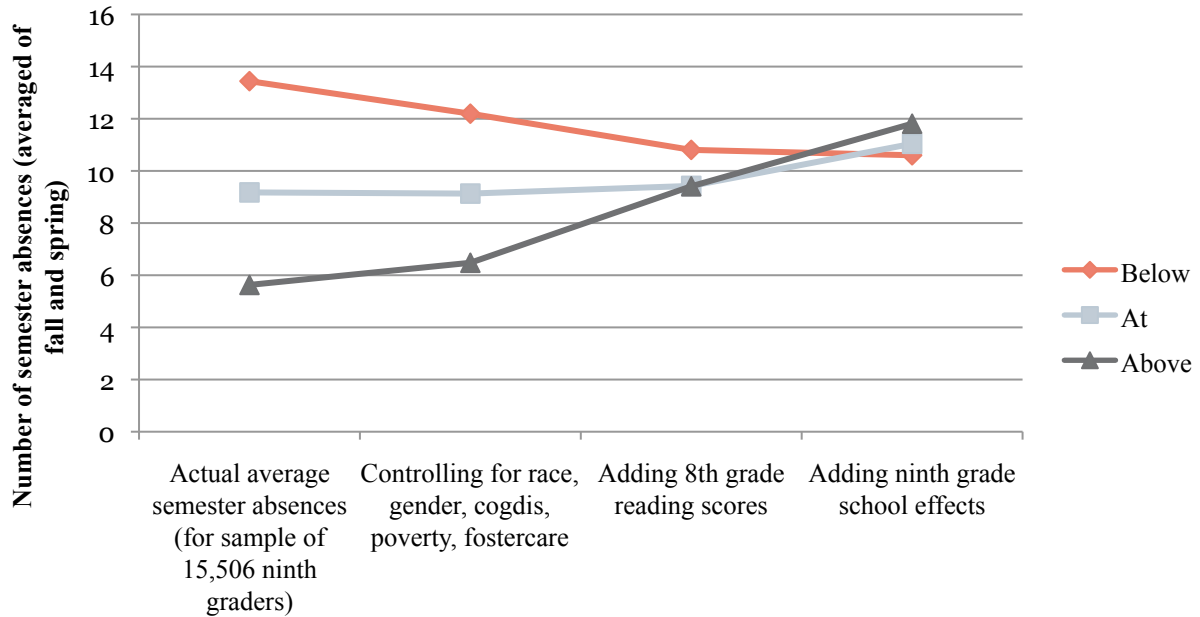
The importance of eighth-grade test scores and ninth-grade school effects is also affirmed for the two other indicators of ninth-grade course performance: course failures and GPA. Figure 9 shows the difference in the number of ninth-grade course failures for students in the below-, at-, and above-grade reading levels from third grade, and Figure 10 displays the differences in ninth grade GPA. Once again, demographic characteristics, eighth-grade reading scores, and ninth-grade school effects all help explain the large difference in performance for students grouped by third-grade reading level.

Figure 9. Differences in demographic characteristics, eighth-grade reading scores, and ninth-grade school effects all contribute to explaining the difference in ninth-grade course failures among students grouped by third-grade reading level.
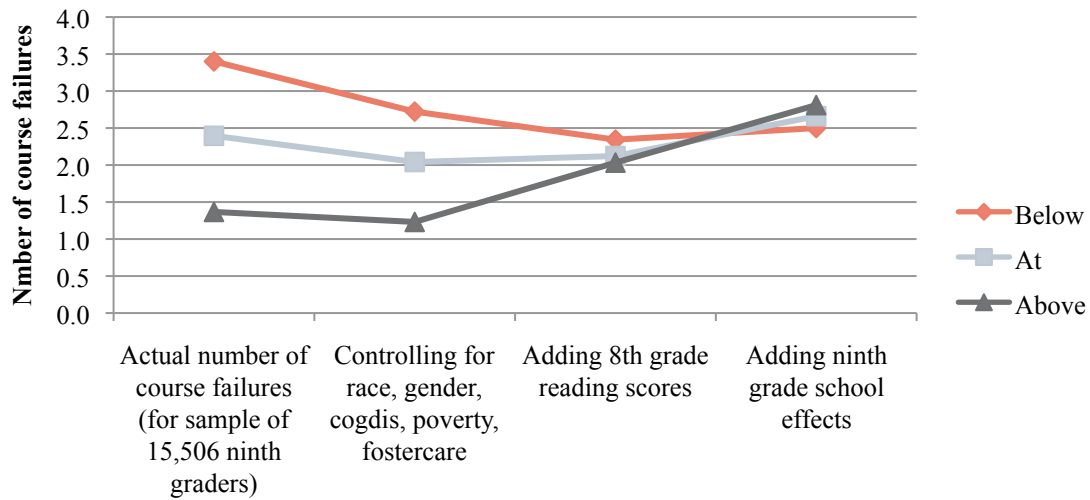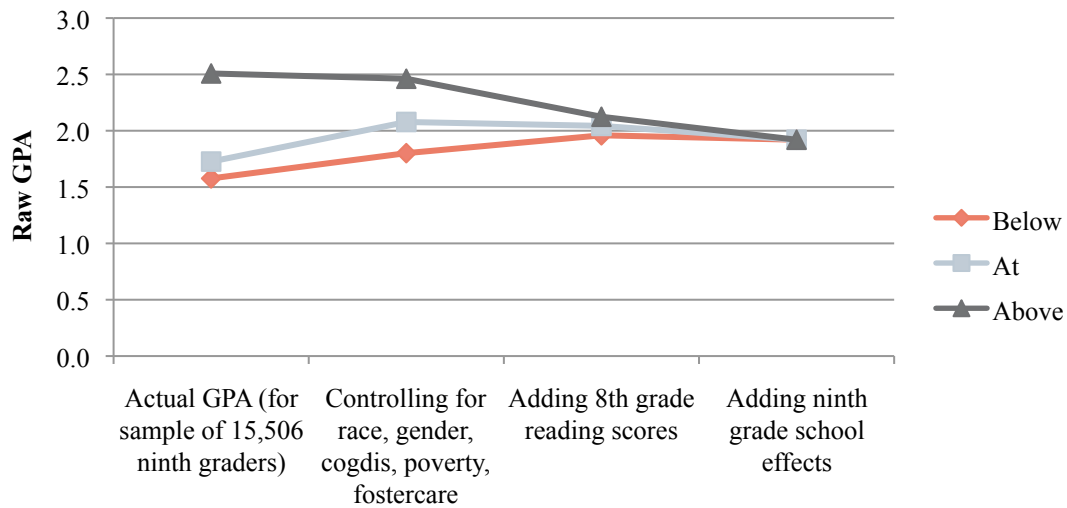

Figure 10. Differences in demographic characteristics, eighth-grade reading scores, and ninth-grade school effects all contribute to explaining the difference in ninth- grade GPA among students grouped by third-grade reading level.
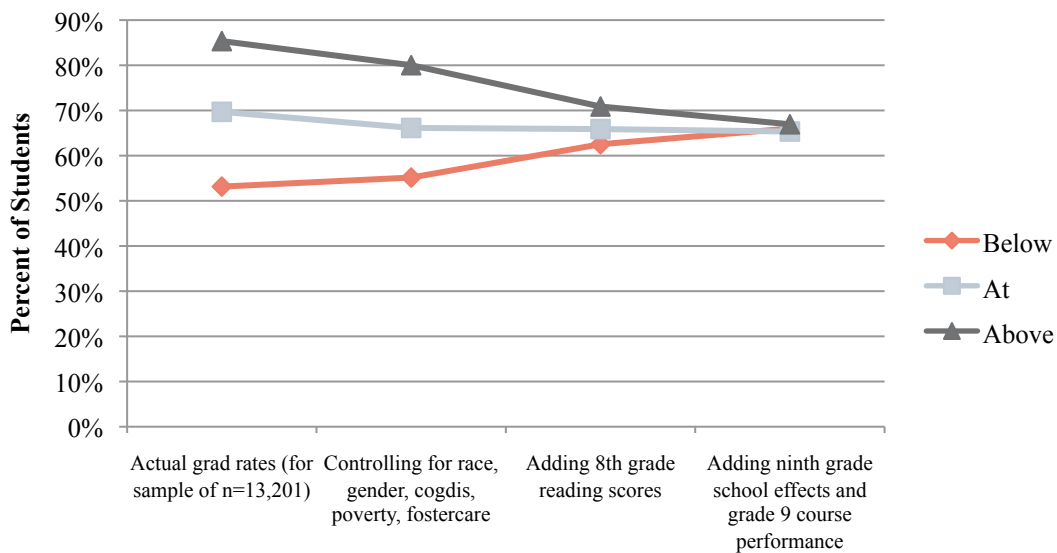
Eighth-Grade Reading Achievement and Ninth-Grade School Effects Explain Differences in Graduation and College Enrollment Rates

Thus far, we have followed the path of student educational experiences through high school completion and postsecondary education to show that third-grade reading level influences eighth-grade reading performance, and that eighth-grade reading performance influences ninth-grade course performance. In this section, we show that ninth-grade course performance influences high school graduation rates and college enrollment.

Figure 11 shows the results of four models that examine how graduation rates are adjusted after controlling for a series of covariates. The first points indicate the graduation rates for students by third-grade reading level. Consistent with the descriptive results presented above, students in the *below*, *at*, and *above* grad*e* level reading groups in third grade have significantly different graduation rates. Even after controlling for demographic characteristics (second set of points) and eighth-grade reading scores (third set of points), the difference in graduation rates remains. Only the addition of ninth-grade school effects and ninth-grade course performance completely explains the difference in graduation rates of students in these groups.

Figure 11. Eighth grade reading scores and ninth grade course performance account for the differences in graduation rates across students grouped by third-grade reading level

Similarly, eighth grade reading scores and ninth-grade experiences also account for the differences in college enrollment for high school graduates. Figure 12 shows that demographic characteristics and eighth-grade reading performance explain much of the difference between college enrollment rates across the third-grade reading levels. In the fourth set of points, ninth-grade school effects and course performance completely explain the gap between groups. Controlling for demographic characteristics, eighth grade reading scores, ninth-grade school effects and ninth grade course performance, college enrollment rates are similar for students who were *below*, *at*, or *above* grade level for reading in third grade.

Figure 12. Eighth grade reading scores and ninth grade course performance account for the differences in college enrollment rates for graduates grouped by third-grade reading level.
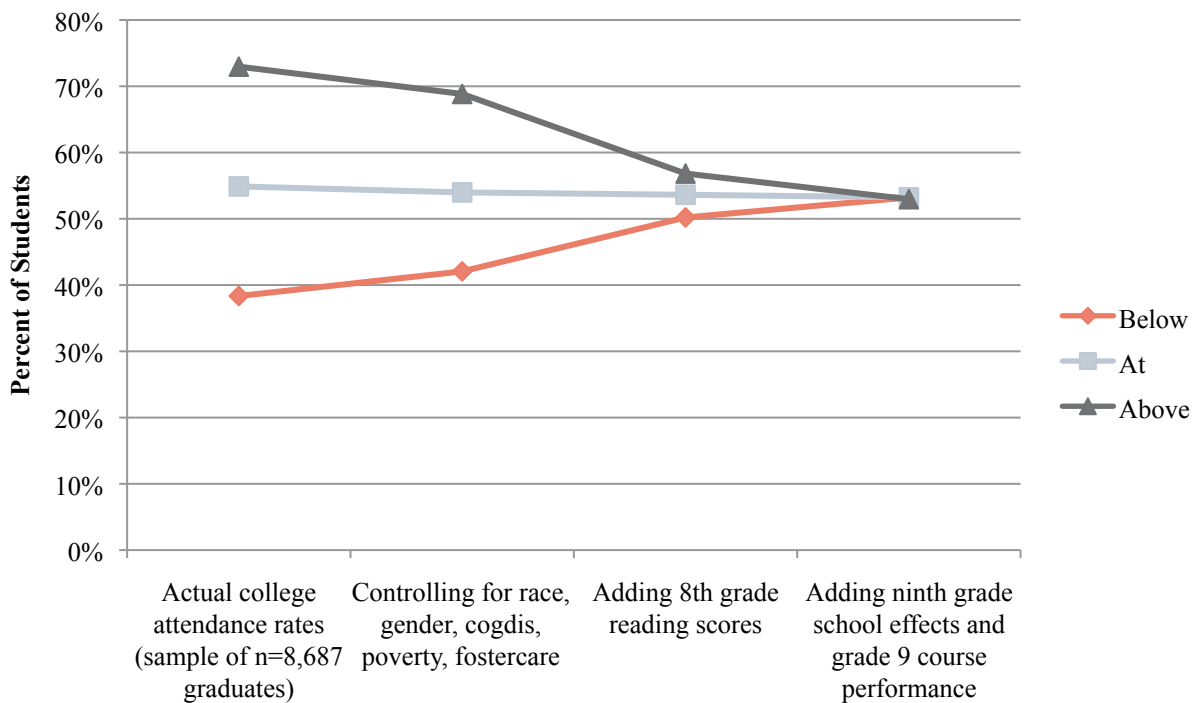
These results suggest that although third-grade reading level is related to eighth-grade reading level, which is related to ninth-grade school attendance and performance, ninth grade school performance plays the largest role in predicting college enrollment. In other words, students in all three groups (below, at, and above-grade level) in third grade have similar college enrollment rates after controlling for ninth grade course performance. Therefore, interventions that better prepare students for a successful ninth grade year are critical for future success.

Summary

Findings from this study are consistent with existing literature that emphasizes the importance of early reading ability for future educational success. Third-grade reading level was shown to be significant predictor of eighth-grade reading level and ninth-grade course performance even after accounting for demographic characteristics and how a child's school influences their individual performance. Third-grade reading level was also shown to be a predictor of graduation and college attendance, even when demographic characteristics were included as controls. However, the effect of third-grade reading level operates through eighth- and ninth-grade performance. When ninth-grade performance was included as a predictor, being below- or at-grade-level was no longer a significant predictor of high school graduation or college attendance. In terms of third grade reading level, only the *above-grade-level* group enrolled in college at significantly higher rates than *below-grade-level* students. Merely being *at-grade* level in third grade did not account for any additional variance in predicting college attendance beyond ninth- grade course performance. Furthermore, whether or not a student was ever in foster care had a small but significantly negative impact on eighth grade reading level, ninth grade course performance, and high school graduation. Even after considering background characteristics, poverty level, prior achievement and school effects, students who ever spent time in foster care - regardless of timing of entry, duration in care, or any other specification of that experience - have lower educational outcomes than their peers.

Although the findings presented here suggest a relationship between early performance and later outcomes, the results of this study are correlational, and therefore cannot determine whether low reading performance in third grade causes low future educational performance. Rather, it is more likely that other individual, family, and community factors contribute to both low reading performance and future educational outcomes for students, as suggested by the significant effect of foster care status on predicting student outcomes.

Future research should investigate the extent to which getting students to at- or above-grade reading levels in third grade is able to change the trajectory of student performance. Given the importance of ninth-grade performance in predicting graduation and college enrollment, children who are below grade level in third grade but catch up by ninth grade have a good prognosis for their future educational outcomes. Studying which interventions best help students prepare for a successful ninth grade year is therefore extremely important.

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Appendix A: Statistical Models and Results

We use a series of non-nested and nested models to estimate the gap among students in the below-, at-, and above-grade-level groups for a total of six outcomes: 1) eighth grade reading performance, 2) ninth grade absences, 3) ninth grade course failures, 4) ninth grade GPA (Grade Point Average), 5) high school graduation, and 6) college enrollment.

First, for the outcome of eighth grade reading performance (Figure 7), a non-nested regression model was used to estimate the initial gap among third grade reading level groups for predicting eighth grade reading level. Two two-level hierarchical linear models (HLM), where students are nested within third grade schools, were then used to estimate the gap among third grade reading level groups after accounting for third grade school effects and demographic characteristics (race, gender, poverty, cognitive disability, and foster care). Next, for the second, third, and fourth outcomes of ninth grade absences, course failures, and GPA (Figures 8 -10), non-nested regression models were used to estimate the initial gap among third grade reading level groups; the gap that remains once we take into account background characteristics; and the remaining gap after taking into account eighth grade test scores. A two-level HLM, where students are nested in high schools, was then used to take into account ninth grade school effects.

For the fifth outcome of high school graduation (Figure 11), logistic regression models were used in the same way described above for outcomes 2-4, with the addition of ninth grade course performance variables included in the final HLM. Finally, for the sixth outcome of college enrollment (Figure 12), the same models were used as for high school graduation, but only high school graduates were included in the sample.

The HLM models included the same variables used in the non-nested models – including dummy variables identifying gender, race, cognitive disability classification during high school, and whether the student was ever in foster care. Other variables included neighborhood poverty and (for models 4 and 5) variables describing ninth grade absences, course failures, and GPA. In addition, eighth grade ITBS scores in reading (in Rasch units) are included to estimate the gap after taking into account prior achievement. For the models predicting outcomes 5-6, a Bernoulli HLM model was used to estimate the results due to the binary values of the outcome variables. All of the variables in the HLM models were grand mean centered. Only the intercept was allowed to vary randomly at Level 2. Tables 5-7 display the coefficients from the full models predicting each of the six outcomes.

Table 5. Coefficients from Full Models Predicting Eighth Grade Reading and Ninth Grade Absences

	Eighth Grade Reading (in Rasch Units)		Absences	
	Coefficient (Logits)	**T-Ratio**	**Coefficient**	**T-Ratio**
Intercept	1.406	0.015***	10.598	0.402***
Reading At Grade Level in Third Grade	0.649	0.016***	0.438	0.204*
Reading Above Grade Level in Third Grade	1.593	0.029***	1.210	0.316***
Male	0.014	0.013	1.223	0.163***
White	0.383	0.032***	0.480	0.456
Native American	0.263	0.115*	-0.217	1.473
Asian	0.517	0.048***	-3.173	0.669***
Latino/a	0.271	0.022***	-0.620	0.349^
Cognitive Disability	-0.889	0.028***	1.195	0.305***
Concentration of Poverty	-0.061	0.012***	0.695	0.195**
Ever in Foster Care	-0.088	0.032**	1.184	0.525*
Eighth Grade Reading ITBS score			-1.514	0.143***
Entered 9th grade in 2001			1.993	1.165^
Entered 9th grade in 2003			3.732	0.468***
Entered 9th grade in 2004			6.078	1.746**
	^ p<.10, * p<.05, ** p<.01, *** p<.001			
Sample Size	17,055		15,506	

Table 6. Coefficients from Full Models Predicting Ninth Grade Course Performance

	Course Failures		GPA	
	Coefficient	**T-Ratio**	**Coefficient**	**T-Ratio**
Intercept	2.503	0.095***	1.922	0.028***
Reading At Grade Level in Third Grade	0.165	0.059*	-0.012	0.018
Reading Above Grade Level in Third Grade	0.312	0.109*	-0.024	0.030
Male	1.078	0.066***	-0.405	0.017***
White	-0.101	0.176	0.210	0.050***
Native American	-0.402	0.527	0.360	0.123**
Asian	-1.178	0.227***	0.820	0.073***
Latino/a	-0.223	0.117^	0.164	0.039***
Cognitive Disability	-0.068	0.115	0.025	0.031
Concentration of Poverty	0.188	0.062**	-0.058	0.013***
Ever in Foster Care	0.646	0.160***	-0.134	0.037***
Eighth Grade Reading ITBS score	-0.544	0.045***	0.225	0.012***
Entered 9th grade in 2001	0.345	0.382	-0.104	0.083
Entered 9th grade in 2003	1.099	0.135***	-0.255	0.029***
Entered 9th grade in 2004	1.944	0.623**	-0.530	0.125***
	^ p<.10, * p<.05, ** p<.01, *** p<.001			
Sample Size	15,506		15,506	

Table 7. Coefficients from Full Models Predicting High School Graduation and College Enrollment

	High School Graduation		College Enrollment (among HS graduates)	
	Coefficient (Logits)	T-Ratio	Coefficient (Logits)	T-Ratio
Intercept	0.817	0.066***	0.016	0.056
Reading At Grade Level in Third Grade	-0.589	0.070	0.025	0.061
Reading Above Grade Level in Third Grade	0.084	0.106	0.003	0.081
Male	-0.235	0.048***	-0.233	0.046***
White	-0.278	0.106*	-0.130	0.118
Native American	-0.405	0.443	1.067	0.459*
Asian	-0.193	0.190	0.981	0.143***
Latino/a	-0.209	0.082*	-0.198	0.070**
Cognitive Disability	0.042	0.085	-0.096	0.085
Concentration of Poverty	-0.041	0.041	-0.100	0.039*
Ever in Foster Care	-0.391	0.117**	0.052	0.131
Grade 8 Reading ITBS score	0.066	0.037^	0.377	0.030***
Entered 9th grade in 2001	-0.059	0.239	-0.405	0.289
Entered 9th grade in 2003	-0.166	0.094^	-0.209	0.070**
Entered 9th grade in 2004	-0.993	0.560^		
9th grade Absences	-0.093	0.006***		
9th Grade Raw GPA	1.296	0.049***		
	^ p<.10, * p<.05, ** p<.01, *** p<.001			
Sample Size	13,201		8,687	

Note: Coefficients from logistic regression models are displayed in logits. In order to calculate the corresponding probability value for the coefficient, the value must be exponentiated using the formula EXP/1+EXP. This is how the actual graduation rates for each of the three groups was calculated in the first set of points in Figures 11 and 12. Because of the non-linear conversion from logits to probabilities, however, simply adding the coefficients of interest to the intercept (regardless of centering) and converting those logits to probabilities will result in incorrect predictions. Therefore, in models 2-4 (sets of points 2-4), we calculate graduation rates for the "typical" student in each of the three groups, where typical is defined by the variables included

in the model. To do so, we used the Level 1 residual file from each model to created an adjustment for each group's fitted value that takes into account the proportion that each group (below, at, above) represents of the full sample.