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The Predictive Power of Ninth-Grade GPA



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Introduction

High schools in Chicago Public Schools (CPS) emphasize the importance of freshman year, specifically the need for students to earn passing grades. There are two important aspects of this focus: its emphasis on freshman year, and its targeting of grades rather than test scores. A large body of research supports this approach. Much of the research has been conducted in Chicago, but has also been widely replicated across the country.¹

Overall, the research on high school grades suggests that grades are not only good predictors of important future outcomes—such as high school graduation, college enrollment, and even college graduation—but they are also better predictors than standardized test scores.² Among researchers, it is now widely accepted that grades reflect multiple factors valued by teachers, and it is this multidimensional quality that makes grades good predictors of important outcomes.³ In addition to student achievement, grades may reflect such qualities as behavior, attitude, willingness to attend class and turn in assignments, and other indicators of effort.

Grades serve many purposes as indicators of student performance and aptitude. Schools may use grades to assign students to subsequent courses (e.g., honors or regular classes), to bestow recognition on high-performing students, or to direct additional resources to struggling students. Colleges certainly take grades into account when making admission and scholarship decisions—both explicitly through GPA, and often through class rank calculations based on relative GPA in high school.

Despite the evidence in favor of grades and their widespread use, there are lingering concerns about grades expressed by both educators and researchers. For example, grades are thought to be more subjective than test scores, since tests are administered under standardized and consistent conditions. There are also concerns that grades reflect differences among individual teachers and schools rather than differences in student performance, suggesting that grades from one school or one teacher do not hold the same meaning as grades from another school or another teacher. In addition, attention to grades may result in grade inflation as teachers and schools feel pressure to raise students' grades.

CPS's special attention to the importance of the freshman year in high school has a relatively long history. Research conducted at the University of Chicago Consortium on School Research (UChicago Consortium) noted that the ninth grade can be a “make or break” experience for students.⁴ Given the right set of positive experiences during the freshman year, students with relatively weak elementary school records can turn around, do well in high school, and go on to

1 Allensworth & Easton (2005); Allensworth & Easton (2007); Bowers, Sprott, & Taff (2013).

2 Bowen, Chingos, & McPherson (2009); Roderick, Nagaoka, Allensworth, Coca, Correa, & Stoker (2006); Bowers et al. (2013).

3 This is one conclusion of a recent review of grading research. Brookhart et al. (2016).

4 Allensworth & Easton (2005); Allensworth & Easton (2007).

graduate. At the same time, students who enter high school with strong track records in the middle grades can falter and end up doing poorly, even dropping out. The research showed that freshman year experiences are pivotal and success is highly dependent on factors like high attendance in school and avoiding failures in coursework. Students' grades play a major role in determining whether they are on-track to graduate or not. Students who earn five full-year credits and do not receive more than one semester F in a core subject⁵ are deemed to be on-track to graduate from high school, whereas students with more than one core subject semester F are not on-track. The simple Freshman OnTrack indicator sets a low bar for success in the freshman year, yet, it is highly predictive of high school graduation four or five years later.⁶

In CPS, the interest in freshman year is reflected by the inclusion of the Freshman OnTrack indicator in the School Quality Report Card, which makes it part of school accountability and visible to prospective parents and students in a school district with a lot of school choice. In the early years of the Freshman OnTrack indicator, CPS developed a rapid reporting system to alert schools of students with attendance problems and low grades in the first quarter of the freshman year. Some schools appointed "on-track coaches" to intervene with at-risk students with tutoring programs, buddy systems, after-school help sessions, and a wide range of locally developed supports.

Recent evidence suggests that the district's attention to improving freshman grades has paid off. Citywide on-track rates have risen considerably and these higher on-track rates have been followed by higher high school graduation rates. For example, for students who entered CPS non-charter high schools in 2009, 71 percent were on track at the end of their freshman year, and 75 percent graduated five years later in 2014.⁷ This compares to on-track and subsequent graduation rates of 60

percent six years earlier. For the most part, the students who are on-track in their freshman year are the ones who graduate four or five years later. Although there are no studies that show a causal relationship between being on-track and graduating from high school, the correlational evidence shows a strong relationship.

Part of high schools' focus on Freshman OnTrack has been a strong emphasis on earning high grades in ninth grade. Perhaps because of this focus, ninth graders' GPAs increased districtwide for over the last ten years. There is a need to better understand these GPA increases. Additionally, as noted above, many people have concerns about the validity of ninth-grade course grades as indicators of later achievement. In the face of these concerns and changes, there is a need to confirm that the relationship between grades and future academic success still hold under current practices.

This study examines the degree to which ninth-grade GPA predicted later outcomes, using rigorous statistical models that took into account differences in grading practices across schools and cohorts, as well as the background characteristics of students entering CPS high schools. We examine how GPAs changed over time, and examine GPA differences among students with varying demographic and academic backgrounds, as well as across the range of CPS high schools. We also look closely at how grades were related to test scores to address questions about the subjectivity of grades. By learning more about the relationship of grades to test scores, we can understand whether they are measuring the same or a different set of skills.

The study focuses exclusively on freshman grades—not because grades in other years of high school are less important, but because of the current widespread interest in CPS and other districts on the freshman year. It is also important given the evidence suggesting that ninth grade is a critical juncture for students that strongly influences future patterns of success or failure.

5 English, math, science, and social studies.

6 Bowers et al. (2013).

7 Allensworth, Healey, Gwynne, & Crespin (2016).

This study addresses three sets of research questions that are motivated by the interest in grades as predictors of important outcomes, as well as by lingering concerns about the possibility of grade inflation and other unintended consequences caused by the focus on grades:

1. Trends and Patterns in Freshman GPA

What is the distribution of freshman GPA in CPS?

How has the distribution changed over time, specifically during a period where CPS had policies focused on freshman GPA? How do GPAs differ from one high school to another? How are GPAs related to student characteristics, including gender, race, economic background, prior test scores, and high school course-taking?

2. Freshman GPA as Predictor of Later Success

How well do freshman GPAs predict important student outcomes like high school graduation and college enrollment? In comparison to achievement test scores, are freshman GPAs good predictors of these outcomes?

3. Freshman GPA as a Measure of Student Achievement

To what extent do freshman GPAs measure student learning? In other words, are freshman GPAs related to student test score performance following the freshman year?



Study Background

Data Used in this Study

This study analyzed administrative data from CPS, including students' enrollment records (their school and grade level); background information (race, gender, neighborhood poverty level,^A and special education status); standardized test scores from both elementary and high school; and high school grades and transcripts. In addition, CPS provided access to National Student Clearinghouse data on college enrollment, so that we could determine college enrollment (both two-year and four-year colleges) and retention.

Description of the Sample in this Study

In this study, we analyzed the freshman-year grades of 187,335 students who were first-time freshmen in eight entering cohorts in non-charter, non-alternative

CPS high schools from fall 2006 through fall 2013. Charter high schools were not included because transcript and grade data was not available.^B We then followed these same students for up to six years.^C As shown in **Table 1**, the size of the cohorts decreased each year, from 27,049 first-time freshmen in 2006 to 20,212 in 2013. At least two factors were behind this change: The overall school population in Chicago declined over this period, and at the same time, charter school enrollment increased. While the size of the freshman cohorts was declining, the racial/ethnic composition also changed significantly. In 2006, 51 percent of freshmen were Black, 37 percent Latino, 9 percent White, and 3 percent Asian. In 2013, almost half of the freshmen (46 percent) were Latino and 37 percent were Black. White and Asian enrollment was about the same, at 10 percent and 5 percent, respectively.

TABLE 1

Enrollment Declined in CPS High Schools, As a Larger Share of Latino Students and Smaller Share of Black Students Enrolled

Characteristics of Ninth-Grade Cohorts at Non-Charter High Schools								
Enrollment	2006	2007	2008	2009	2010	2011	2012	2013
Total Enrollment	27,049	25,357	26,046	23,827	22,190	21,757	20,897	20,212
Black	51%	49%	49%	44%	41%	39%	38%	37%
Latino	37%	38%	38%	42%	44%	45%	46%	46%
White	9%	9%	8%	9%	9%	9%	9%	10%
Asian	3%	4%	4%	4%	4%	4%	4%	5%

Note: Students included in the sample were first-time ninth-graders who attended non-charter, non-alternative CPS high schools. Overall enrollment declined partially due to increases in charter school enrollment, and charter schools do not report grades to CPS. In later years, percentages may not add up to 100 because CPS introduced the option for students to identify as multiracial.

A In the absence of individual-level information on family income and resources, the UChicago Consortium generates two measures of poverty based on the census block groups where individual students live. The first measure is of the concentration of poverty in the census block. It is a linear combination of the percent of adult males unemployed and the percent of families with incomes below the poverty line, as reported in the 2009 American Community Survey (part of the U.S. Census). The second measure captures information about the social status in the census block group in which the student lives, the mean level of education of adults, and the percentage of employed persons who work as managers or professionals. These measures provided more detail and more variability

than the more commonly used free- and reduced-price lunch counts.

B The Consortium uses student transcript data provided by CPS, which does not include charter school grades.

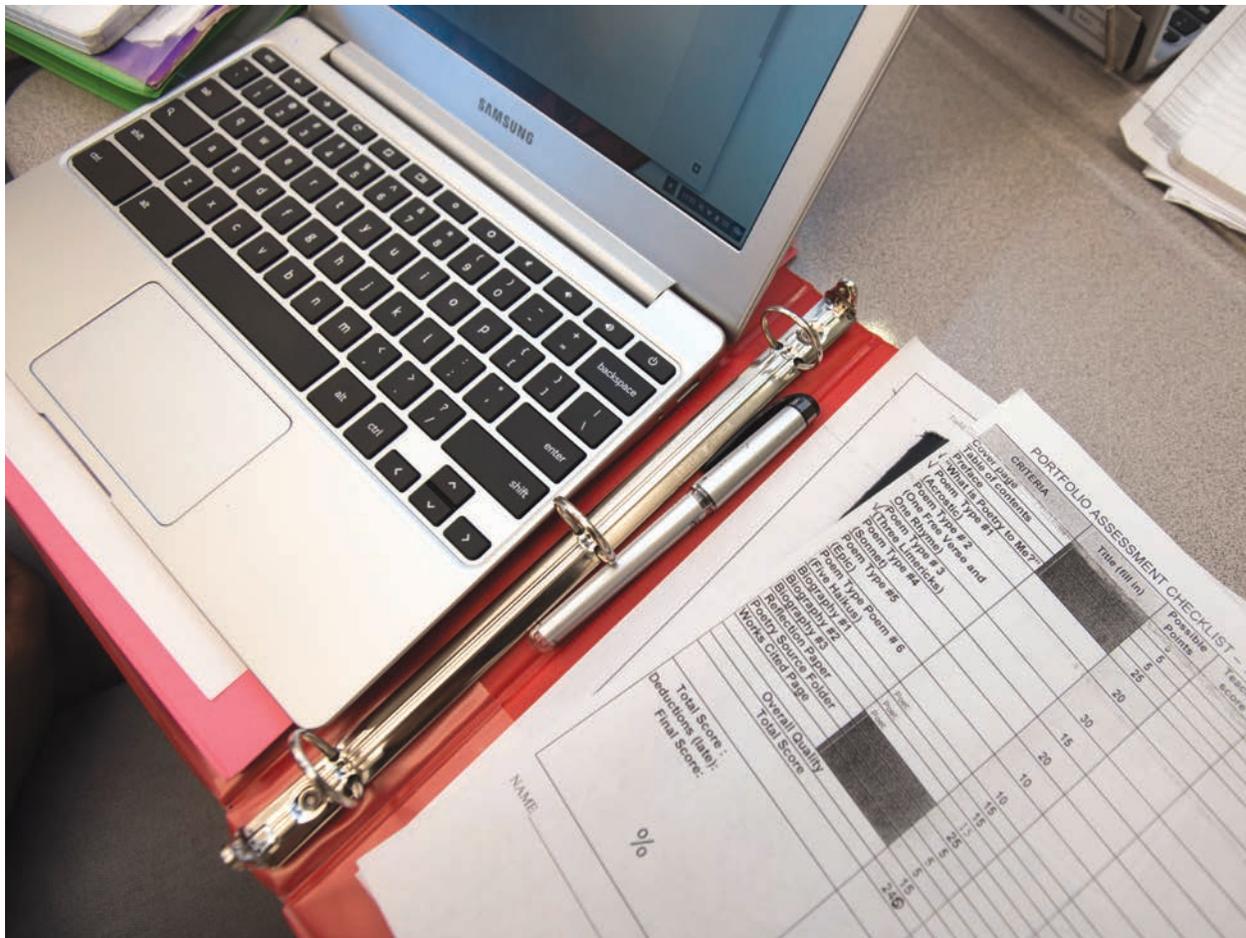
C Not every one of the eight cohorts is included in every analysis in this report, depending on whether or not the students experienced the outcome as this report was prepared. For example, the 2013 cohort had not graduated, so they were not included in the analyses of high school graduation, college enrollment, and college retention. In addition, we sometimes report only the most recent cohorts, as they are most relevant to policymakers and practitioners. We do, however, examine patterns over time to see whether they have changed or not. **See Table A.1. in Appendix A.**

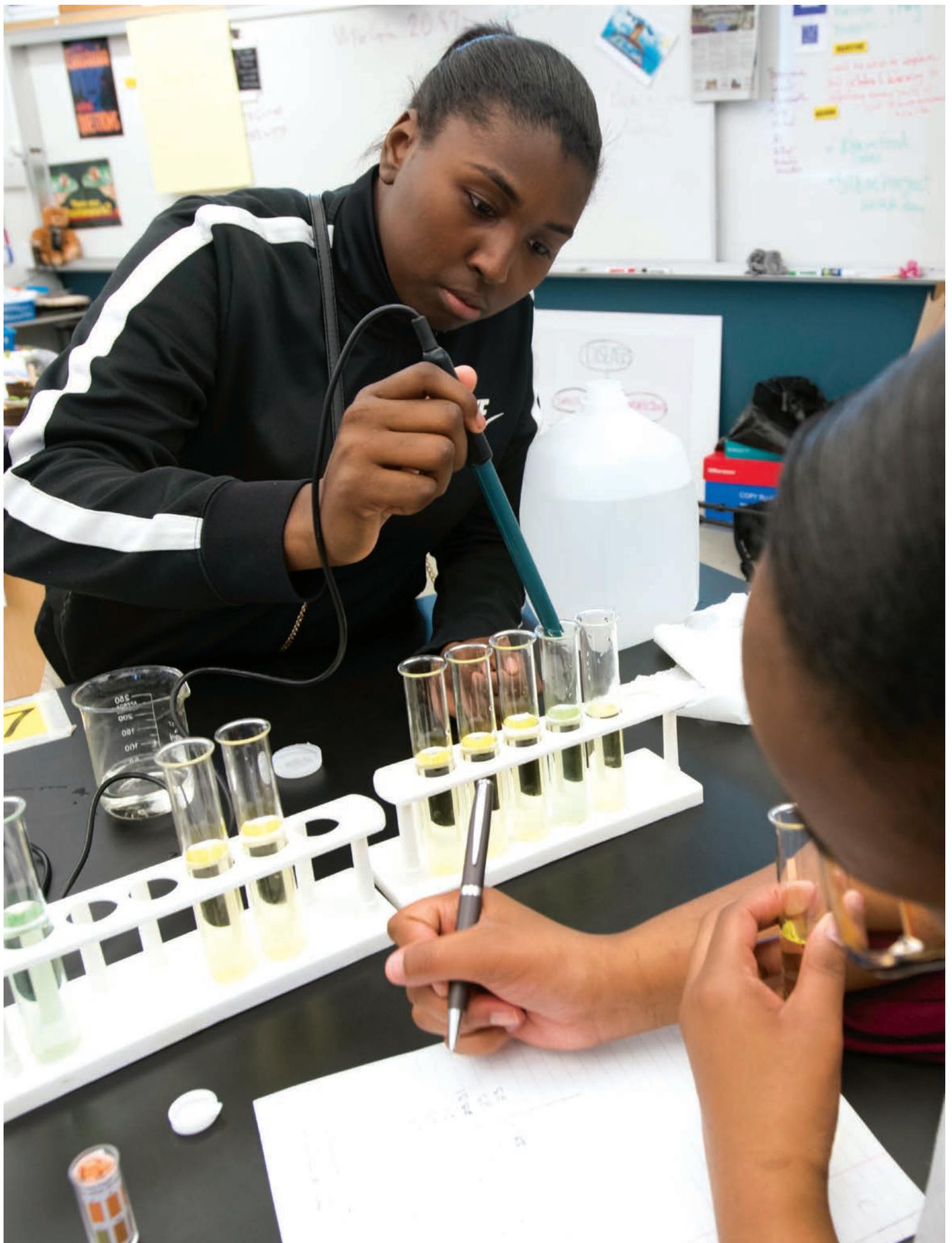
How We Calculate GPA

To calculate students' GPAs, we averaged together all first and second semester grades in English, math, science, and social studies, assigning a value of 4 to As, 3 to Bs, 2 to Cs, 1 to Ds, and 0 to Fs. There was no special weighting for honors or other advanced classes. Forty-two percent of freshmen had eight grades (four core courses in each of two semesters) contributing to their freshman GPA. Because of double-period math classes and other extra course work in the four major subjects, 31 percent of students had 10 courses contributing to their freshman GPA, and 10 percent had 12 courses. The remaining 17 percent of students took other numbers of semester core courses. To conduct our statistical analyses, we created categories of GPAs that we have labelled A, B,

C, D, and F. Each category is actually a range of GPAs: The F category includes GPAs from 0.00 to 0.49; D is 0.50 to 1.49; C is 1.50 to 2.49; B is 2.50 to 3.49, and A is 3.50 to 4.00. A student who took eight semester courses in the core subjects and received two As, three Bs, two Cs, and one D would have a GPA of 2.75, which falls in the B category.

In calculating these GPAs, we noticed that students who get high or low grades in one subject tend to get similarly high or low grades in other subjects. There are exceptions, but the general pattern shows consistency in grades across subjects. The correlations among the subjects range from a low of 0.70 (between math and social studies grades) to a high of 0.75 (between English and social studies grades).





Trends and Patterns in Ninth-Grade GPA

This chapter provides an overview of the GPAs that freshmen receive in CPS—how grades have changed over time, how grades differ across schools, and how grades differ for students with different characteristics. Here, we look at unadjusted GPAs; that is, we do not account for any other factors that may influence GPA. This straightforward, descriptive approach enables a basic understanding of the facts about GPA that then motivate the more probing analyses later in this report.

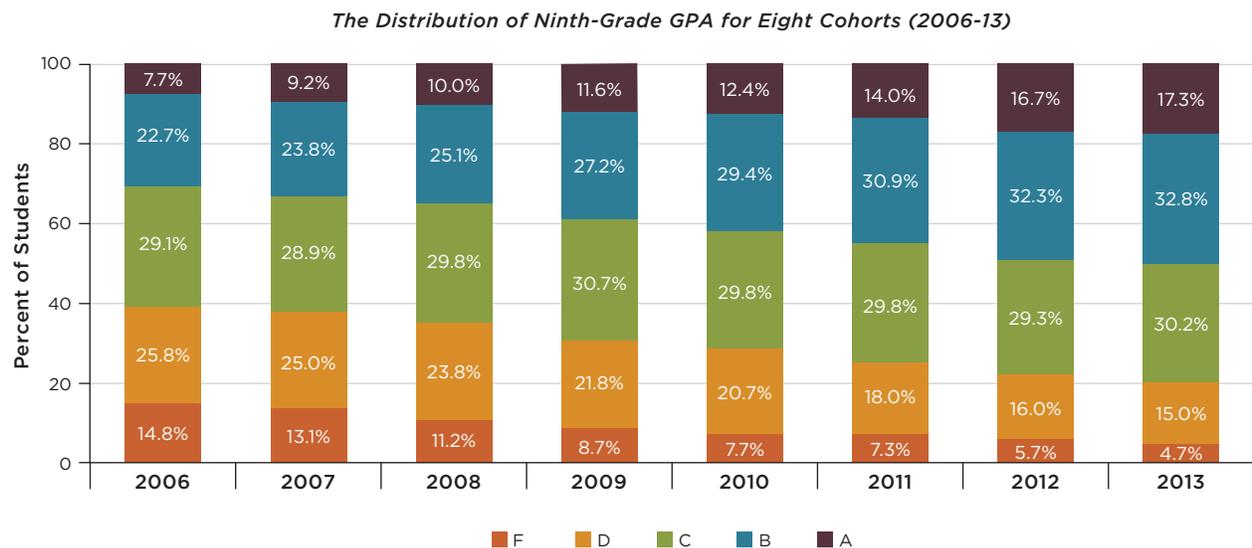
The analyses showed that GPAs have been increasing in CPS over time and that there are substantial differences among students by school, gender, race/ethnicity, test scores prior to entering high school, socioeconomic status (SES), and the level of the course (e.g., honors vs. regular courses). These differences are important in their own right and they play a crucial role in the later investigation of the predictive power of grades, as we strive to capture the unique aspects of grades that are independent of these other factors.

Ninth-grade GPA has risen steadily in CPS since 2006

GPAs improved steadily during this time frame. In 2006, 30.4 percent of students earned a GPA of A or B. The distribution of grades shifted dramatically by 2013, when 50.1 percent of students earned an A or B GPA. As there are more and more As and Bs, there are as many fewer Ds and Fs. Over 40 percent of freshmen in the 2006 cohort had GPAs of F and D; in 2013, fewer than 20 percent of freshmen did. The pattern is very marked: There are more A and B students each year over this eight-year span and fewer D and F students. Interestingly, the percent of C students is constant at about 30 percent. See Figure 1 for details.

There are many possible explanations and, very likely, multiple, interconnected reasons why grades have improved over time. Often, people worry that when grades rise there could be grade inflation. Under pressure to improve Freshman OnTrack rates, teach-

FIGURE 1
Grades in CPS Increased over Time



Note: These are unadjusted differences (no controls for other variables). Students included in the sample were first-time ninth-graders who attended non-charter, non-alternative CPS high schools.

ers and schools could have simply given higher grades. Alternatively, the improvements could all be due to improved student achievement and behavior or to demographic changes. We are not attempting to explain why freshmen GPA increased over this time, both because that would be a very complex undertaking and because it is not the main purpose of this report. Other researchers have examined trends in high school GPA from nationally representative data sets and observed increases from 1982 to 2004.⁸ GPA continued to predict college enrollment despite the increases. In fact, GPA became a stronger predictor of college enrollment in the study using the national data sets.

The increase in freshmen GPAs in CPS is highly consistent with other positive trends. For example, the eighth-grade test scores of entering freshmen have also steadily increased over this period (see Table 2), suggesting that students are entering high school better prepared academically. In the 2006 freshman cohort, the average eighth-grade combined reading and math test score⁹ was 251.5, and in the 2013 freshman cohort

it was 260.9, an increase equal to 0.54 standard deviations.¹⁰ Scores on tenth-grade PLAN increased from 15.1 in the 2006 cohort to 16.9 in the 2011 cohort (the last year it was given), which is another indication that students are performing better in ninth grade. Eleventh-grade ACT also improved considerably, from 17.1 in the 2006 freshman cohort to 18.8 in the 2012 freshman cohort. Similarly, student attendance improved and the number of suspensions declined (leading to an increase in instructional time).

Since there is a consistent pattern of improving achievement on multiple measures among CPS students in their freshman and subsequent years, we feel confident that at least part of the improvement in GPA can be attributed to improved achievement and academic success, and not solely to grade inflation. A previous Consortium study also concluded that improved graduation rates in CPS could be largely attributed to real improved performance of students in high schools according to several different measures.¹¹

TABLE 2
Ninth-Grade Test Scores, Attendance, and Behavior Improved over Time

Ninth-Grade Cohorts Entering Non-Charter High Schools 2006-13								
Test Scores	2006	2007	2008	2009	2010	2011	2012	2013
8th-Grade Test	251.5	252.0	245.0	251.9	254.8	257.5	259.8	260.9
PLAN Fall	15.1	15.4	15.3	15.7	16.3	16.9		
ACT	17.1	17.9	17.8	18.3	18.3	18.7	18.8	
Attendance								
95% to 100%			56%	64%	66%	67%	67%	67%
Below 80%			6%	4%	3%	3%	3%	2%
Behavior								
Any Suspensions			30%	31%	27%	26%	27%	24%
Multiple Suspensions			17%	19%	15%	15%	16%	14%

Note: Students included in the sample were first-time ninth-graders who attended non-charter, non-alternative CPS high schools.

⁸ Pattison, Grodsky, & Muller (2013).

⁹ We use a predicted test score created from a student's entire test score trajectory during elementary school. The model controls for the student's age (and age squared to account for non-linearity) at the time of the test, cumulative number of times the student was retained, cumulative number of times the student skipped a grade, the school, and the student's cohort. The main advantages of using the predicted score are

(a) it is less subject to noise and random fluctuations than the observed test score, and (b) we have a prediction for any student who did not take the eighth-grade test, as long as they have previous scores.

¹⁰ The standard deviation of the average eighth-grade combined reading and math test score in CPS in 2006 was 17.25.

¹¹ Allensworth et al. (2016).

GPA's varied greatly from one high school to another

Freshman GPAs differ greatly across high schools.

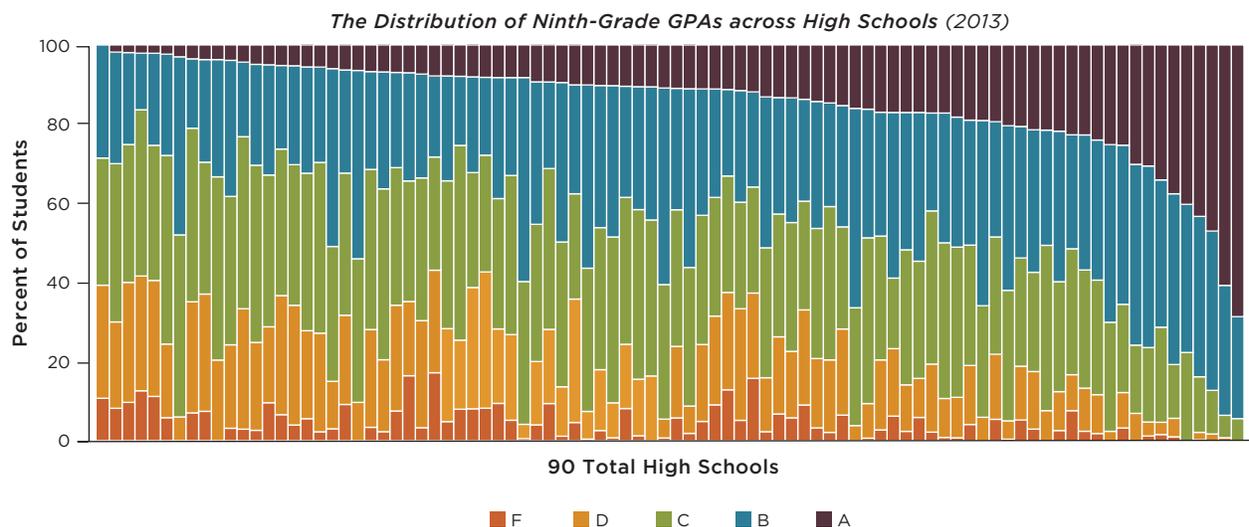
Figure 2 shows the distribution of freshman GPAs in the 90 non-charter, non-alternative CPS high schools in our 2013 analysis. Each school is represented by a single stacked bar that is broken down into the percent of students in each of the five GPA categories, A, B, C, D, and F (see box titled “Study Background” on p.3). On the far left of the figure is the school with the fewest A students (in that specific school, no freshmen had a GPA in the A range). On the far right is the school with the most A students (in that school, about 69 percent of freshmen had a GPA in the A range). Going from left to right, schools are arranged in ascending order, based on the percent of students with an A GPA. In the middle of the figure are the schools most “typical” of CPS, with about 20 percent of students receiving Fs and Ds, another 30 percent with Cs, and about 50 percent with As and Bs. Selective enrollment high schools cluster to the right side of the figure, and chronically low-performing neighborhood high schools cluster on the left side.¹²

The differences among schools in GPAs could occur for a wide range of reasons, including student selection (better prepared students attend one cluster of schools and less prepared students attend other schools), differences in grading practices, and quality of instruction, for example. In this study, we do not examine the reasons for the variability in GPA among schools, but we do statistically account for school differences in later analyses (see Chapters 2 and 3).

Male students, Black students, students from less-advantaged neighborhoods, and students with low test scores entering high school tended to have lower GPAs than their counterparts

There were notable differences in the distribution of GPA across various student characteristics. **Figures 3-7** display distributions by gender, race/ethnicity, neighborhood poverty level, prior achievement (eighth-grade test scores), and course-taking patterns (regular classes vs. honors classes). Just as we found great variability among schools in the distribution of GPAs, there were

FIGURE 2
Grades Varied Greatly across CPS High Schools



Note: Each bar represents the distribution of GPA at a single CPS high school. Students included in the sample were first-time ninth-graders who attended non-charter, non-alternative CPS high schools.

¹² Charting schools by students’ incoming achievement test scores, rather than by ninth-grade GPA, would result in a similar distribution.

also notable differences among students, depending on individual characteristics. In the following descriptive analyses, we do not make any statistical adjustments or control for any other variables.

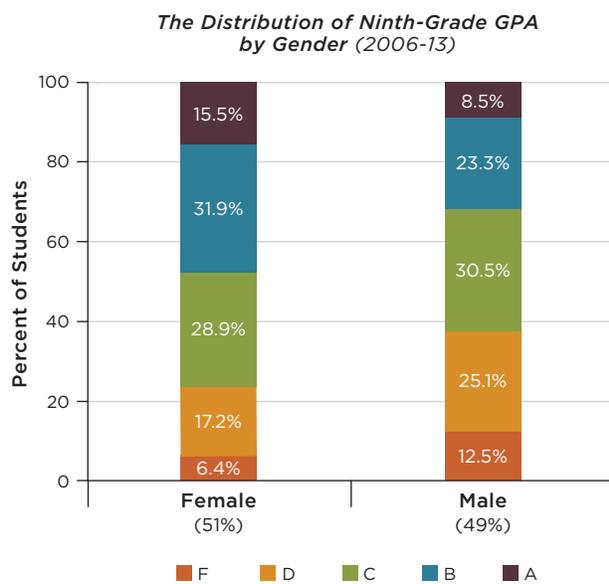
Girls earned higher GPAs in their freshman year than boys. The differences were quite large, in fact. Across all eight cohorts from 2006 to 2013, almost one-half (47.4 percent) of girls had freshman GPAs of A or B, whereas fewer than one-third (31.8 percent) of boys did (see Figure 3). Fewer than one-quarter (23.6 percent) of girls had very low, F or D, GPAs, whereas more than one-third (37.6 percent) of boys did. The percent of girls and boys with a GPA of C was roughly the same (28.9 percent compared to 30.5 percent, respectively). As the Freshman OnTrack rates predicted, and as in national data, girls graduated from high school at higher rates than boys.¹³

There were also differences among students from different racial/ethnic backgrounds, as shown in Figure 4. Black and Latino students earned lower freshman grades than White and Asian students. Looking only at students who earned a freshman GPA

of A, we see that 6.3 percent of Black students, 12.2 percent of Latino students, 25.4 percent of White students, and 38.9 percent of Asian students reached this highest category. The proportion of B students within each racial/ethnic group followed the same pattern, though the differences are not as great. Asian students were 2.5 times more likely to earn As and Bs than Black students. Conversely, Black and Latino students were much more likely to have very low GPAs (F or D) than White and Asian students. The gender gaps described above also held within each of the racial/ethnic groups and were constant across groups (not shown here). That is, the GPA differences between girls and boys were about the same within each racial/ethnic group.

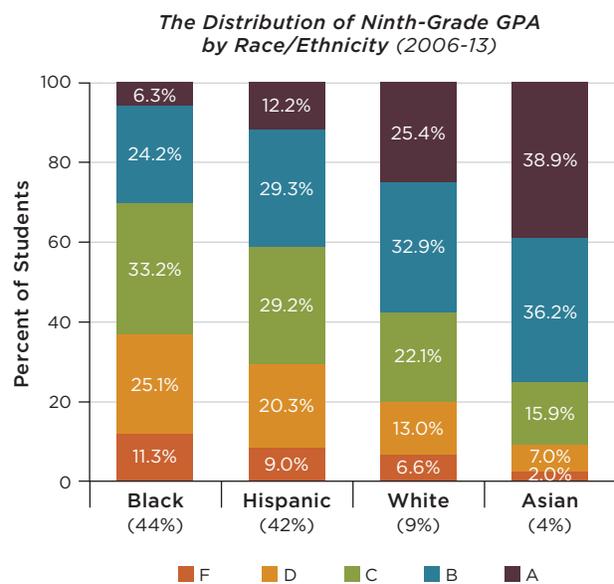
Freshman GPA was also related to students' economic backgrounds. For this breakdown, we looked at two variables from the U.S. Census at the block-level matched to students' home address.¹⁴ The two variables were "percent of adult males employed" and "percent of families with income above the poverty level." These provided information about the SES of the immediate neighborhoods where CPS students resided. To examine

FIGURE 3
Girls Earned Higher Grades than Boys



Note: These are unadjusted differences (no controls for other variables).

FIGURE 4
GPAs Differed Greatly by Race/Ethnicity



Note: These are unadjusted differences (no controls for other variables).

¹³ See Allensworth et al. (2016) for CPS graduation rates by gender. See Stetser & Stillwell (2014) for national graduation rates by gender.

¹⁴ See explanation on p.4 in Study Background.

the relationship between neighborhood SES and freshman GPA, we created quartiles of the SES by combining the two variables and breaking the distribution into four equal groups. As **Figure 5** shows, freshman GPA increased steadily with the SES of students' immediate neighborhoods.

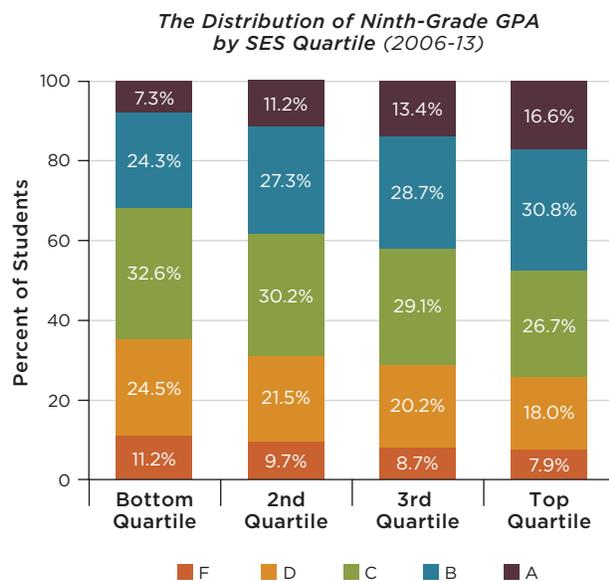
Students who entered high school with higher standardized achievement test scores were more likely to earn high grades their freshman year than students with lower entering test scores. Higher test scores reflected some degree of academic success in elementary school, and probably helped the transition to high school go more smoothly for many students, as they were more able to engage in new content. As **Figure 6** shows, the top one-quarter of students, as measured by their eighth-grade ISAT scores, earned much higher GPAs than students with lower entering test scores. Whereas only about one-quarter of freshmen who entered high schools with test scores in the lowest quartile (compared to their classmates across the city) earned A or B GPAs, about 45 percent of the students in the highest quartile did. Conversely, F and D GPAs

were much more prevalent among students with lower entering test scores than those with higher scores. Yet, a substantial number of students with weak scores earned high GPAs and many students with strong scores earned low GPAs. In fact, over 54 percent of the highest scoring students ended freshman year with a GPA of C or lower.

Consistent with the finding that students who entered high school with stronger achievement test scores earned higher freshman GPAs, we also found that students who enrolled in honors classes¹⁵ were more likely to get higher grades than students enrolled in regular (non-honors) classes. (There was no special weighting for honors classes in calculating these GPAs.) Again, the differences were quite large. As **Figure 7** demonstrates, about twice as many students who took (at least some) honors classes received A or B GPAs than students in non-honors classes (61 percent compared to 31.8 percent).

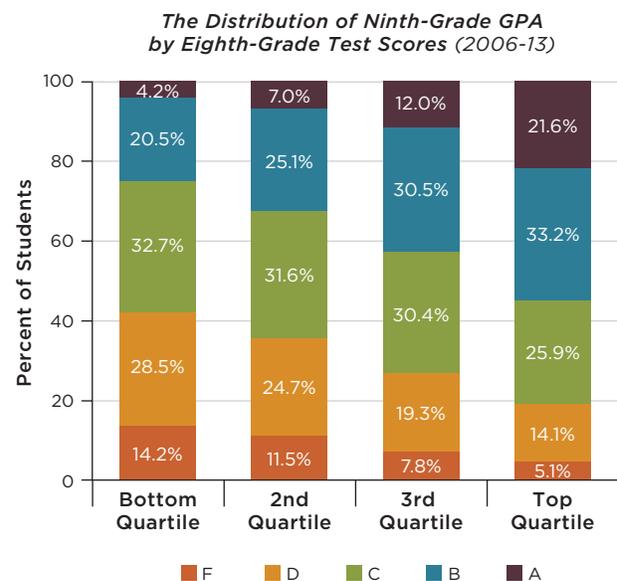
These differences also had major implications for our analytic strategies for studying the influence of freshman GPA on later outcomes. Because of the

FIGURE 5
Students from More-Advantaged Neighborhoods Were Most Likely to Earn As



Note: These are unadjusted differences (no controls for other variables).

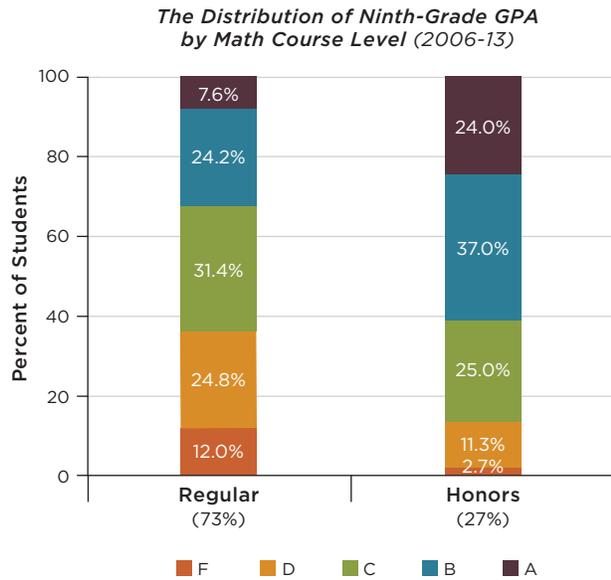
FIGURE 6
Students with Highest Incoming Test Scores Were Most Likely to Earn As



Note: These are unadjusted differences (no controls for other variables).

¹⁵ This category includes all students who took at least one semester honors class in a core subject.

FIGURE 7
Students Who Took Honors Courses Tended to Earn Better Grades



Note: The level is defined as honors if at least one course during ninth grade is honors. These are unadjusted differences (no controls for other variables).

many factors that influence grades—including those described above—we needed to be careful in studying the predictive relationship between grades and subsequent outcomes. We wanted to make sure that the GPAs themselves were responsible for any observed predictive power and were not simply acting as a proxy for other, more important factors. For example, as shown earlier, students who entered high school with higher eighth-grade test scores were more likely to earn higher grades in their freshman year. So, when we were using ninth-grade GPA to predict high school graduation, we wanted to be sure that we were isolating the relationship between grades and graduation and were not simply capturing the influence that prior test score performance had on later outcomes.

Ninth-Grade GPA as a Predictor of Later Success

Districts across the country are increasingly turning to “early warning indicators” like Freshman OnTrack as a way of identifying students who will benefit from assistance, including both formal and informal interventions.¹⁶ Broadening the focus to students’ overall GPA could have further benefits—beyond improving high school graduation rates—to include more distal education outcomes, such as college enrollment and retention. This study intended to discover how valuable GPA is in making these predictions.

There was a strong relationship between GPA in ninth grade and eleventh grade: Most students had about the same GPA

Freshman GPA was highly predictive of GPA two years later, when most students were in their junior year.¹⁷ GPA in eleventh grade is important because it is often

included on students’ college applications. As shown in **Table 3**, among the students who earned A GPAs in freshman year, 99 percent earned As or Bs two years later. Similarly, among students who earned a B GPA in freshman year, 75 percent retained a B average, 7 percent moved up to A, and 18 percent slipped to a C GPA. Students’ GPAs were quite stable between ninth and eleventh grade.

Using correlation to measure the relationship between freshman GPA and GPA two years later, we found a coefficient of 0.87. This correlation coefficient is quite large by most standards—roughly equivalent to correlations of test scores one year apart. Prior Consortium research showed a lower correlation of 0.66 between overall GPA in sixth and eighth grades.¹⁸ The stronger correlation between ninth- and eleventh-grade GPAs suggests the greater importance of freshman year GPA

Statistical Analysis

In analyzing the research questions addressed in Chapters 2 and 3, we used two kinds of statistical procedures to help ensure that we were relating the unique contribution of grades to subsequent outcomes, rather than the contribution of other factors that are also related to grades. First, we statistically “controlled” for several variables: prior test score achievement, demographic characteristics (gender, race/ethnicity, special education status, and SES), and high school course-taking patterns (honors vs. non-honors classes). This means that statistical comparisons were restricted to “students like you” on the control variables just listed. The second technique is called “fixed effects.” Fixed-effects models hold constant the systematic differences among high schools and cohorts that we have observed. In the

regression analysis to follow, the school and school-by-cohort fixed effects account for the systematic differences we observed in cohorts over time and across schools. All comparisons were made within school and school-by-cohort. *Ultimately, we are comparing students with similar characteristics who entered the same high school in the same cohort—the difference is that one student earned an A GPA and another earned a B GPA, for example.* There is still the possibility that other unmeasured factors may be responsible for the relationships between freshman grades and subsequent outcomes, but we think that we have assembled a comprehensive set of control variables and have accounted for many of the factors that are related to the set of variables that we examined.

¹⁶ Bruce, Bridgeland, Fox, & Balfanz (2011).

¹⁷ Since grade level in high school is officially defined by credits earned (as shown on transcripts), many lower-performing

freshmen—ones who fail several courses and don’t earn six full-year credits—did not advance to tenth grade.

¹⁸ Allensworth, Gwynne, Moore, & de la Torre (2014).

TABLE 3
Ninth-Grade GPA Strongly Predicted Eleventh-Grade GPA

The Relationship Between GPA in Ninth and Eleventh Grade (2010-12)					
9th-Grade GPA	11th-Grade GPA				
	F	D	C	B	A
F	16%	65%	18%	1%	0%
D	1%	48%	49%	2%	0%
C	0%	9%	66%	25%	0%
B	0%	0%	18%	75%	7%
A	0%	0%	1%	33%	66%

Note: This table includes students who were enrolled in non-charter, non-alternative CPS high schools two years after ninth grade. Students might have dropped out or left the CPS system in between. It is also possible that even though a student was still enrolled in a non-charter, non-alternative CPS high school, his or her records were missing. Of the students who had F GPAs in ninth grade, 77 percent were missing from our sample two years after ninth grade due to any of these reasons. That percentage decreased to 51 percent for students who had D GPAs in ninth grade, and to 38 percent for students with C GPAs. Less than one-third of students who had B or A GPAs were missing from our sample two years after ninth grade.

over GPAs from earlier years, and corroborates the belief that freshman-year performance is a particularly important milestone for students. Students can (and do) recover from poor performance freshman year, but many remain on the trajectory established in freshman year.

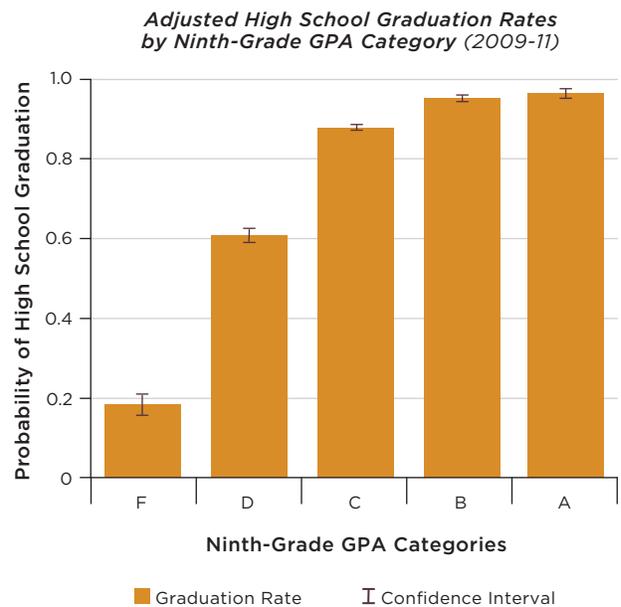
Ninth-grade GPA was strongly predictive of a student’s likelihood of graduating from high school and enrolling and persisting in college

Figures 8-10 display the percent of students who graduated from high school, enrolled in college, and persisted in college for one year, broken down by freshman GPA.¹⁹ In all cases, the higher the GPA, the better the outcome. All three analyses used the statistical procedures described in the box, *Statistical Analysis on p.3*, that isolated the relationship between freshman GPA and the specific outcome over and above the influence of test scores and other background characteristics. Think of comparing the outcomes of two students from the same cohort, in the same high school, who are similar demographically and in terms of eighth-grade test scores. They only differed from each other in their ninth-grade GPAs.

¹⁹ Note that Figures 8-10 each include different cohorts of students. We used the three most recent cohorts that had outcome measures on the three different variables: High school graduation, college enrollment, and college retention.

Figure 8 shows high school graduation rates. As seen in prior Consortium research, including studies of Freshman OnTrack, freshman GPA is a strong predictor of graduating from high school in four years.²⁰ The higher the student’s GPA, the better his or her chances of an on-time high school graduation in CPS. Very few F students ended up graduating in four or five years, whereas almost all students with freshman A, B, and C GPAs ended up graduating on time. Note on the figure the large difference in graduation rates between F students (at about 18 percent) and D students (at about 60 percent). This suggests that avoiding freshman Fs is an important way to increase the likelihood of on-time graduation, which is consistent with prior research on freshman on-track indicators. There is also a substantial difference in graduation rates between D students,

FIGURE 8
Students with Low Ninth-Grade GPAs Were Less Likely to Graduate from High School



Note: These results derive from a statistical model that adjusts for school and school-by-cohort effects, and controls for student race/ethnicity, gender, eighth-grade test scores, neighborhood poverty, freshman course taking (honors or not), and special education status. Each bar represents the estimation for a typical student in a particular GPA group. The confidence intervals are calculated at a 95 percent level, and they show the range of possible values of the estimate given that probability.

²⁰ It is also a strong predictor of graduating from high school after five years (Allensworth & Easton, 2005).

on the one hand, and C, B, and A students, on the other. D students probably need as much attention and help as F students to ensure that they end up graduating.

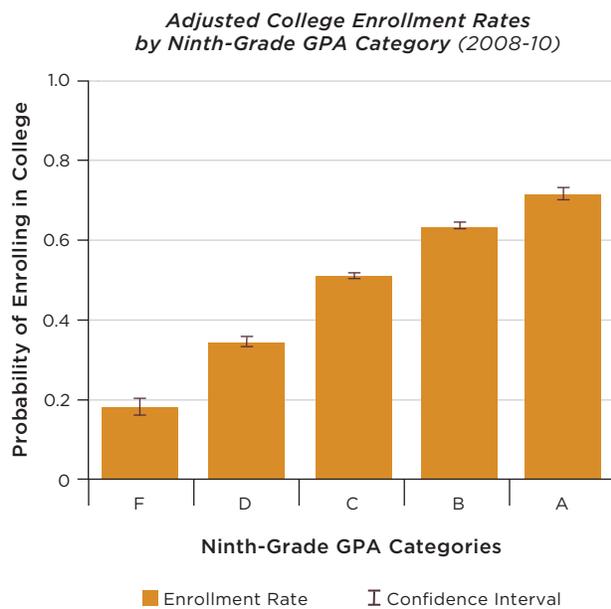
Freshman grades, independent of other important factors, were powerful predictors of high school graduation. Our finding is consistent with other research studies across the country. One recent article reviewed 110 different high school dropout indicators from 36 separate studies and concluded that indicators based on grades were the most accurate in predicting high school dropout.²¹ (In only one case are test scores more predictive. That is when researchers use a longitudinal trajectory of scores up to, and including, twelfth-grade scores.)

Freshman GPAs (independent of the control variables) also predicted later college enrollment.²² As **Figure 9** shows, about 18 percent of students who had an F freshman

GPA went on to college. About 35 percent of students with Ds went to college; about 50 percent of students with Cs did. B and A students fared better: 60 percent of B students went to college and 70 percent of A students did. The relationship between freshman GPA and college-going is more linear and incremental than the relationship between freshman GPA and high school graduation, where avoiding Fs made a big difference in the likelihood of graduating.

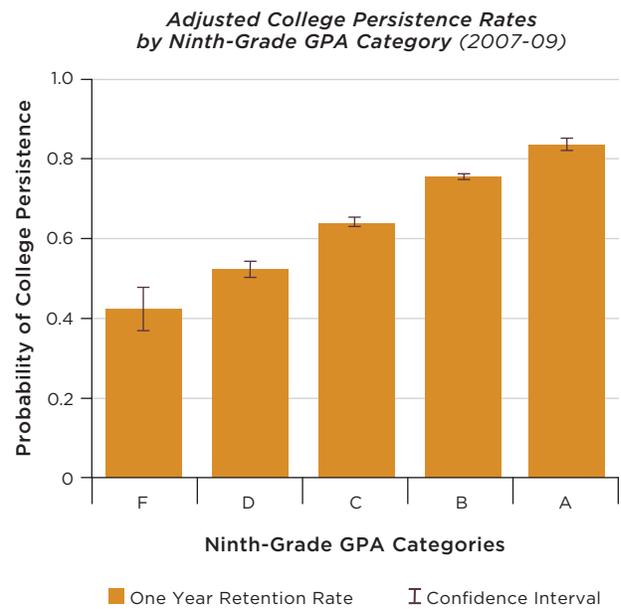
The same pattern applied to one-year college retention.²³ **Figure 10** shows the retention rates for the 2007 through 2009 cohorts. Only students who enrolled in college in the first place are included in this analysis. The same linear and incremental pattern applies here, as it did for GPAs and college enrollment. The better the freshman GPA, the higher the likelihood of remaining in college for a second year.

FIGURE 9
Freshman GPA Predicted a Student’s Likelihood of Enrolling in College



Note: These results derive from a statistical model that adjusts for school and school-by-cohort effects, and controls for student race/ethnicity, gender, eighth-grade test scores, neighborhood poverty, freshman course taking (honors or not), and special education status. Each bar represents the estimation for a typical student in a particular GPA group. The confidence intervals are calculated at a 95 percent level, and they show the range of possible values of the estimate given that probability.

FIGURE 10
Conditional on Enrolling in College, Higher GPAs Were Associated with Higher Persistence Rates



Note: These results derive from a statistical model that adjusts for school and school-by-cohort effects, and controls for student race/ethnicity, gender, eighth-grade test scores, neighborhood poverty, freshman course taking (honors or not), and special education status. Each bar represents the estimation for a typical student in a particular GPA group. The confidence intervals are calculated at a 95 percent level, and they show the range of possible values of the estimate given that probability.

²¹ Bowers et al. (2013).

²² Note that this analysis is not conditioned on high school graduation. Any CPS dropout is considered not to have enrolled in college. Students count as having enrolled if they enroll in college any year after high school graduation, up to the 2013-14 school year.

²³ In this study, we only examined one-year college retention. We are interested in college graduation, but to examine that we would be restricted to using the earliest cohorts in this sample.

The large differences in GPAs by gender and by race/ethnicity prompted the question of whether the prediction patterns described above are consistent for both boys and girls and for students of different race/ethnicities. The answer is that yes, they are, but with one exception. Using the same statistical models used throughout this study, we found boys with high grades (As, Bs, or Cs) are significantly more likely to graduate from high school than girls with the same GPAs. Otherwise, GPAs have similar influences on high school graduation, college enrollment, and college retention, regardless of gender or race/ethnicity.

GPA or test scores: What is more useful for predicting outcomes?

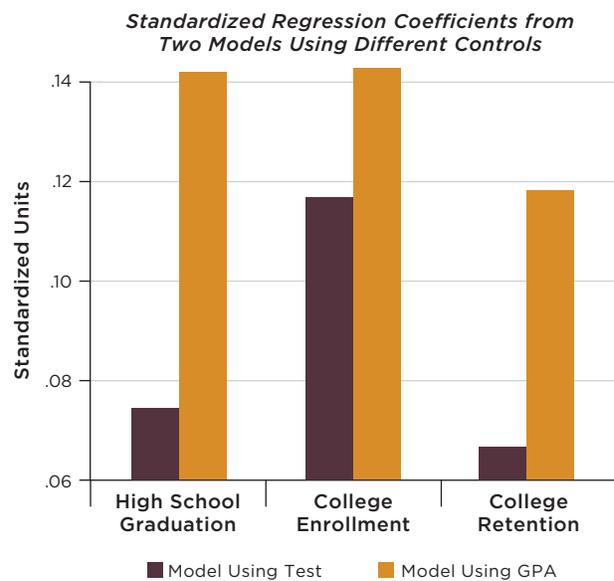
Among indicators of educational achievement and readiness, test scores have been the coin of the realm. Local, state, national, and even international education agencies primarily rely on test scores as measures of student performance. Yet, we found that freshman GPA predicts many outcomes better than test scores (either EXPLORE or PLAN—see note on Figure 11).

The analytic strategy here was similar to that used above, with one major exception. We excluded prior achievement (eighth-grade test scores) as a control variable in the prediction equations. It is included in the previous analyses because we wanted to know the impact of grades “above and beyond” that of prior test scores. Here, we wanted to know the impact of grades separate from that of prior test scores. We predicted high school graduation, college enrollment, and college retention with two “competing” sets of equations. First, we predicted our three outcomes from freshman GPA, using the same fixed effects and control variables (but no eighth-grade test scores). Then we predicted the same outcomes using freshman EXPLORE or PLAN scores with the same models. We used standardized regression coefficients so that we could compare them across different predictor and outcome variables.

As shown in Figure 11, the standardized regression coefficient for predicting high school graduation from EXPLORE or PLAN scores was 0.074. When these test

scores are replaced in the model by freshman GPA, the coefficient increased to 0.14—freshman GPA was nearly twice as predictive of high school graduation as the EXPLORE and PLAN scores. The improvement for predicting college enrollment was not as great: The coefficient increases from 0.12 to 0.14. This is probably because college admission sometimes depends on test scores. One-year college retention, however, can be predicted better from freshman GPA than from EXPLORE or PLAN scores (coefficients of 0.07 compared to 0.12). We interpreted this evidence as making a strong case for the “validity” of grades as predictors of important milestones in student development and later success.

FIGURE 11
Ninth-Grade GPA Predicted Later Educational Attainment Better than Test Scores



Note: Both models include cohort and school-by-cohort fixed effects, demographics, socio-economic status, special education status, and course taking patterns. The models do not include prior achievement. End-of-grade-nine test score is a combination of standardized EXPLORE and PLAN at the cohort level. Until 2011, EXPLORE was taken during the fall semester of ninth grade, and PLAN during the fall semester of tenth grade. Then, both tests started to be taken in the spring semester. Therefore, we use PLAN for cohorts between 2006-11, and EXPLORE for cohorts between 2012-13. Ninth-grade GPA is standardized at the cohort level. High school graduation is defined as on-time graduation. This outcome is available for cohorts between 2006-11. A student is considered enrolled in college if she was registered in the first semester of any post-secondary program according to NSC data. This variable is defined unconditional to graduation status, and all non-high school graduates are coded as not enrolling in college. This outcome is available for cohorts between 2006-10. A student persists in college if she is registered in the third semester of any post-secondary program according to NSC data. This variable is defined conditional to enrollment; therefore, we only include students who had enrolled in the post-secondary system. This outcome is available for cohorts between 2006-09.

Ninth-Grade GPA as a Measure of Student Achievement

In this chapter, we address the question of whether grades measured student learning of content matter, by using freshman GPA to predict beginning-of-tenth-grade PLAN test scores. By establishing this relationship, we confirmed that at least some aspects of GPAs are indeed “objective” in the sense that they correspond with measures obtained under standard conditions for all students.

The 2011, 2012, and 2013 cohorts in our sample took the test at the beginning of the tenth grade. PLAN (no longer administered in CPS) is part of the EPAS sequence of tests developed and sold by ACT. Both PLAN and EXPLORE (for students in earlier grades) are designed to be predictive of ACT and are scored on a similar scale to enable measuring students’ growth over time. While valuable for this purpose, both PLAN and EXPLORE have some shortcomings. First, and probably most prominent, these tests are not aligned to the CPS high school curriculum, so it is not always certain that they are measuring the same content included in CPS high school courses, and certainly not in the same sequence.²⁴ Second, both tests have relatively few items, and the scores fall on a scale with a very limited range. The range of the ACT is 1 to 36, and the range of the PLAN is 1 to 32.

Despite these limitations, we wanted to probe the relationship between freshman GPA and a commonly used high school standardized achievement test. Even though CPS freshmen may not be exposed to all the content on the PLAN test (and conversely, they may have learned other content that is not included on the test), it is recognized as part of the ACT series of tests and has been valued as a predictor and indicator of the ACT, which for many years was given to all eleventh-graders in the state of Illinois, and is used in the college applica-

tion process. This analysis used the same control variables and fixed effects as the analyses used for Figures 8-10. It is important to emphasize that in predicting beginning-of-tenth-grade test scores from freshman GPAs, we are also controlling for end-of-eighth-grade ISAT scores. Although about 18 months apart from each other, these two test scores are highly correlated (with a correlation coefficient of 0.87) to each other, and therefore, prediction of the beginning-of-tenth-grade test score from the end-of-eighth-grade test is relatively accurate. From a statistical viewpoint, it is rare to identify intervening factors that have a significant effect on future test scores predicted from previous test scores.

Ninth-grade GPA was predictive of a student’s standardized achievement test scores

We found a statistically significant association between freshman grades and beginning-of-year tenth-grade PLAN scores, controlling for eighth-grade ISAT scores and the other factors discussed previously. **Figure 12** displays our findings in points on the PLAN (recall that the range of possible scores on PLAN is 1 to 32). Given their eighth-grade test scores, A students scored 1.20 points higher on the PLAN than average students. B students scored 0.25 points more than average. In contrast, C, D, and F students scored lower than average, by 0.46, 1.14, and 1.85 points, respectively.

At first glance, these differences may seem to be relatively modest, especially in comparison to unadjusted PLAN scores. On average, A students scored 21.3, B students 17.5, C students 14.7, D students 13.0, and F students 11.8; with the overall average being 16.1. The statistical controls reduced the observed differences considerably, by accounting for many other factors that influence test scores, especially eighth-grade

²⁴ Note, however, that many schools and networks of schools in CPS did align their instruction to ACT’s College Readiness Standards

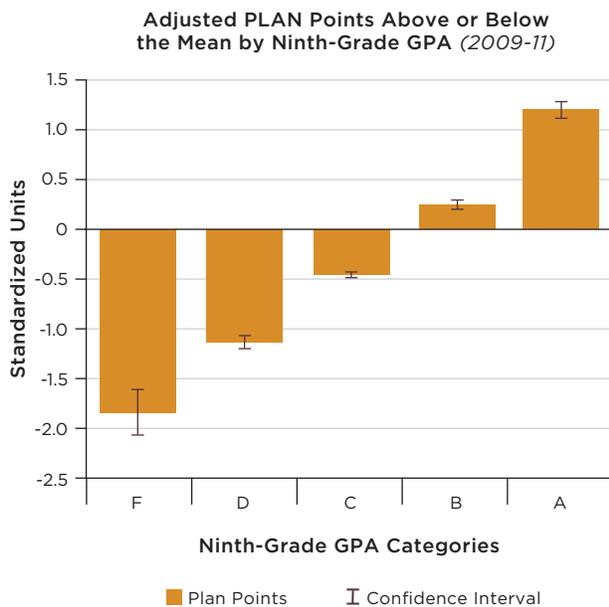
achievement test scores. As we saw in **Figure 6** on p.11, students with higher eighth-grade test scores tended to earn higher freshman GPAs. The analysis shown in **Figure 12** accounted for that fact, and showed how much advantage As and Bs give to students (who are similar to each other in all other respects) in terms of their PLAN test scores. **Figure 12** also shows how detrimental C, D, and F GPAs were. For example, a student with an A GPA in ninth grade was likely to score 1.20 PLAN points above the average, while a similar student (with the same eighth-grade test scores) with an F GPA in ninth grade was likely to score 1.85 PLAN points below the average.

The A and B students were learning more of the material covered by the PLAN than students who resembled them on our control variables, and the C, D, and F students were learning less. The background characteristics of students held constant, so the only difference among them was their freshman GPA. Because we were controlling for the eighth-grade ISAT scores, we can be sure that this was new learning that occurred

in the ninth grade and was not just a reflection of what those students already knew. This gives us confidence in saying that these students' A and B grades reflected achievement that paid off in the form of higher test scores. The students with lower grades scored lower on the tenth-grade PLAN than other students like them who got better grades. They scored significantly lower than what would be expected of them given their earlier test scores and other characteristics.

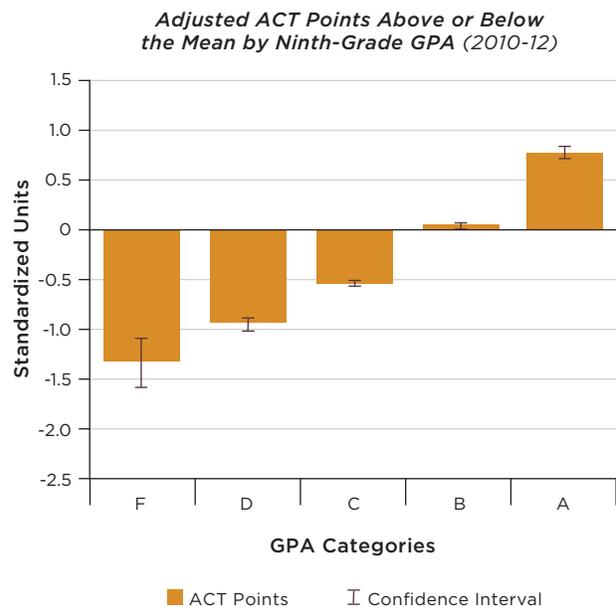
The same pattern applied to eleventh-grade ACT scores, though the relationships were somewhat weaker, probably because of the longer time lapse between the freshman year GPA and the eleventh-grade ACT (see **Figure 13**). This reaffirms the finding that grades, at least in part, measure student learning of the same content material that was measured by widely used achievement tests. Earlier Consortium studies also showed that eleventh-grade grades in different subjects are positively related to higher ACT scores.²⁷

FIGURE 12
Higher GPA Predicted Higher Achievement, as Measured by Fall Tenth-Grade PLAN Scores



Note: These results derive from a statistical model that adjusts for school and cohort-by-school effects, and controls for student race/ethnicity, gender, eighth-grade test scores, neighborhood poverty, freshman course taking (honors or not), and special education status.

FIGURE 13
Higher Ninth-Grade GPA was Correlated with Higher ACT Scores in Eleventh Grade



Note: These results derive from a statistical model that adjusts for school and school-by-cohort effects, and controls for student race/ethnicity, gender, eighth-grade test scores, neighborhood poverty, freshman course taking (honors or not), and special education status.

25 Allensworth, Correa, & Ponisciak (2008); Easton, Ponisciak, & Luppescu (2008).

Interpretive Summary

This study shows that ninth-grade GPA has great value in that it provides a “signal” indicating the likelihood of future academic success.

It turned out that this signal is quite strong, in fact, and that freshman GPA is a statistically valid indicator and predictor of future student academic success. It is strongly predictive of eleventh-grade GPA, which plays a big role in college admission. Freshman GPA also predicts high school graduation, college enrollment, and one-year college retention, and, in fact, is a much better predictor of these important milestones than test scores. It is a strong “leading indicator” of subsequent positive outcomes, suggesting that students who have strong freshman grades are likely to do well academically in the future. This evidence also supports a focus on students who are struggling in ninth grade, who may need additional help to overcome a poor freshman year and improve the likelihood of better academic outcomes in the future.

We also found that freshman GPA is a reliable and valid indicator of student achievement and academic learning, given its ability to predict both beginning-of-tenth-grade and end-of-eleventh-grade standardized achievement test scores. By accounting for prior achievement test scores, we found that freshman GPAs measure not only the knowledge and skills that students brought with them into high school, but also what they learned during the freshman year. In addition, freshman GPAs measure some of the same content that is covered by nationally-normed standardized achieve-

ment tests. Considering this evidence, CPS’s concerted, citywide attention to freshman grades seems highly warranted and appropriate. Further, it indicates that policymakers and practitioners can generally trust grades as a good indicator of skill and knowledge acquisition. The findings of this study also support a focus on supporting students to achieve higher grades—As and Bs—because of greater payoffs on later achievement test scores. In fact, we found that lower grades were associated with little or no test score improvement.

Grades have been criticized for being “subjective,” suggesting that teachers apply an uneven or non-objective set of standards when they assign grades. This research did not directly address the question of how much subjectivity there is in grades, but it did show that grades do include an objective achievement component, even though schools and teachers do not use standardized criteria in grading. It is likely that factors such as effort, behavior, and attitude, for example, are influencing grades. But this does not detract from the validity of grades; in fact, these other factors are likely to be contributing to the validity of grades: in addition to content knowledge as measured by standardized tests, teachers appear to be accurately measuring other important skills and characteristics of students. This conclusion is supported by a long history of grades research described in a recently published research

“It indicates that policymakers and practitioners can generally trust grades as a good indicator of skill and knowledge acquisition.”

review article.²⁶ The evidence shown here is unequivocal in demonstrating consistent differentiation among students based on their grades. These other components of grades are adding useful information to the signal that grades provide, rather than diminishing the signal.

However, this study did not answer—or even address—the question of “exactly what other factors are grades measuring besides the kind of achievement that tests measure?” Grades may measure student effort, persistence, good behavior, attendance, attitude, and other related factors, yet we do not know this for sure. In future research, we will use additional available data, such as attendance, discipline records, and student survey reports to identify and quantify how these other factors influence grades.

This report sidesteps another common concern—grade inflation. How much of the improvement in freshman GPA (and on-track rates) can be attributed to teachers simply giving students higher grades, either under pressure from administrators or by their own choice? Other research has shown that accountability pressures can have negative consequences that corrupt otherwise useful statistical indicators.²⁷ Our evidence did show that GPAs were equally predictive of high school graduation across all eight cohorts in this study, even as GPAs increased year after year. This finding is comparable to the national research described earlier and suggests that increasing GPAs reflect increasing academic success, and not grade inflation.

We are not sure why freshman GPA is so highly predictive of so many important outcomes. For most students in CPS, ninth grade is a major transition from a K-8 elementary school and presents a new chance to

set expectations for the rest of high school. It is reasonable to believe that a successful freshman year opens many future opportunities for students. A strong GPA may lead to placement in better courses the next year. Teachers may have higher expectations for students who demonstrate success early in high school. They may be more favorably inclined toward these students. The students themselves may develop greater self-confidence in their abilities and adopt a “growth mindset.” They may select their peers or their extracurricular activities differently. We don’t know which of these paths are true, but it seems likely that there are elements of “success breeding success” at play.

This study highlighted a series of related questions about freshman grades that are highly relevant to CPS high schools and likely to be of interest elsewhere. The answers to some of the initial questions may raise alarms. There are large differences in freshman GPAs among racial/ethnic groups that reflect “achievement gaps” usually associated with test score differences. There is also a large gender gap, with girls earning much higher GPAs than boys. The many differences between groups of students noted here are consequential. Perhaps reducing the “GPA gap” could become a more deliberate focus of policy and practice, in the same way that the “achievement gap,” as measured by standardized test scores, has been.

Finally, the study showed that freshman GPA is rising in CPS, and it continues to be a strong predictor of future academic success. Sustained attention to freshman GPA may help reduce racial/ethnic and gender gaps, while leading to better outcomes for all students.

²⁶ Brookhart et al. (2016).

²⁷ See Neal & Schanzenbach (2007) for a Chicago specific example..

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Appendix

The cohorts that were used for the analyses illustrated in the figures and tables of this report are included in **Table A.1** below. Not all cohorts were used for each analysis. First, students in more recent cohorts were not old enough to have attained some of the outcomes

(e.g., they were too young to have enrolled in college at the time of publication). In other instances, we restricted the analyses to include the most recent cohorts of students in order to be most relevant to policymakers and practitioners.

TABLE A.1
Samples Used to Describe the Relationship of Freshman GPA and Later Outcomes

Ninth Grade Cohorts Used for Analyses and Figures							
Cohort <i>Fall Year</i>	11th-Grade GPA	PLAN	ACT	11th-Grade GPA	High School Graduation	College Enrollment	One-Year College Retention
	End of School Year	Fall of 10th Grade	Spring of 11th Grade	End of School Year	End of School Year	Fall after End of School Year or Later	One Year after Enrollment
	Figures 1,3-7	Figure 11	Figure 12	Table 3	Figure 8	Figure 9	Figure 10
2006	X						
2007	X						X
2008	X					X	X
2009	X	X			X	X	X
2010	X	X	X	X	X	X	
2011	X	X	X	X	X		
2012	X		X	X			
2013	X						



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This report reflects the interpretation of the authors. Although the UChicago Consortium's Steering Committee provided technical advice, no formal endorsement by these individuals, organizations, or the full Consortium should be assumed.

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OUR MISSION The University of Chicago Consortium on School Research (UChicago Consortium) conducts research of high technical quality that can inform and assess policy and practice in the Chicago Public Schools. We seek to expand communication among researchers, policymakers, and practitioners as we support the search for solutions to the problems of school reform. The UChicago Consortium encourages the use of research in policy action and improvement of practice, but does not argue for particular policies or programs. Rather, we help to build capacity for school reform by identifying what matters for student success and school improvement, creating critical indicators to chart progress, and conducting theory-driven evaluation to identify how programs and policies are working.



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