Evidence of Grade Inflation Since 2010 in High School English, Mathematics, Social Studies, and Science Courses

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ACT®

Conclusions

This study revealed evidence of grade inflation in English, mathematics, social studies, and science. Grade inflation did not, however, increase at the same rate for all subjects. The rate of grade inflation tended to be higher for math, followed by science, then English, and finally social studies. In all subjects, Black students saw the greatest grade inflation when compared to other racial/ethnic groups. Differences in the rate of grade inflation were also observed when taking into account the number of students at a school eligible for free or reduced-price lunch, and when considering a school's percentage of students from traditionally underserved racial/ethnic groups.

So What?

Because the greatest rate of grade inflation was observed in mathematics and science, it is possible that these subject grade point averages (GPAs) may be an overestimation of academic readiness. A similar concern can be expressed for Black students who experienced the highest levels of grade inflation. This is a particular concern for Black students at schools with lower percentages of students from traditionally underserved racial/ethnic groups.

Now What?

When trying to evaluate whether the grade inflation that has been observed in this and other studies is really a problem, we can look to the findings of this study to help us contextualize this question. The main issue is that grade inflation is not happening at the same rate for all students. As we saw in this study, inflation differs by key student characteristics. This is particularly important because these are not malleable characteristics that a student can strive to change. This suggests that there are concerns about equity in high school grades for some students. I encourage a robust conversation about the systemic nature of the findings in this report in order to identify why grade inflation is happening.

Introduction

The phenomenon of "grade inflation" can be defined as the assignment of grades that do not align with content mastery (Camara et al., 2003; Gershenson, 2018; Godfrey, 2011). In the recent ACT research report *Grade Inflation Continues to Grow in The Past Decade*, we documented evidence of grade inflation from 2010 to 2021 (Sanchez & Moore, 2022). The report documents one of the many studies that have found evidence of inflation in high school grade point average (Goldman, 1985; Bejar & Blew, 1981; Bellott, 1981; Godfrey, 2011; U.S. Department of Education, National Assessment of Educational Progress [NAEP], Long-Term Trend Reading Assessments, 2020; Gershenson, 2018; Gershenson, 2020; Tyner and Gershenson, 2020).

As explained in the 2022 report, grades are meant to indicate a student's academic knowledge and skills and, often, the student's preparation for college and career. This study showed that grade inflation has accelerated for all students; however, average ACT Composite scores have continued to decline, reaching the lowest average score of the past decade in 2021. The number of students receiving B grades has decreased over time, while the number of students receiving A grades has increased. Grade inflation also became especially pronounced in 2020 and 2021, with more grade inflation taking place between 2018 and 2021 than in the preceding eight years.

The evidence of grade inflation presented thus far in the literature has primarily focused on grade inflation in cumulative high school GPA (HSGPA). An unanswered question exists as to the degree grade inflation is present within different academic subjects. Given that we know there is inflation in cumulative HSGPA, this study seeks to understand how grades in individual subjects may or may not exhibit grade inflation. In this analysis, I focus on two research questions:

1. Is there evidence of grade inflation for high school graduating cohorts from 2010 to 2022 in English, math, social studies, and science courses?

2. Does grade inflation vary by racial/ethnic background, gender, percentage of students eligible for free or reduced-price lunch at the school (FRL), or percentage of students from traditionally underserved racial/ethnic groups at the school (i.e., Black, Hispanic, American Indian, and Pacific Islander)?

Methods

Sample

Study data included students from the 2010 to 2022 ACT-tested high school graduating cohorts. I focus on public schools that were matched to the National Center for Education Statistics Common Core of Data (U.S. Department of Education, Institute of Education Sciences, NCES, CCD Data Files, 2023). To facilitate hierarchical modeling, I required that students have data for high school coursework, gender, and family income; schools have data for the percentage of

students eligible for free or reduced-price lunch, percentage of students from traditionally underserved racial/ethnic groups, percentage of female students, and percentage of students taking advanced coursework; and each school have at least 30 students. Additionally, I limited the sample to have the same students in the English, math, social studies, and science analyses. The analyses included 6,871,894 students from 3,884 schools (Table 1).

Across years, there tends to be slightly more female students than male students in the sample. The percentage of students with a family income greater than $100,000 increased from 20% in 2010 to 37% in 2022, which could be due to economic inflation. In the study sample, about 60% of students were White. The percentage of students whose last ACT test was under the ACT national testing program (typically administered on Saturdays) declined from 93% in 2010 to 61% in 2022, while the percentage of students whose last test was in a school-day (state or district) testing program rose from 7% in 2010 to 39% in 2022. Less than half of the students in each year had taken advanced coursework in English, math, social studies, or science. The percentages of students eligible for free or reduced-price lunch at a school, students from traditionally underserved racial/ethnic groups at a school, female students at a school, students taking advanced coursework at a school, and students at the school taking the ACT were relatively stable from 2010 to 2022. Observed cumulative English GPA, math GPA, social studies GPA, and science GPA increased slightly from 2010 to 2022. At the same time, ACT English, math, reading, and science scores decreased slightly from 2010 to 2022. As this table demonstrates, there were differences across years in observed characteristics that will be accounted for in the statistical analysis employed.

Table 1. Sample Characteristics

Characteristic		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Gender[a]	Female	56	56	56	55	55	55	54	54	55	55	56	55	55
	Male	46	44	44	45	45	45	46	46	45	45	44	45	45
Testing program	National	93	92	91	84	83	80	68	68	69	71	72	61	61
	State or District	7	8	9	16	17	20	32	32	31	29	28	39	39
Family income	<36K	30	31	30	29	29	29	29	28	27	26	25	23	22
	36K-60K	23	23	23	23	22	22	22	22	21	21	20	20	18
	60K-100K	27	26	26	25	25	25	24	24	24	24	24	23	23
	>100K	20	20	22	23	24	25	25	26	27	29	31	34	37
Race/ethnicity	Missing	2	1	0	1	1	1	1	1	1	2	1	1	0
	Black	15	15	15	15	15	15	15	14	14	14	14	13	12
	Native American	1	1	1	1	1	1	1	1	1	1	1	1	1
	White	65	63	62	61	60	59	58	57	57	57	57	60	61
	Hispanic	8	11	12	12	13	13	14	14	14	14	14	13	13
	Asian	4	4	4	4	5	5	5	5	5	5	6	5	5
	Native Hawaiian/Other Pacific Islander[b]	0	0	0	0	0	0	0	0	0	0	0	0	0
	Two or More Races	2	3	3	4	4	4	4	5	5	5	5	5	5
	Prefer Not to Respond	2	3	3	3	3	3	3	3	3	3	3	2	2
Taken advanced courses in English	Yes	46	46	46	47	48	48	47	48	49	50	50	51	52
	No	54	54	54	53	52	52	53	52	51	50	50	49	48

Characteristic		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Taken advanced courses in math	Yes	39	39	39	39	40	41	41	42	42	43	44	46	47
	No	61	61	61	61	60	59	59	58	58	57	56	54	53
Taken advanced courses in social studies	Yes	40	40	40	42	43	44	43	44	44	45	45	47	49
	No	60	60	60	58	57	56	57	56	56	55	55	53	51
Taken advanced courses in sciences	Yes	38	38	38	39	40	40	40	41	42	43	43	46	49
	No	62	62	62	61	60	60	60	59	58	57	57	54	51
Percentage of students eligible for FRL at the school[c]		34	36	38	40	39	39	40	39	39	39	39	39	39
Percentage of traditionally underserved students at the school[c]		29	30	30	31	32	32	33	33	33	33	33	32	32
Percentage of female students at the school[c]		49	49	49	49	49	49	49	49	49	49	49	49	49
Percentage of students taking advanced coursework at the school[c]		12	12	14	15	16	18	18	17	16	13	10	11	11
Percentage of students at the school taking the ACT[c]		15	15	16	16	16	17	18	18	18	17	16	16	16
English GPA (mean)		3.30	3.31	3.31	3.31	3.32	3.33	3.30	3.32	3.35	3.39	3.43	3.45	3.41
Math GPA (mean)		3.19	3.20	3.20	3.20	3.21	3.21	3.19	3.22	3.25	3.30	3.34	3.37	3.36
Social Studies GPA (mean)		3.39	3.39	3.40	3.40	3.40	3.41	3.40	3.43	3.45	3.49	3.53	3.55	3.52
Science GPA (mean)		3.28	3.29	3.30	3.29	3.31	3.32	3.30	3.33	3.36	3.39	3.43	3.46	3.45
ACT English (mean)[d]		20.9	20.9	20.9	20.8	20.9	20.9	20.6	20.7	20.9	21.0	21.1	20.9	20.2

Characteristic	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
ACT Math (mean) [d]	21.4	21.4	21.4	21.3	21.3	21.2	20.9	21.0	21.0	21.0	21.1	20.9	20.2
ACT Reading (mean) [d]	21.7	21.7	21.7	21.7	21.9	21.9	21.8	21.8	21.9	22.0	22.2	22.1	21.5
ACT Science (mean) [d]	21.3	21.3	21.3	21.2	21.3	21.4	21.2	21.3	21.3	21.4	21.6	21.5	20.9
N	503,081	515,898	530,327	556,590	573,299	598,896	648,377	641,328	587,723	522,730	442,704	347,377	403,564

Note: [a] Starting in the 2019–2020 academic year, additional gender options were included beyond male and female. These were excluded from analysis because of the few students in these categories. [b] Because of rounding, 0% may be less than half a percent. [c] These ACT means reflect the current study sample and may not match the ACT means provided in annual graduating class profile reports. [d] Data for 2021–2022 were not available at time of analysis so data for 2020–2021 were used. These data were collected from CCD reported data.

Measures

Demographics. When students register to take the ACT test, they are asked to self-identify certain demographic information. This includes race/ethnicity, family income, and gender.

Coursework and grades. After registration, students have the opportunity to provide information on the courses they have taken (or are currently taking) as well as their grades in those courses on an A–F scale which are then converted to a 0.0–4.0 scale. Subject GPAs in English, social studies, math, and science were calculated based on the grades provided by students.[1] Additionally, students indicate whether they have taken any advanced coursework in English, math, social studies, and science courses in high school (e.g., AP and honors courses).

Table 2 lists the courses that are included in each of the four subject areas, the percentage of students reporting grades for those courses, and the average GPA for those courses. The mix of courses taken varies across students. It is also important to understand that the data do not typically include 12th grade. For example, for students in the 2022 cohort, the high school courses occurred between fall 2018 (when they began 9th grade) and the time of their ACT test (typically spring of 2021, when they were nearing the end of 11th grade). Additionally, students may not have taken all courses in each subject. Subject GPA is based on the reported grades.

Table 2. Percentage of Students Reporting Grades and Average GPA for 23 Courses Examined

Course Subject	Course Title	% Reported	Average Grade
English	English 9	97	3.35
	English 10	97	3.34
	English 11	86	3.33
	English 12	22	3.47
	Speech	7	3.66
Math	Algebra 1	97	3.28
	Algebra 2	85	3.20
	Geometry	93	3.19
	Trigonometry	28	3.42
	Other Advanced Math	29	3.41
	Beginning Calculus	9	3.51
	Computer Science	9	3.64

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[1] The number of courses a student reported and the number of grades used in the subject GPA calculation varied. To account for this variation, the number of courses in each subject was included as a covariate in the regression model.

Science	General Science	76	3.40
	Biology	95	3.29
	Chemistry	74	3.23
	Physics	30	3.35
Social studies	US History	90	3.42
	World History	86	3.41
	American Government	46	3.43
	Other History	19	3.52
	Economics	24	3.45
	Geography	43	3.51
	Psychology	22	3.54

High school characteristics. Data for public high schools were obtained from the National Center for Education Statistics (NCES) Common Core of Data (CCD), which is the Department of Education's primary database on public elementary and secondary education in the United States (U.S. Department of Education, Institute of Education Sciences, NCES, CCD Data Files, 2023). From this database, the following school characteristics were gathered: percentage of students eligible for free or reduced-price lunch, percentage of students in traditionally underserved racial/ethnic groups, and percentage of female students. For each school, the percentage of students taking advanced coursework and the percentage of ACT-tested students were then gathered. These percentages were calculated as the number of students taking advanced coursework (or the number of ACT-tested students) divided by the total NCES-reported school enrollment.

Data Analysis

The data analysis for this report employed both descriptive and inferential statistical modeling. Descriptive analysis included the observed percentage of students having certain characteristics. Inferential statistical modeling employed hierarchical linear modeling to estimate and adjust high school GPA for students in the sample. These models adjusted estimated high school GPA by accounting for the number of courses taken in a subject, tested year, test type, ACT subject score, race/ethnicity, gender, family income, percentage of students eligible for free or reduced-price lunch at a school, percentage of students from traditionally underserved racial/ethnic groups at a school, percentage of women at a school, percentage of students taking advanced coursework in a school, and the percentage of ACT-tested students at a school.

To answer the first research question, the following statistics are presented for each subject:

- the percentage of students attaining A, B, and C subject GPAs from 2010 to 2022

- the observed subject GPA and corresponding subject ACT scores from 2010 to 2022 (note that ACT Reading scores are used for social studies)

- the average observed subject GPA for each ACT subject score from 2010 to 2022

- the adjusted subject GPA[2] and effect size (relative to 2010) from 2011 to 2022

To answer the second research question, the effect size in subject GPA (relative to 2010) from 2011 to 2022 is presented for different groups of students, including by the following:

- race/ethnicity

- family income

- gender

- percentage of students eligible for free or reduced-price lunch at a school

- the combination of percentage of traditionally underserved racial/ethnic students at a school and student race/ethnicity

Results

Research Question 1: Is there evidence of grade inflation for high school graduating cohorts from 2010 to 2022 in English, math, social studies, and science courses?

In this section, observed HSGPA results are presented first followed by adjusted HSGPA results. The observed results are those observed from the data without any adjustment for student or school characteristics. The adjusted HSGPAs are adjusted through the use of regression models and incorporate student and school characteristics.

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[2] Subject GPAs are adjusted by a covariate hierarchical model that controls for student gender, race/ethnicity, family income, year, test type, ACT subject score, the number of subject courses included in the GPA calculation, having taken advanced coursework in the subject, the percentage of students from traditionally underserved groups at the school, the percentage of female students at the school, the percentage of students eligible for free or reduced-price lunch at the school, the percentage of students at the school taking advanced coursework, the percentage of the school taking the ACT, and interactions between year and race/ethnicity, gender, and family income; percentage of students from traditionally underserved and racial/ethnic groups; and year by percentage of students from traditionally underserved racial/ethnic groups

Percentage of students attaining A, B, and C grades from 2010 to 2022. In English, math, social studies, and science, there was a decline in the number of students being assigned B and C grades from 2010 to 2021 (Figure 1). At the same time, there was an increase in the percentage of students being assigned A grades. This increase in the percentage of students being assigned A grades was most dramatic between 2016 and 2021. In 2022, the percentage of students receiving A grades decreased slightly while the percentage of students receiving B and C grades increased slightly.

Figure 1. Percentage of ACT Test Takers With an Average English, Math, Social Studies, and Science GPA of A, B, or C From 2010 to 2022
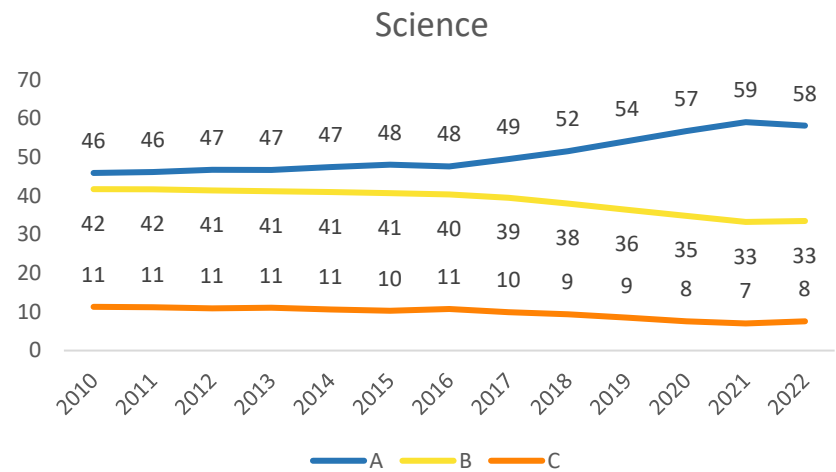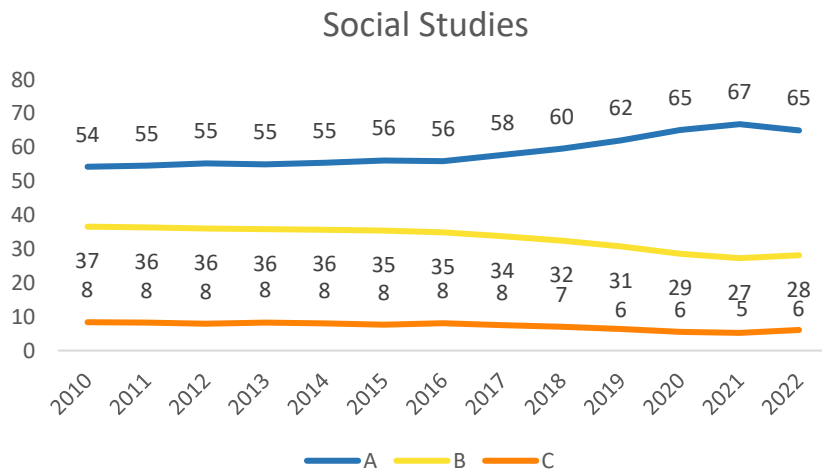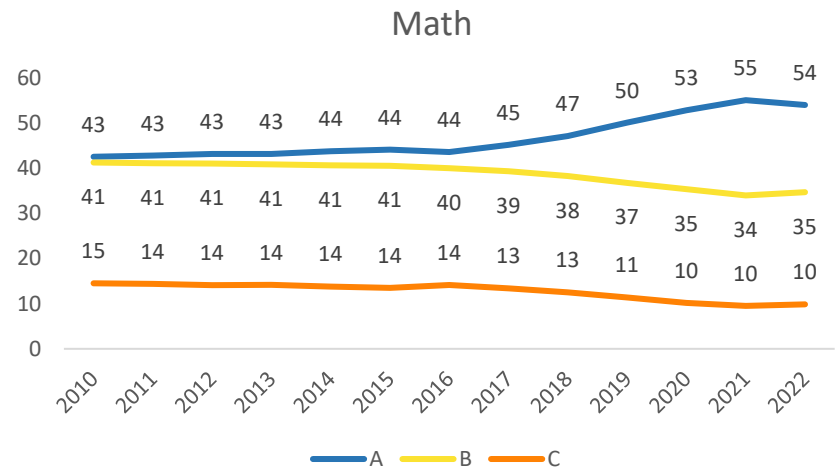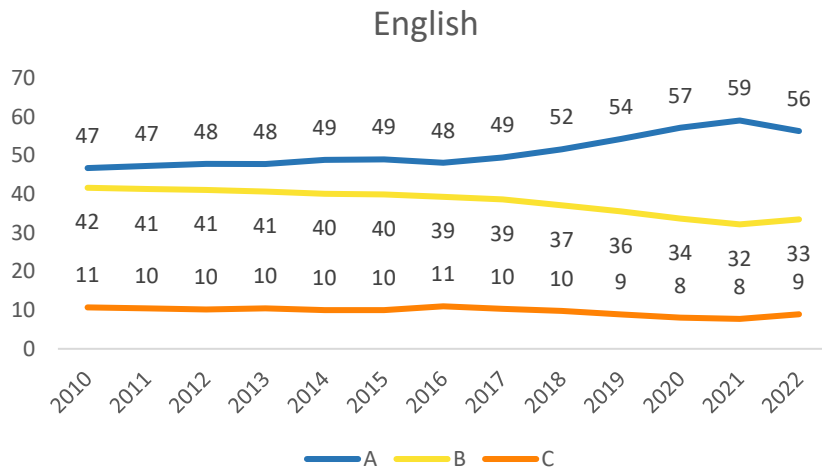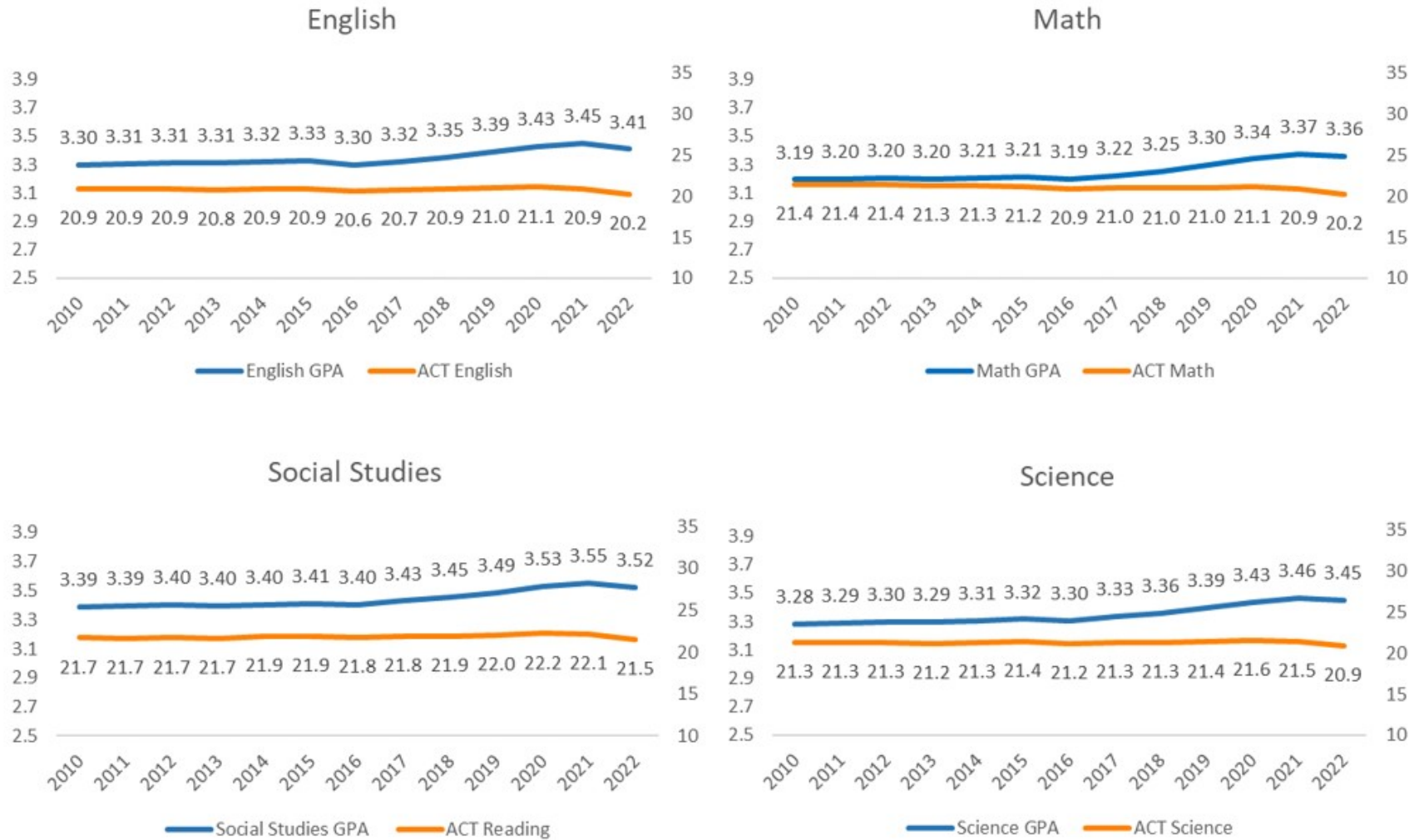
Figure 2. Observed Subject GPA and ACT Subject Score by Year

The percentage of students in English, math, social studies, and science who reported receiving an A GPA increased by 9.6, 11.4, 10.7, and 12.2 percentage points, respectively, from 2010 to 2022. The greatest discrepancy between the assignment of A grades and B and C grades was seen in social studies. While we cannot determine from these figures why more students are receiving A grades, it is clear that more students are receiving A grades and fewer students are receiving B and C grades, regardless of subject.

Observed subject GPA and subject ACT scores from 2010 to 2022. Across subject areas, we can see that from 2010 to 2022, observed GPA increased slightly while the corresponding ACT subject score decreased slightly (Figure 2). Typically, observed GPA increased by 0.1 grade point while the corresponding average ACT subject score decreased by less than one scale score point. Recall that the observed subject GPAs do not account for differences in student and school characteristics across cohorts.

Average subject GPA for each ACT subject score from 2010 to 2022. In Figure 3, we can see that across the four subjects examined, the average observed subject GPA increased at each point along the ACT subject scale in the years examined. Even after accounting for changes in academic achievement, as measured by the ACT subject score, subject GPA increased year over year. Since academic achievement was not increasing from year to year, this suggests that grade inflation is occurring.

Figure 3. Average Observed Subject GPA Across the ACT Subject Scale Over the Years 2010 to 2022
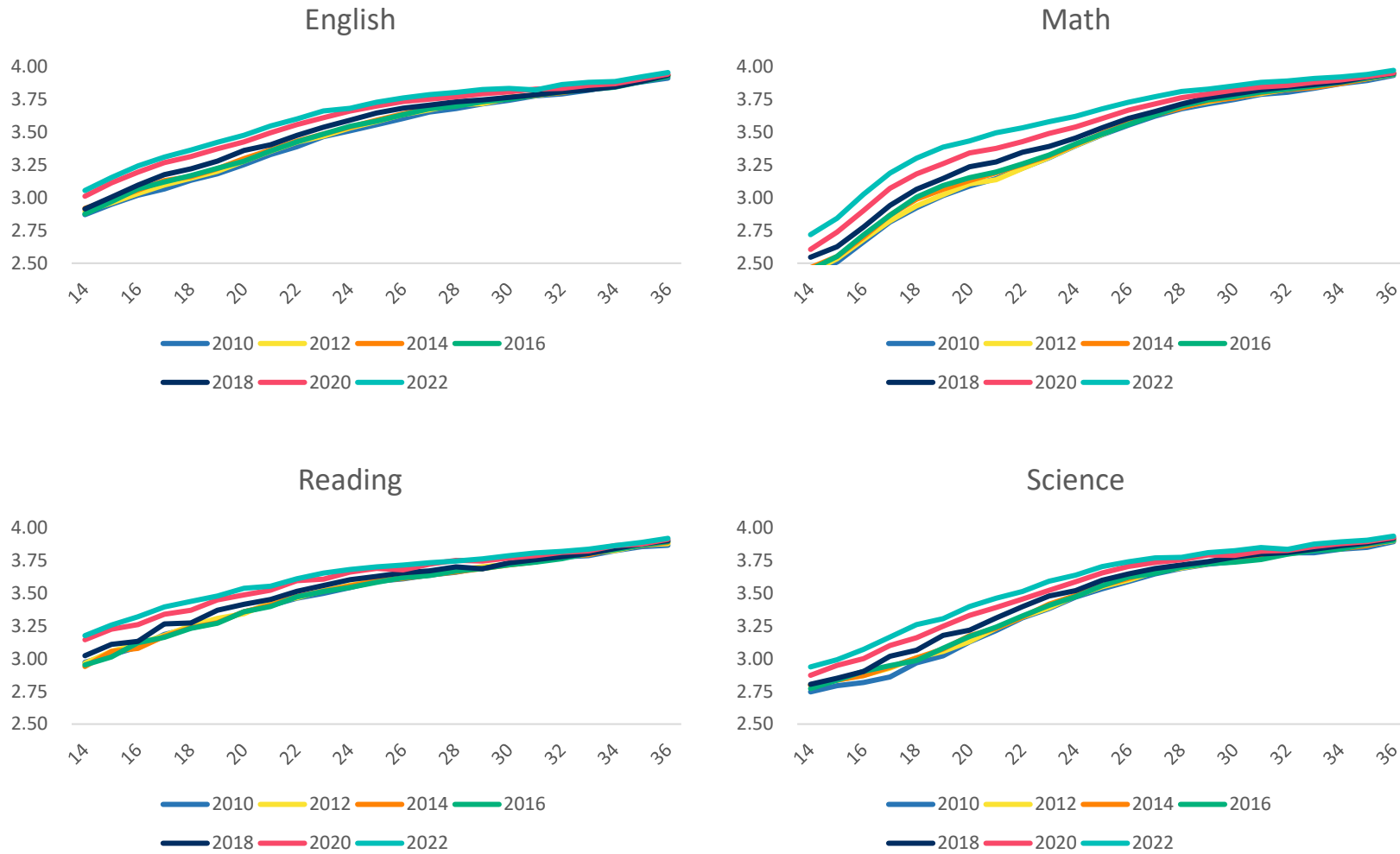
Subject GPA was estimated using hierarchical linear modeling (HLM) by controlling for key characteristics that have been shown to relate to HSGPA. In these hierarchical models, I accounted for both student and school characteristics in the estimation of HSGPA across time (see appendix for estimates of HLM parameters).

Figure 4 demonstrates that for English, math, reading, and science, there was a steady increase in adjusted subject GPA from 2010 to 2022. During this 12-year time frame, average adjusted English GPA increased from 3.17 to 3.39, a 0.22 grade point change. For math, adjusted subject GPA increased from 3.02 to 3.32, a 0.30 grade point change. A 0.18 adjusted grade point change was observed for social studies, from 3.28 in 2010 to 3.46 in 2022. Finally, in science, adjusted subject GPA increased from 3.12 in 2010 to 3.36 in 2022, a 0.24 grade point increase. In the years examined, the rate of grade inflation for math and science continued in 2021 and 2022, while English and social studies saw a decrease in the rate of grade inflation from 2021 to 2022 relative to previous years.

Figure 4. Adjusted Subject GPA From 2010 to 2022
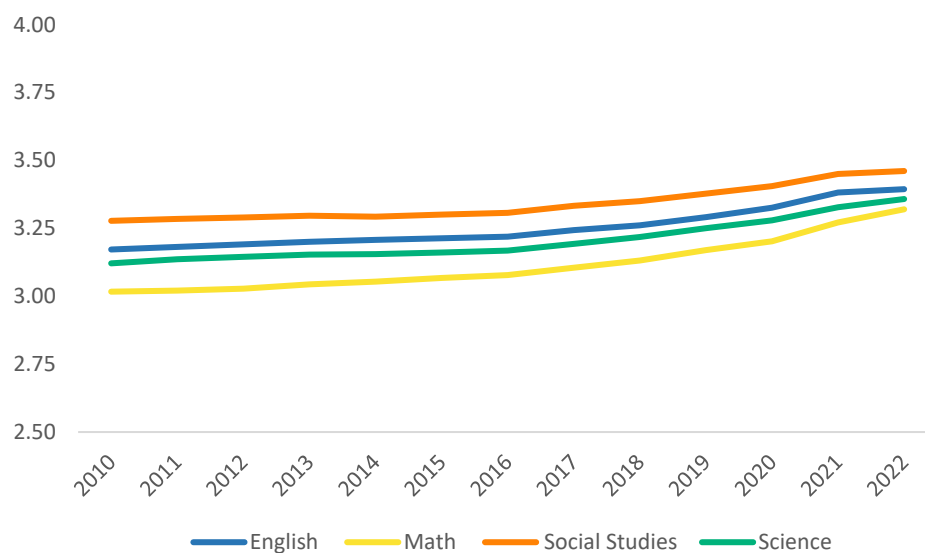
To better understand how subject GPA has changed over the course of the 12 years, standardized mean differences were calculated between adjusted HSGPA in 2010 and subsequent years (Figure 5). Standardized mean differences (or effect sizes) are independent of the unit of measurement and therefore allow a comparison of magnitude. First, we can see that grades in all subjects exhibited inflation from 2010 after accounting for student and school characteristics, including ACT scores. It is also evident that grade inflation was highest in math courses. Science and English courses had similar levels of grade inflation, and social studies courses demonstrated the lowest amount of grade inflation from 2010. Subject GPA in English, math, social studies, and science increased by 0.33, 0.43, 0.29, and 0.36 standard deviation units, respectively, between 2010 and 2022.

Figure 5. Standardized Mean Difference From 2010 for Each Subject in Subsequent Years
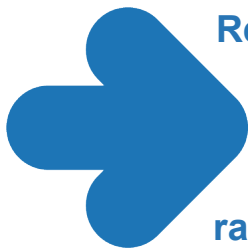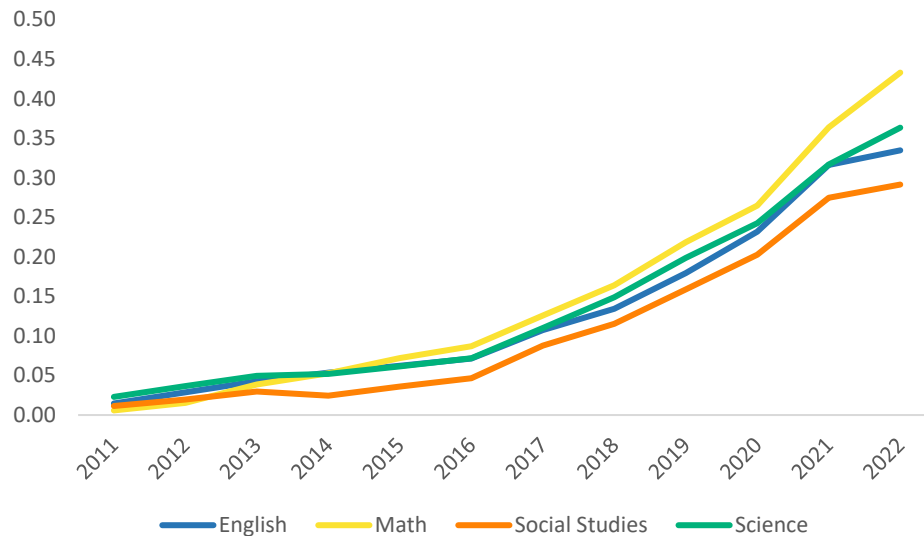
Research Question 2: Does grade inflation vary by racial/ethnic background, gender, percentage of students eligible for free or reduced-price lunch at the school, or percentage of students from traditionally underserved racial/ethnic groups at the school?

Standardized mean difference in subject GPA (relative to 2010) for 2011 to 2022, by race/ethnicity. In English, math, social studies, and science, Black students tended to experience the highest level of grade inflation across the years examined (Figure 6). Generally speaking, White, Hispanic, and students from other racial/ethnic groups had similar levels of grade inflation in all four subject areas. By 2022, Black, White, Hispanic, and students from other racial/ethnic groups had experienced a mean difference from 2010 of 0.42, 0.33, 0.29, and 0.30 standard deviations in English, respectively. In math, by 2022, Black, White, Hispanic, and students from other racial/ethnic groups had experienced a standardized mean difference of 0.50, 0.42, 0.40, and 0.40, respectively, since 2010. By 2022, in social studies, Black, White, Hispanic, and students from other racial/ethnic groups had experienced a standardized mean difference of 0.39, 0.26, 0.25, and 0.26, respectively. In science, by 2022, Black, White, Hispanic, and students from other racial/ethnic groups had experienced a standardized mean difference from 2010 of 0.48, 0.32, 0.33, and 0.33, respectively.

Figure 6. Standardized Differences by Subject in Adjusted Grades Between 2010 and Subsequent Years by Race/Ethnicity
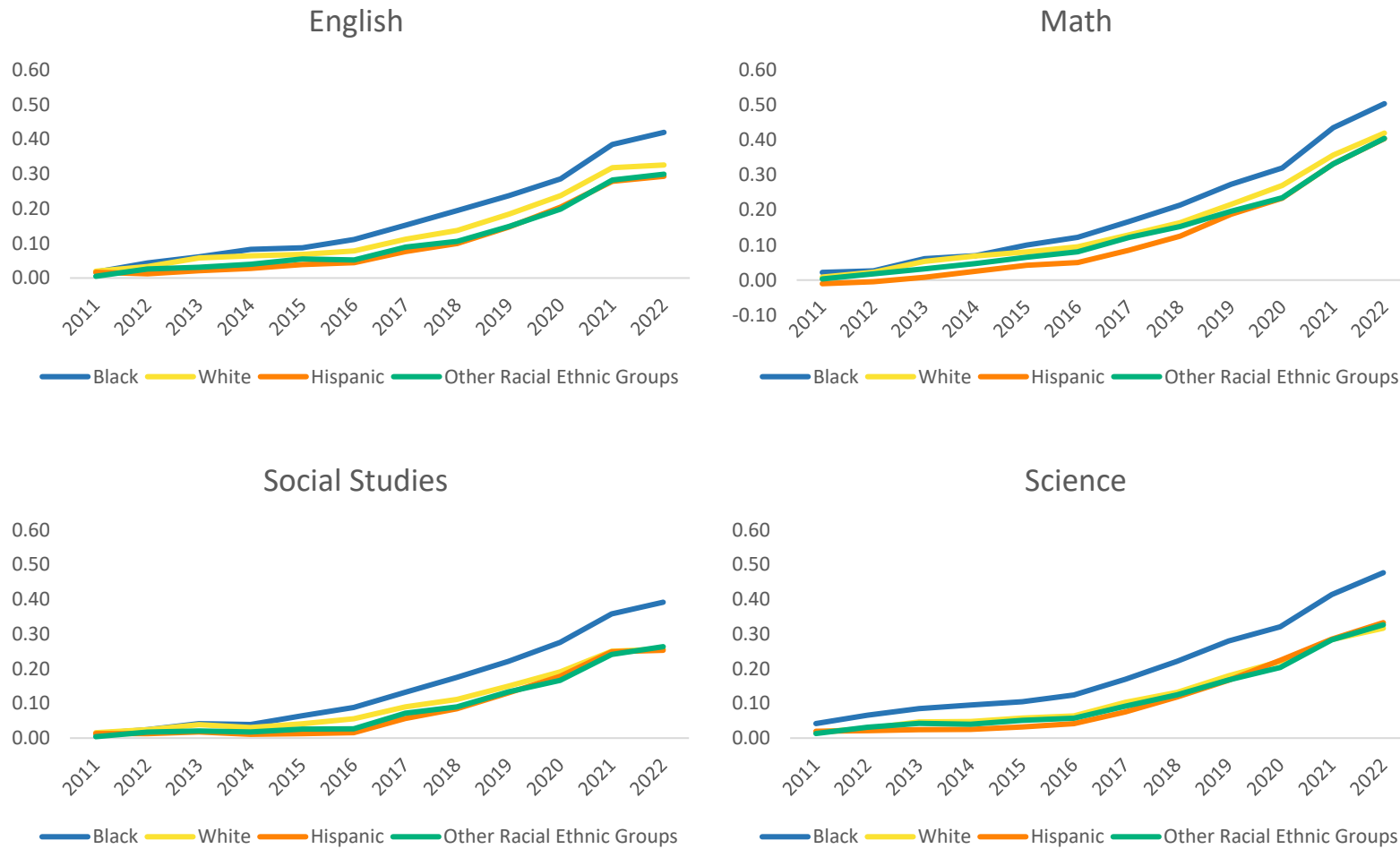
Standardized mean difference in subject GPA from 2010 for the years 2011 to 2022 by family income. Across subjects, the rate of grade inflation was similar for all family income groups examined (Figure 7). By 2022, in English, GPA had increased 0.31, 0.34, 0.35, and 0.34 standard deviation units for students from family incomes of less than $36,000, $36,000–$60,000, $60,000–$100,000, and greater than $100,000, respectively. In math, GPA had increased 0.40, 0.44, 0.45, and 0.44 standard deviation units for students from family incomes of less than $36,000, $36,000–$60,000, $60,000–$100,000, and greater than $100,000, respectively. In social studies, GPA had increased 0.29 standard deviation units for students from each family income group. In science, GPA had increased 0.36, 0.37, 0.36, and 0.36 standard deviation units for students from family incomes of less than $36,000, $36,000–$60,000, $60,000–$100,000, and greater than $100,000, respectively.

Figure 7. Standardized Differences by Subject in Adjusted Grades Between 2010 and Subsequent Years by Family Income
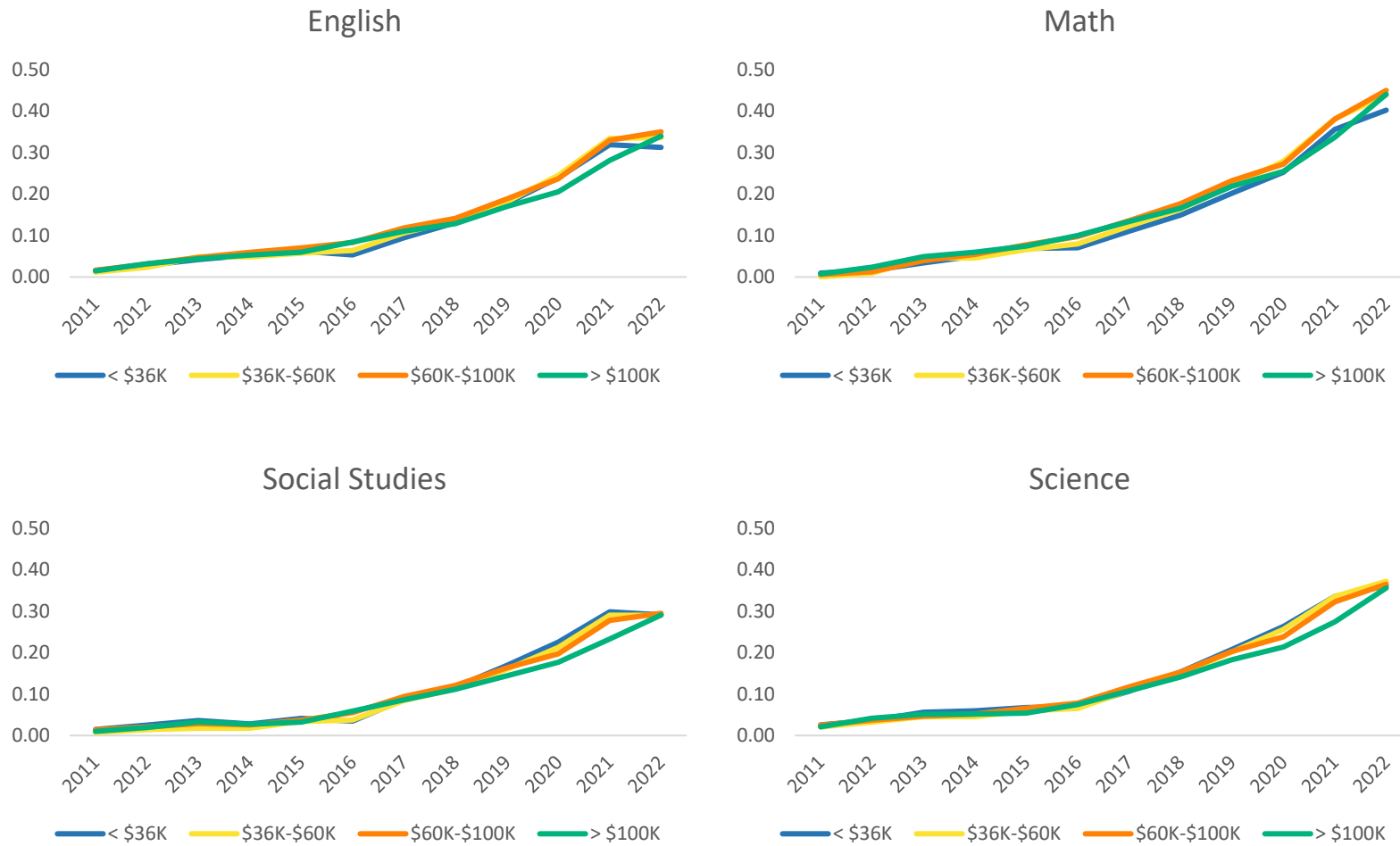
Standardized mean difference in subject GPA from 2010 for the years 2011 to 2022 by gender. In general, female students experienced more grade inflation across years than male students in all four subject areas. The greatest difference in grade inflation was observed in math. By 2022, female and male students experienced a standardized mean difference from 2010 of 0.36 and 0.31 for English. In Math, by 2022, female and male students experienced a standardized mean difference from 2010 of 0.48 and 0.39. In social studies, by 2022, female and male students experienced a standardized mean difference from 2010 of 0.32 and 0.26. Finally, in science, by 2022, female and male students experienced a standardized mean difference from 2010 of 0.39 and 0.33.

Standardized mean difference in subject GPA from 2010 for the years 2011 to 2022 by the percentage of students receiving free or reduced-price lunch at a school. To explore the effects of school characteristics on grade inflation, the average grade inflation at a school was estimated by the percentage of students eligible for free or reduced-price lunch while controlling for other student and school characteristics in the model. Figure 8 displays the grade inflation at schools with varying percentiles of students eligible for free or reduced-price lunch services.[3] These figures show the grade inflation at schools at the 5th, 25th, 50th, 75th, and 95th percentiles, which correspond to percentages of students eligible for free or reduced-price lunch of about 8%, 22%, 37%, 55%, and 78%, respectively.

We can see that, as the percentage of students eligible for free or reduced-price lunch increases, so does the grade inflation observed. For example, by 2022, the standardized mean differences in English GPA from 2010 to 2022 for the 5th, 25th, 50th, 75th, and 95th percentiles were 0.27, 0.29, 0.32, 0.35, and 0.39, respectively. In math, the standardized differences for these percentiles were 0.37, 0.39, 0.42, 0.53, and 0.66 standard deviation units. In social studies, the standardized differences for these percentiles were 0.22, 0.24, 0.27, 0.30, and 0.34. Finally, in science, the standardized differences for these percentiles was 0.27, 0.30, 0.33, 0.37, and 0.42. We can also see that for math, schools at the 75th and 95th percentiles of poverty consistently had higher grade inflation than schools at lower percentiles.

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[3] In the model used, percentages were included as a continuous variable. To calculate these values, specific percentiles were chosen for demonstration purposes.

Figure 8. Standardized Differences by Subject in Adjusted Grades Between 2010 and Subsequent Years by Percentile of Students Eligible for Free or Reduced-Price Lunch at a School
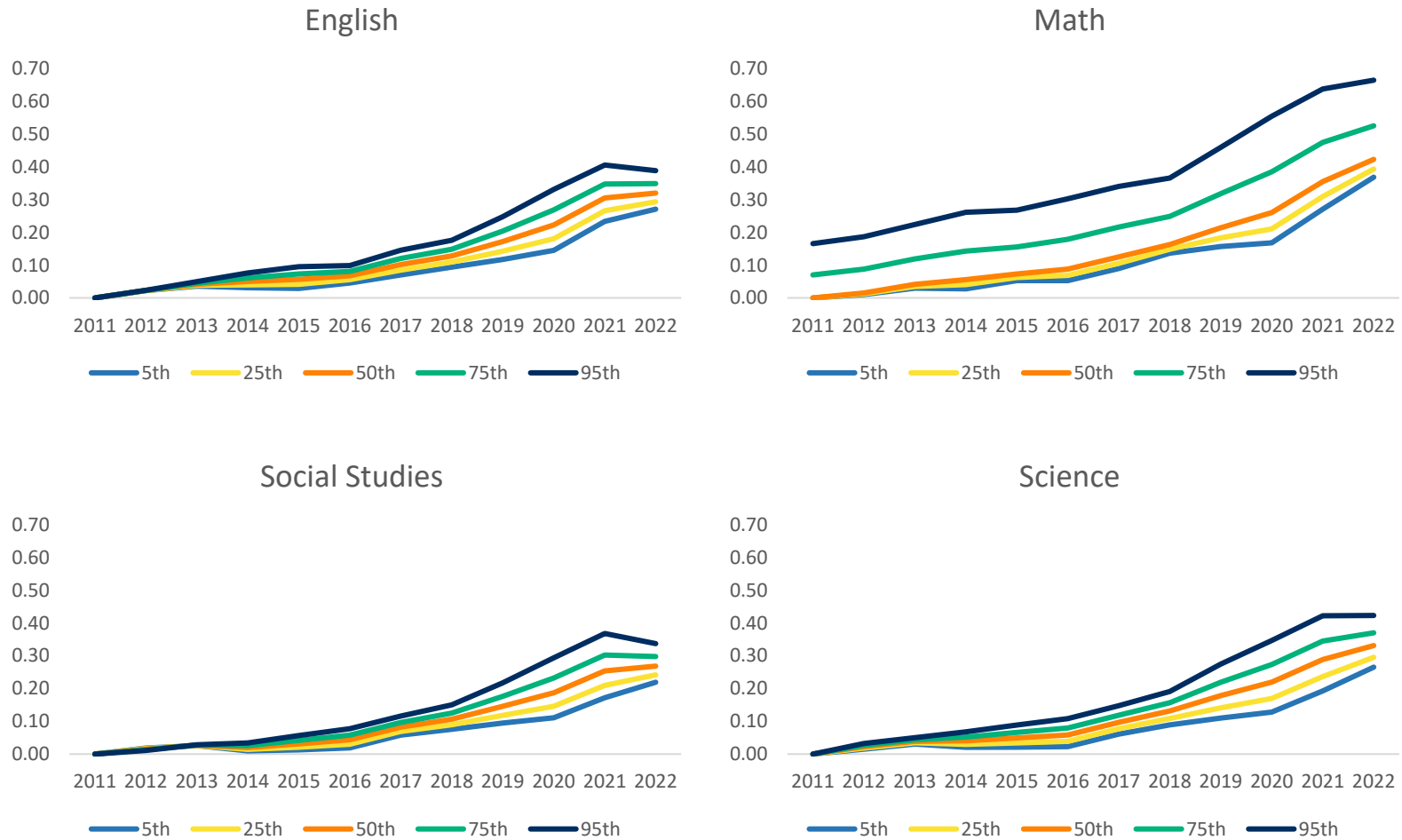
Standardized mean difference in subject GPA (relative to 2010) for 2011 to 2022 by the combination of percentage of students from traditionally underserved racial/ethnic groups at a school and race/ethnicity. In this analysis the standardized mean differences between subject GPAs in 2010 and subsequent years were estimated by race/ethnicity at different levels of percentages of students from traditionally underserved racial/ethnic groups at a school while controlling for other characteristics. For English, prior to 2015, all race/ethnicities examined at the 5th, 25th, 50th, 75th, and 95th percentile of students from traditionally underserved racial/ethnic groups had roughly similar grade inflation (Figure 9). For White and Black students since 2020, as the percentile of students from traditionally underserved racial/ethnic groups decreased, English grade inflation increased. For Hispanic students, this trend emerged starting in 2019. For other race/ethnicities, English grade inflation was similar across percentiles except for 2016 to 2018.

Figure 9. Standardized Differences in English in Adjusted Grades Between 2010 and Subsequent Years by Percentile of Students From Traditionally Underserved Racial/Ethnic Groups at a School and Student-Level Race/Ethnicity
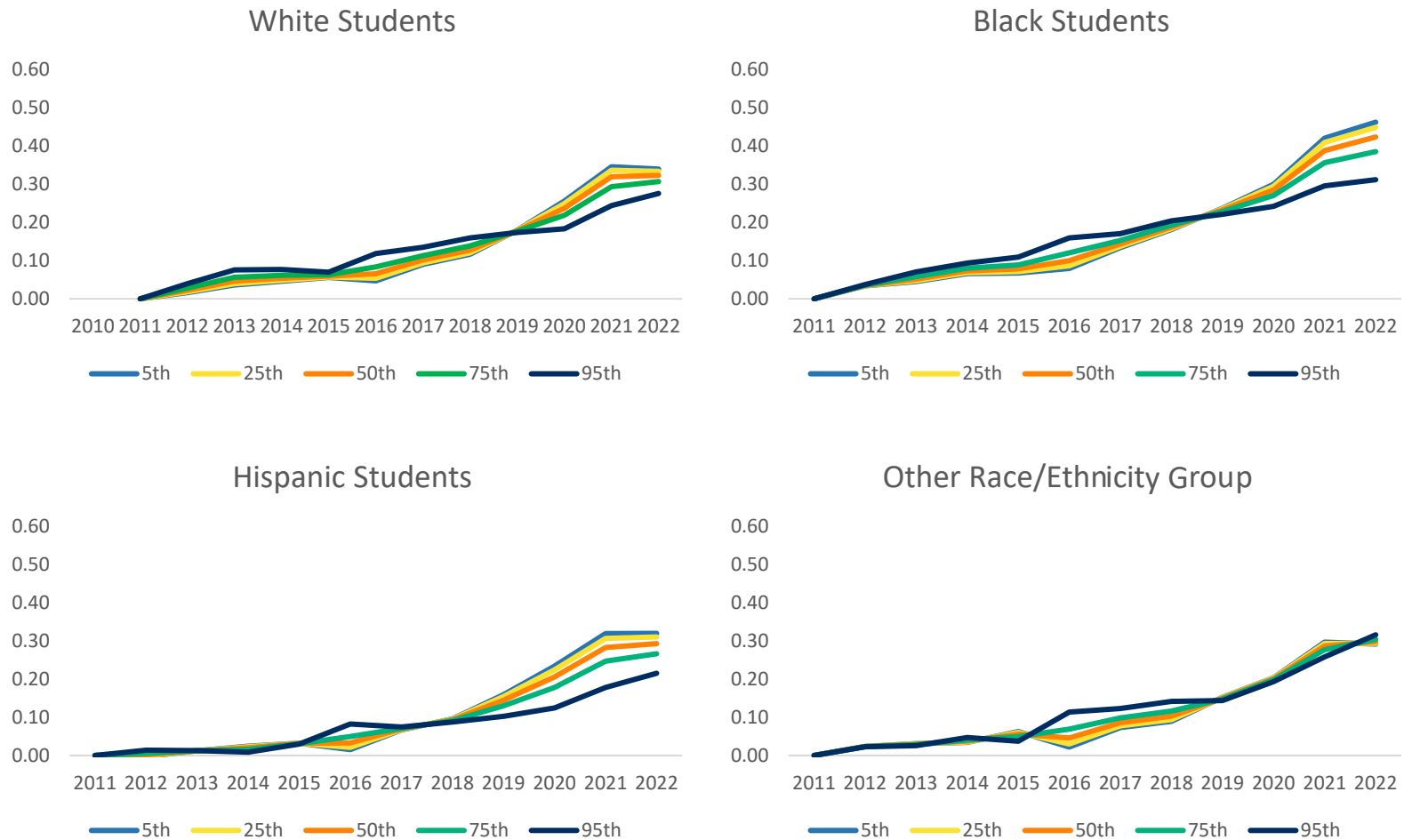
In math courses, as the percentile of students from traditionally underserved racial/ethnic groups at a school increased, so did grade inflation for both White and Black students prior to 2019 (Figure 10). From 2020 to 2022, the opposite trend emerged. For Hispanic students, between 2015 and 2018, as the percentile of students from traditionally underserved racial/ethnic groups at a school increased, so did math grade inflation. Prior to 2015 and after 2018, the opposite trend was seen where math grade inflation decreased as the percentile of students from traditionally underserved racial/ethnic groups at a school increased. For students from other racial/ethnic groups, before 2015 and in 2021, math grade inflation was similar across the percentiles of students from traditionally underserved racial/ethnic groups at a school. For other years, as the percentile of students from traditionally underserved racial/ethnic groups at a school increased, so did math grade inflation.

Figure 10. Standardized Differences in Math in Adjusted Grades Between 2010 and Subsequent Years by Percentile of Students From Traditionally Underserved Racial/Ethnic Groups at a School and Student-Level Race/Ethnicity

White Students

Black Students

Hispanic Students

Other Race/Ethnicity Group
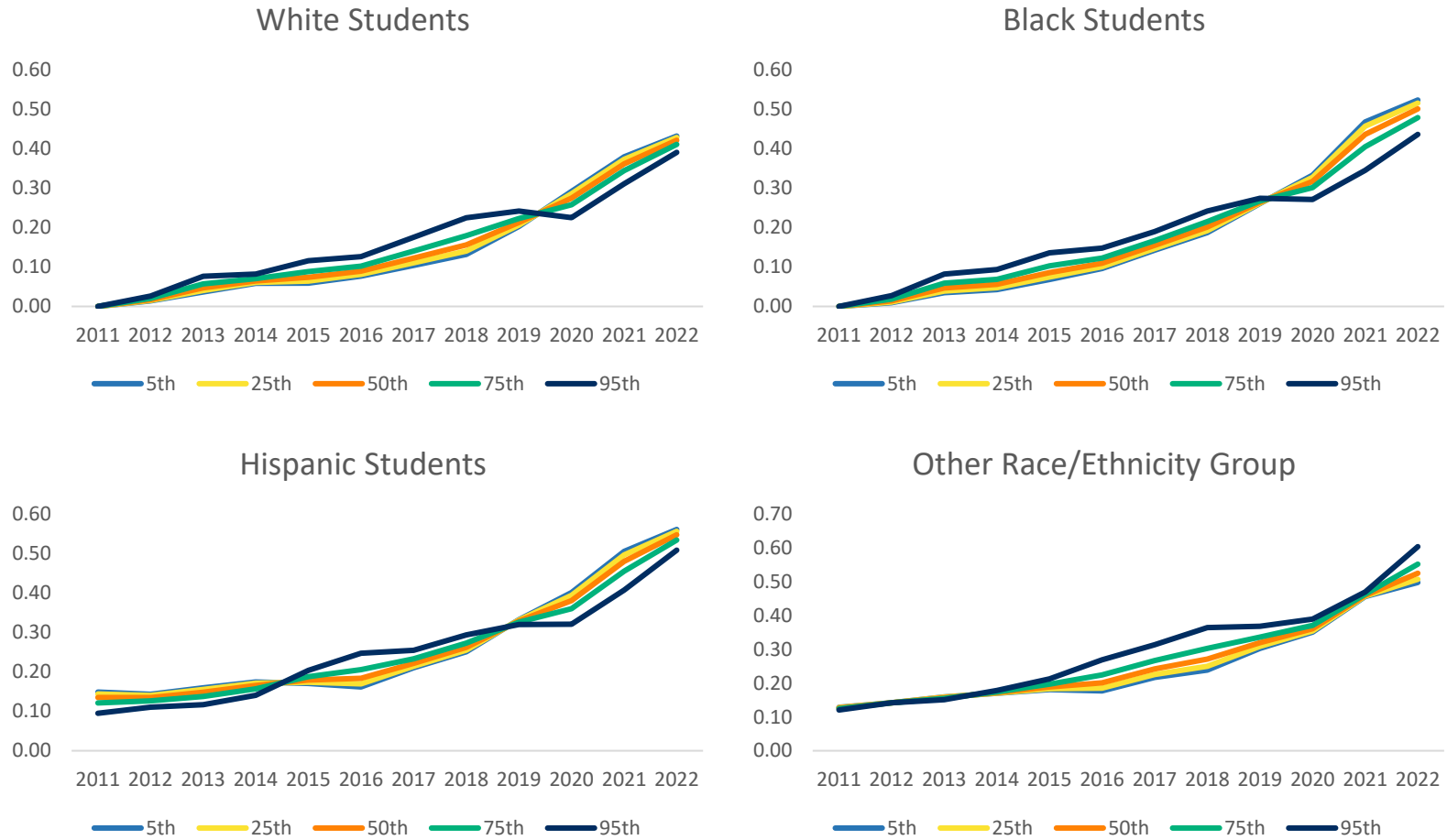
In social studies for White, Hispanic, and students from other racial/ethnic groups, as the percentile of students from traditionally underserved racial/ethnic groups in a school decreased, grade inflation increased (Figure 11). For Black students, this same pattern emerged after 2019. For White, Black, and Hispanic students, greater variability in social studies grade inflation across school percentiles of students from traditionally underserved racial/ethnic groups was observed after 2018. For students from other racial/ethnic groups, there was more consistency in the variability of social studies grade inflation across percentiles of students from traditionally underserved racial/ethnic groups at a school.

Figure 11. Standardized Differences in Social Studies in Adjusted Grades Between 2010 and Subsequent Years by Percentile of Students From Traditionally Underserved Racial/Ethnic Groups at a School and Student-Level Race/Ethnicity
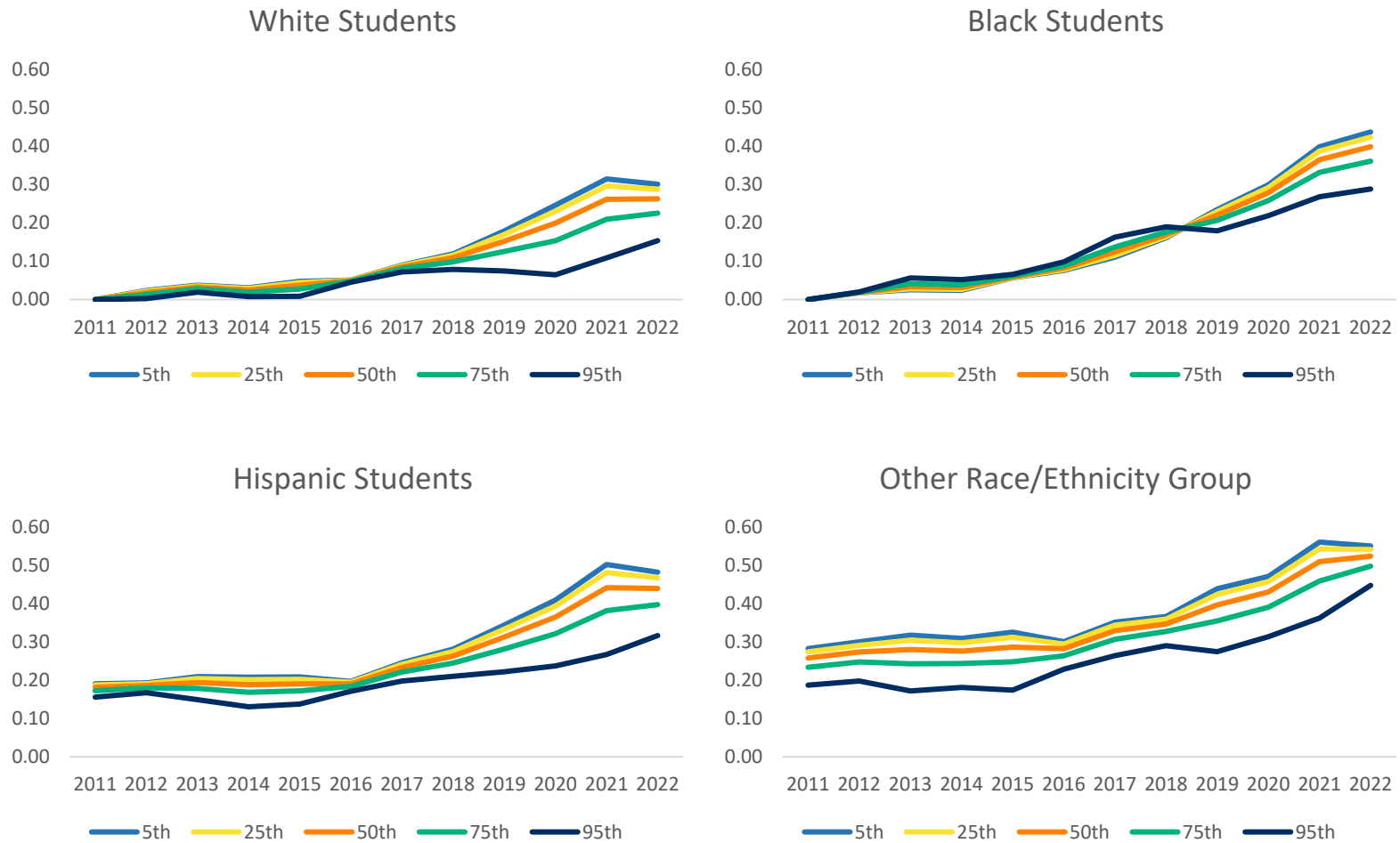
In science, White students experienced similar grade inflation regardless of percentile of students from traditionally underserved racial/ethnic groups at a school prior to 2018 (Figure 12). In 2018 and the years following, White students experienced more science grade inflation in schools with lower percentiles of students from traditionally underserved racial/ethnic groups. For Hispanic students, prior to 2018, there was little variability in science grade inflation by percentile of students from traditionally underserved racial/ethnic groups at a school. From 2018 forward, science grade inflation for Hispanic students was greater in schools with lower percentiles of students from traditionally underserved racial/ethnic groups. For Black students, prior to 2018, science grade inflation tended to increase as the percentile of students from traditionally underserved racial/ethnic groups at a school increased. From 2020 forward, the opposite trend was observed for Black students. For students from other racial/ethnic groups, science grade inflation generally increased as the percentile of students from traditionally underserved racial/ethnic groups at a school decreased. Across all non-White student groups, greater variability in grade inflation was seen by percentile of students from traditionally underserved racial/ethnic groups at a school from 2019 forward.

Figure 12. Standardized Differences in Science in Adjusted Grades Between 2010 and Subsequent Years by Percentile of Students From Traditionally Underserved Racial/Ethnic Groups at a School and Student-Level Race/Ethnicity
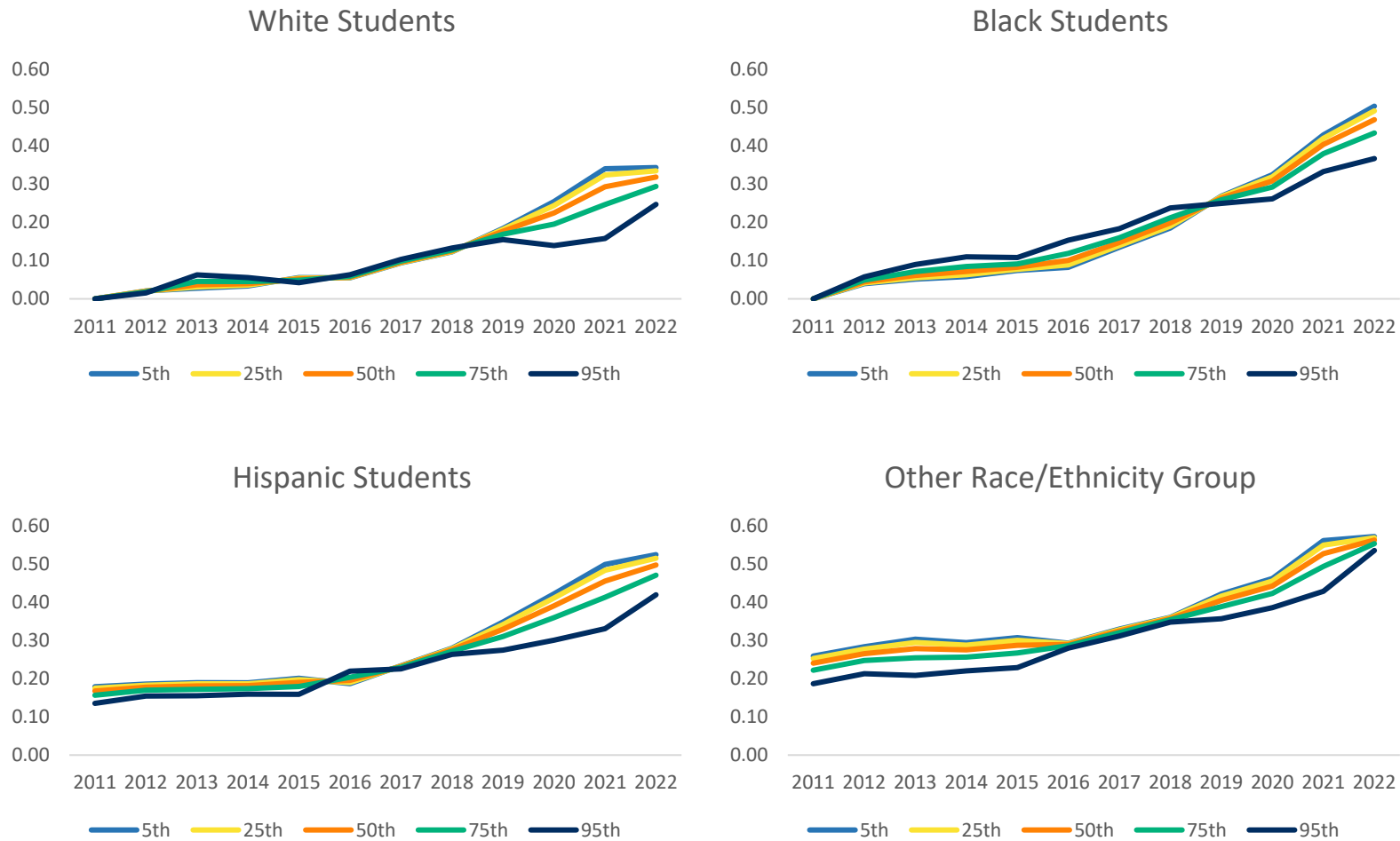
Discussion

The present research investigated whether there was evidence of grade inflation in high school English, math, social studies, and science GPA. It further investigated whether there was evidence of differences in grade inflation by race/ethnicity, family income, gender, percentage of students eligible for free or reduced-price lunch at a school, and percentage of students from traditionally underserved racial/ethnic groups at a school.

This study revealed evidence of grade inflation at the subject level. I saw that, for all subjects examined from 2010 to 2022, the percentage of students assigned B and C grades declined, while the number of students assigned A grades increased. The greatest difference between the percentages of students reporting A and B grades was observed in social studies, and the smallest difference was observed in math. I also saw that, prior to adjusting for student and school characteristics, there was a slight increase in the observed subject GPA from 2010 to 2022, even while the ACT score corresponding to each subject remained the same or decreased. I can also see that the average observed subject GPA increased year over year for students who demonstrated the same level of academic achievement as measured by the ACT. After adjusting for student and school characteristics, the adjusted subject GPA increased from 2010 to 2022 for all subjects. However, they did not increase at the same rate. The rate of grade inflation, particularly in the latter years, tended to be higher for math, followed by science, then English, and finally social studies.

Given that grade inflation was observed overall in all subjects, group differences for each subject were also examined. Turning first to race/ethnicity, I saw that in all subjects, Black students experienced the greatest grade inflation when compared to White, Hispanic, and students from other racial/ethnic groups. When I compared Black, Hispanic, and students from other racial/ethnic groups to White students, I saw that Black students tended to have greater grade inflation than White students, while Hispanic and students from other racial/ethnic groups tended to have lower grade inflation than White students. Across family income groups, only slight differences were observed in the rates of grade inflation.

In comparison to male students, female students tended to see greater grade inflation, but both groups experienced increases in grades over time from 2010 to 2022. Both male and female students had higher rates of grade inflation after 2016. In English, social studies, and science, males and females experienced similar rates of grade inflation across time. In math, female students experienced higher rates of grade inflation than male students did.

Grade inflation was also examined by the percentile of students eligible for free or reduced-price lunch at a school. For English, social studies, and science, grade inflation was similar across school poverty levels prior to 2014. In 2015 and later years, the amount of grade inflation for students at different levels of school poverty began to differ, and greater inflation was observed as time progressed. In English, social studies, and science, the differences across school poverty levels continued to increase until 2021; in 2022, the differences between school poverty groups decreased.

This study found evidence that student grades were related to both percentile of students from traditionally underserved racial/ethnic groups at a school and student-level race/ethnicity simultaneously. In this study, the percentage of students from traditionally underserved racial/ethnic groups at a school was collected from the NCES Common Core of Data, while the student's race/ethnicity was collected from the student directly. By 2022, greater variability in English grade inflation was seen across percentiles of students from traditionally underserved groups at a school for Black, Hispanic, and White students. In fact, Black and Hispanic students experienced the greatest variability in grade inflation by percentile of students from traditionally underserved groups at a school. In math, there was some variability in the rate of grade inflation for Black, Hispanic, White, and students from other racial/ethnic groups by percentile of students from traditionally underserved groups at a school. The differences across percentiles of students from traditionally underserved groups at a school, however, were small. For social studies, prior to 2019, Black, Hispanic, and White students did not experience much variability in grade inflation by percentile of students from traditionally underserved groups at a school. The rates of grade inflation, however, began to diverge in 2019. Amongst students from other racial/ethnic groups, students in schools with the highest (95th) percentile of students from traditionally underserved groups experienced the lowest rate of grade inflation in comparison to other levels. In science, similar trends were observed.

When examining grade inflation for the 2020, 2021, and 2022 cohorts, we must consider the potential impact of the COVID-19 pandemic on grade inflation. For the 2020 ACT graduating class, less than 1% of ACT tests took place after June 2020; for the 2021 graduating class, about 47% of ACT tests took place after June 2020; and for the 2022 graduating class, over 99% of ACT tests were taken during the pandemic. Further, only courses taken after spring 2020 could have been impacted by the pandemic. For example, for a student in the 2022 cohort who last tested in spring 2021, the courses from spring 2020 (10th grade) and 2020–2021 (11th grade) could have been impacted. During the pandemic, many changes were made at the school level in grading practices. For example, in spring 2020, some schools instituted rules so that students could not receive a course grade lower than they had prior to the pandemic or could not fail. This could have impacted grade inflation during this period. In fact, these changes raise questions about how one should interpret GPAs assigned during this time. We must ask whether the grades for courses in spring 2020 and the 2020–2021 school year mean the same thing as they did in prior years or mean the same thing as grades for courses after the COVID-19 pandemic was under better control. In our study sample during the testing year of 2019–2020, the April, June, and July ACT test dates were impacted by the COVID-19 pandemic. During the fall 2020 testing window, all students were impacted because of social distancing rules and some testing center closures due to the COVID-19 pandemic. In this study, grade inflation continued to increase steadily for all years, including during the COVID-19 pandemic. So, while it is possible that grades were impacted by the changes in grading practices, the trends across all years in grade inflation were consistent.

When we think about the potential effects of grade inflation, we must think of a very important way that HSGPA is used: postsecondary admissions decisions. Institutions take a wide variety of approaches to admissions. Colleges do different things as appropriate for their individual

institutions to best help their students. As test-optional admissions policies grow in popularity, the importance of HSGPA also increases. In previous years, postsecondary institutions had at least two measures of academic achievement: HSGPA and a standardized test score. As a result of the COVID-19 pandemic, many postsecondary institutions instituted test-optional policies. As a result, in these situations, institutions may have only a single academic measure to evaluate students: HSGPA. While postsecondary institutions have other indicators of student performance, such as letters of recommendation or personal essays, in regard to academic performance in a test-optional environment, they are reliant in many cases solely on HSGPA. Of additional concern is that, while institutions may have these pieces of information in addition to HSGPA, these additional sources of information are subjective and do not quantify content mastery. This results in increased pressure and importance being placed on a single measure, which runs contrary to best practices when evaluating potential applicants. This study provides important context for colleges to consider as they develop their unique approach to admissions, placement, and student services. Fundamentally, if persistent grade inflation in high school exists, colleges need to know this in order to make the best decisions possible for their institutions and their students.

When trying to evaluate whether the grade inflation that has been observed in this and other studies is really a problem, we can look to the findings of this study to help us contextualize this question. The main issue is that grade inflation is not happening at the same rate for all students. As we saw in this study, inflation differs by a student's race/ethnicity, a school's percentile of students eligible for free or reduced-price lunch, and a school's percentile of students from traditionally underserved racial/ethnic groups. This is particularly important because these are not malleable characteristics that a student can strive to change. This suggests that there are concerns about equity in high school grades for some students.

As average HSGPA continues to increase, more students are receiving A grades and fewer students are receiving B and C grades. This compresses the upper end of the HSGPA scale and makes it more difficult to use HSGPA to differentiate students' academic achievement and preparation. If this trend continues, it poses a threat to the validity of HSGPA for the purposes of understanding academic readiness and for using HSGPA for college admissions or course placement.

We could also postulate that students may be taking more advanced or honors courses and earning bonus points to increase their HSGPA. This could be one reason why grades are increasing. In our analysis, I cannot determine whether students reported their weighted grades, which would include bonus points, or unweighted grades. While there is some evidence to suggest that some students may be taking more rigorous courses, this does not explain what is happening for all students. In fact, in this study, at most 18% of students in the cohorts examined had taken advanced coursework. Additionally, not all students across the country have access to advanced coursework that could potentially boost HSGPA through bonus points and weighted calculations.

One thing to be clear about is that this study does not suggest that HSGPA should play a smaller role in the admissions and scholarship process. HSGPA provides very useful information because it includes both academic mastery and behavioral components. While previous research suggests that HSGPA alone is more predictive of postsecondary outcomes, such as first-year GPA, compared to standardized test scores alone, that research also indicates that using HSGPA in combination with standardized test scores is more predictive than either indicator alone (Sanchez, 2013). The evidence available suggests that this is not a situation of either/or but both/and. More information is better than less, and the use of multiple measures is beneficial.

Given the long history of studies that document the evidence of grade inflation in high school, it is imperative to continue to monitor these trends over time. Furthermore, it is important to conduct validity studies to examine whether the value of HSGPA for predicting postsecondary outcomes such as enrollment, first-year GPA, retention, and cumulative college GPA has been impacted by the changes made to the assignment of grades during the COVID-19 pandemic. Additionally, we should monitor these validity impacts for cohorts after the pandemic to see if HSGPA still performs as an indicator of academic achievement and behaviors in the ways we have traditionally understood HSGPA to work.

About the Author

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Edgar I. Sanchez is a lead research scientist at ACT, studying issues of postsecondary admissions, national testing programs, test preparation efficacy, and intervention effectiveness. In his career, Dr. Sanchez has focused on the transition between high school and college and supporting the decision-making capacity of college administrators, students, and their families.

Acknowledgements

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Appendix

Table A1. HLM English Model Results

Characteristic		Coefficient	Sig
Intercept		2.726	<.0001
Number of English courses		0.049	<.0001
Year	2010	—	—
	2011	0.011	0.000
	2012	0.016	<.0001
	2013	0.029	<.0001
	2014	0.034	<.0001
	2015	0.034	<.0001
	2016	0.027	<.0001
	2017	0.057	<.0001
	2018	0.076	<.0001
	2019	0.113	<.0001
	2020	0.162	<.0001
	2021	0.212	<.0001
	2022	0.203	<.0001
Test type	National	0.226	<.0001
	State/District	—	—
ACT English		0.041	<.0001
Race/ethnicity	Black	-0.119	<.0001
	Hispanic	-0.017	<.0001
	Other	0.015	<.0001
	White	—	—
Family income	<36K	-0.054	<.0001
	36K–60K	—	—
	60K–100K	0.039	<.0001
	>100K	0.067	<.0001
Gender (male reference)	Male	—	—
	Female	0.175	<.0001
Taken advanced coursework in English	No	—	—
	Yes	0.173	<.0001
Percentage free or reduced-price lunch		0.000	0.049
Percentage non-White		-0.001	<.0001
Percentage female		-0.004	<.0001
Percentage taking advanced courses		-0.007	<.0001
Percentage tested		0.004	<.0001

Year*gender	2010*Male	—	—
	2010*Female	—	—
	2011*Male	—	—
	2011*Female	0.001	0.508
	2012*Male	—	—
	2012*Female	0.005	0.012
	2013*Male	—	—
	2013*Female	0.013	<.0001
	2014*Male	—	—
	2014*Female	0.012	<.0001
	2015*Male	—	—
	2015*Female	0.018	<.0001
	2016*Male	—	—
	2016*Female	0.042	<.0001
	2017*Male	—	—
	2017*Female	0.034	<.0001
	2018*Male	—	—
	2018*Female	0.033	<.0001
	2019*Male	—	—
	2019*Female	0.022	<.0001
	2020*Male	—	—
	2020*Female	0.012	<.0001
	2021*Male	—	—
	2021*Female	0.023	<.0001
	2022*Male	—	—
	2022*Female	0.028	<.0001
Year*race/ethnicity	2010*Black	—	—
	2010*Hispanic	—	—
	2010*Other	—	—
	2010*White	—	—
	2011*Black	-0.002	0.686
	2011*Hispanic	-0.002	0.638
	2011*Other	-0.010	0.005
	2011*White	—	—
	2012*Black	0.007	0.127
	2012*Hispanic	-0.014	0.003
	2012*Other	-0.005	0.141
	2012*White	—	—
	2013*Black	0.002	0.607

2013*Hispanic	-0.025	<.0001
2013*Other	-0.018	<.0001
2013*White	—	—
2014*Black	0.012	0.004
2014*Hispanic	-0.025	<.0001
2014*Other	-0.016	<.0001
2014*White	—	—
2015*Black	0.013	0.002
2015*Hispanic	-0.020	<.0001
2015*Other	-0.009	0.006
2015*White	—	—
2016*Black	0.022	<.0001
2016*Hispanic	-0.023	<.0001
2016*Other	-0.017	<.0001
2016*White	—	—
2017*Black	0.027	<.0001
2017*Hispanic	-0.024	<.0001
2017*Other	-0.015	<.0001
2017*White	—	—
2018*Black	0.038	<.0001
2018*Hispanic	-0.025	<.0001
2018*Other	-0.021	<.0001
2018*White	—	—
2019*Black	0.035	<.0001
2019*Hispanic	-0.025	<.0001
2019*Other	-0.024	<.0001
2019*White	—	—
2020*Black	0.032	<.0001
2020*Hispanic	-0.023	<.0001
2020*Other	-0.025	<.0001
2020*White	—	—
2021*Black	0.044	<.0001
2021*Hispanic	-0.026	<.0001
2021*Other	-0.023	<.0001
2021*White	—	—
2022*Black	0.062	<.0001
2022*Hispanic	-0.022	<.0001
2022*Other	-0.017	<.0001
2022*White	—	—

2010*<36K	—	—
2010*36K–60K	—	—
2010*60K–100K	—	—
2010*>100K	—	—
2011*<36K	0.003	0.380
2011*36K–60K	—	—
2011*60K–100K	0.003	0.353
2011*>100K	0.002	0.601
2012*<36K	0.003	0.320
2012*36K–60K	—	—
2012*60K–100K	0.005	0.102
2012*>100K	0.006	0.090
2013*<36K	0.003	0.361
2013*36K–60K	—	—
2013*60K–100K	0.006	0.044
2013*>100K	0.004	0.216
2014*<36K	0.003	0.330
2014*36K–60K	—	—
2014*60K–100K	0.007	0.018
2014*>100K	0.003	0.373
Year*family income 2015*<36K	0.003	0.297
2015*36K–60K	—	—
2015*60K–100K	0.008	0.009
2015*>100K	0.002	0.634
2016*<36K	-0.007	0.020
2016*36K–60K	—	—
2016*60K–100K	0.013	<.0001
2016*>100K	0.014	0.000
2017*<36K	-0.008	0.016
2017*36K–60K	—	—
2017*60K–100K	0.008	0.017
2017*>100K	0.003	0.383
2018*<36K	-0.003	0.364
2018*36K–60K	—	—
2018*60K–100K	0.004	0.284
2018*>100K	-0.005	0.166
2019*<36K	-0.002	0.541
2019*36K–60K	—	—
2019*60K–100K	0.004	0.192
2019*>100K	-0.008	0.041
2020*<36K	-0.004	0.347

	2020*36K–60K	—	—
	2020*60K–100K	-0.006	0.123
	2020*>100K	-0.026	<.0001
	2021*<36K	-0.010	0.016
	2021*36K–60K	—	—
	2021*60K–100K	-0.003	0.494
	2021*>100K	-0.035	<.0001
	2022*<36K	-0.016	0.001
	2022*36K–60K	—	—
	2022*60K–100K	0.009	0.014
	2022*>100K	0.002	0.519
Year*percentage FRL	2010	—	—
	2011	0.000	0.168
	2012	0.000	0.357
	2013	0.000	0.012
	2014	0.000	<.0001
	2015	0.001	<.0001
	2016	0.001	<.0001
	2017	0.001	<.0001
	2018	0.001	<.0001
	2019	0.001	<.0001
	2020	0.002	<.0001
	2021	0.002	<.0001
	2022	0.001	<.0001
Year*percentage non-White	2010	—	—
	2011	0.000	0.050
	2012	0.000	0.002
	2013	0.000	<.0001
	2014	0.000	0.000
	2015	0.000	0.026
	2016	0.001	<.0001
	2017	0.000	<.0001
	2018	0.000	<.0001
	2019	0.000	0.787
	2020	0.000	<.0001
	2021	-0.001	<.0001
	2022	0.000	<.0001
Percentage non-White* race/ethnicity	Black	0.002	<.0001
	Hispanic	0.001	<.0001
	Other	0.001	<.0001
	White	—	—
	2010*Black	—	—

2010*Hispanic	—	—
2010*Other	—	—
2010*White	—	—
2011*Black	0.000	0.379
2011*Hispanic	0.000	0.031
2011*Other	0.000	0.091
2011*White	—	—
2012*Black	0.000	0.121
2012*Hispanic	0.000	0.140
2012*Other	0.000	0.037
2012*White	—	—
2013*Black	0.000	0.222
2013*Hispanic	0.000	0.001
2013*Other	0.000	0.002
2013*White	—	—
2014*Black	0.000	0.560
2014*Hispanic	-0.001	0.000
2014*Other	0.000	0.063
2014*White	—	—
2015*Black	0.000	0.174
2015*Hispanic	0.000	0.037
2015*Other	0.000	0.003
2015*White	—	—
2016*Black	0.000	0.850
2016*Hispanic	0.000	0.143
2016*Other	0.000	0.818
2016*White	—	—
2017*Black	0.000	0.358
2017*Hispanic	0.000	0.001
2017*Other	0.000	0.553
2017*White	—	—
2018*Black	0.000	0.121
2018*Hispanic	-0.001	<.0001
2018*Other	0.000	0.726
2018*White	—	—
2019*Black	0.000	0.386
2019*Hispanic	-0.001	0.000
2019*Other	0.000	0.342
2019*White	—	—
2020*Black	0.000	0.596
2020*Hispanic	0.000	0.003
2020*Other	0.000	0.025

Year*percentage non-White*race/ethnicity

2020*White	—	—
2021*Black	0.000	0.136
2021*Hispanic	0.000	0.004
2021*Other	0.000	0.040
2021*White	—	—
2022*Black	-0.001	<.0001
2022*Hispanic	0.000	0.002
2022*Other	0.001	0.001
2022*White	—	—

Note: Non-White students refers to students from traditionally underserved racial/ethnic groups

Table A2. HLM Math Model Results

Characteristic		Coefficient	Sig
Intercept		2.508	<.0001
Number of English courses		0.069	<.0001
Year	2010	—	—
	2011	0.002	0.524
	2012	0.012	0.000
	2013	0.031	<.0001
	2014	0.040	<.0001
	2015	0.042	<.0001
	2016	0.048	<.0001
	2017	0.072	<.0001
	2018	0.094	<.0001
	2019	0.132	<.0001
	2020	0.182	<.0001
	2021	0.238	<.0001
	2022	0.267	<.0001
Test type	National	0.190	<.0001
	State/District	—	—
ACT English		0.067	<.0001
Race/ethnicity	Black	-0.098	<.0001
	Hispanic	0.006	0.149
	Other	-0.003	0.281
	White	—	—
Family income	<36K	-0.039	<.0001
	36K–60K	—	—
	60K–100K	0.022	<.0001
	>100K	0.029	<.0001
Gender	Male	—	—
	Female	0.171	<.0001
Taken advanced coursework in English	No	—	—
	Yes	0.146	<.0001
Percentage free/reduced price lunch		0.003	<.0001
Percentage non-White		-0.002	<.0001
Percentage female		-0.002	0.115
Percentage taking advanced courses		-0.003	<.0001
Percentage tested		0.003	<.0001

	2010*Male	—	—
	2010*Female	—	—
	2011*Male	—	—
	2011*Female	0.001	0.705
	2012*Male	—	—
	2012*Female	-0.001	0.602
	2013*Male	—	—
	2013*Female	0.004	0.088
	2014*Male	—	—
	2014*Female	0.008	0.000
	2015*Male	—	—
	2015*Female	0.021	<.0001
Year*gender	2016*Male	—	—
	2016*Female	0.029	<.0001
	2017*Male	—	—
	2017*Female	0.037	<.0001
	2018*Male	—	—
	2018*Female	0.044	<.0001
	2019*Male	—	—
	2019*Female	0.045	<.0001
	2020*Male	—	—
	2020*Female	0.037	<.0001
	2021*Male	—	—
	2021*Female	0.051	<.0001
	2022*Male	—	—
	2022*Female	0.063	<.0001
	2010*Black	—	—
	2010*Hispanic	—	—
	2010*Other	—	—
	2010*White	—	—
	2011*Black	0.010	0.046
	2011*Hispanic	-0.013	0.012
Year*race/ethnicity	2011*Other	-0.004	0.354
	2011*White	—	—
	2012*Black	0.003	0.521
	2012*Hispanic	-0.019	0.000
	2012*Other	-0.003	0.390
	2012*White	—	—
	2013*Black	0.006	0.230

2013*Hispanic	-0.032	<.0001
2013*Other	-0.015	<.0001
2013*White	—	—
2014*Black	0.001	0.849
2014*Hispanic	-0.031	<.0001
2014*Other	-0.015	<.0001
2014*White	—	—
2015*Black	0.014	0.002
2015*Hispanic	-0.026	<.0001
2015*Other	-0.011	0.004
2015*White	—	—
2016*Black	0.019	<.0001
2016*Hispanic	-0.031	<.0001
2016*Other	-0.010	0.007
2016*White	—	—
2017*Black	0.026	<.0001
2017*Hispanic	-0.031	<.0001
2017*Other	-0.005	0.179
2017*White	—	—
2018*Black	0.035	<.0001
2018*Hispanic	-0.027	<.0001
2018*Other	-0.008	0.037
2018*White	—	—
2019*Black	0.040	<.0001
2019*Hispanic	-0.020	<.0001
2019*Other	-0.014	0.000
2019*White	—	—
2020*Black	0.035	<.0001
2020*Hispanic	-0.025	<.0001
2020*Other	-0.024	<.0001
2020*White	—	—
2021*Black	0.054	<.0001
2021*Hispanic	-0.017	0.001
2021*Other	-0.017	<.0001
2021*White	—	—
2022*Black	0.058	<.0001
2022*Hispanic	-0.011	0.039
2022*Other	-0.009	0.027
2022*White	—	—

2010*<36K	—	—
2010*36K–60K	—	—
2010*60K–100K	—	—
2010*>100K	—	—
2011*<36K	0.006	0.101
2011*36K–60K	—	—
2011*60K–100K	0.004	0.286
2011*>100K	0.005	0.225
2012*<36K	0.005	0.205
2012*36K–60K	—	—
2012*60K–100K	0.002	0.507
2012*>100K	0.010	0.008
2013*<36K	0.002	0.636
2013*36K–60K	—	—
2013*60K–100K	0.006	0.116
2013*>100K	0.012	0.001
2014*<36K	0.003	0.383
2014*36K–60K	—	—
2014*60K–100K	0.006	0.079
2014*>100K	0.010	0.009
2015*<36K	0.002	0.550
2015*36K–60K	—	—
2015*60K–100K	0.008	0.017
2015*>100K	0.006	0.127
2016*<36K	-0.006	0.096
2016*36K–60K	—	—
2016*60K–100K	0.012	0.002
2016*>100K	0.014	0.001
2017*<36K	-0.009	0.034
2017*36K–60K	—	—
2017*60K–100K	0.009	0.013
2017*>100K	0.008	0.033
2018*<36K	-0.010	0.010
2018*36K–60K	—	—
2018*60K–100K	0.010	0.006
2018*>100K	0.002	0.623
2019*<36K	-0.013	0.001
2019*36K–60K	—	—
2019*60K–100K	0.008	0.019
2019*>100K	-0.001	0.770
2020*<36K	-0.019	<.0001

Year*family income

	2020*36K–60K	—	—
	2020*60K–100K	-0.005	0.217
	2020*>100K	-0.017	<.0001
	2021*<36K	-0.018	0.000
	2021*36K–60K	—	—
	2021*60K–100K	-0.001	0.903
	2021*>100K	-0.031	<.0001
	2022*<36K	-0.025	<.0001
	2022*36K–60K	—	—
	2022*60K–100K	0.008	0.058
	2022*>100K	0.001	0.782
Year*percentage FRL	2010	—	—
	2011	0.000	<.0001
	2012	0.000	0.000
	2013	0.000	<.0001
	2014	0.001	<.0001
	2015	0.001	<.0001
	2016	0.001	<.0001
	2017	0.001	<.0001
	2018	0.001	<.0001
	2019	0.002	<.0001
	2020	0.002	<.0001
	2021	0.002	<.0001
	2022	0.002	<.0001
Year*percentage non-White	2010	—	—
	2011	0.000	0.624
	2012	0.000	0.430
	2013	0.000	0.001
	2014	0.000	0.087
	2015	0.000	<.0001
	2016	0.000	<.0001
	2017	0.001	<.0001
	2018	0.001	<.0001
	2019	0.000	0.003
	2020	-0.001	<.0001
	2021	-0.001	<.0001
	2022	0.000	0.000
Percentage non-White*race/ethnicity	Black	0.001	<.0001
	Hispanic	0.001	<.0001
	Other	0.001	<.0001
	White	—	—
	2010*Black	—	—

2010*Hispanic	—	—
2010*Other	—	—
2010*White	—	—
2011*Black	0.000	0.193
2011*Hispanic	0.000	0.595
2011*Other	0.000	0.679
2011*White	—	—
2012*Black	0.000	0.290
2012*Hispanic	0.000	0.760
2012*Other	0.000	0.954
2012*White	—	—
2013*Black	0.000	0.236
2013*Hispanic	0.000	0.085
2013*Other	0.000	0.064
2013*White	—	—
2014*Black	0.000	0.019
2014*Hispanic	0.000	0.728
2014*Other	0.000	0.862
2014*White	—	—
2015*Black	0.000	0.175
2015*Hispanic	0.000	0.136
2015*Other	0.000	0.465
2015*White	—	—
2016*Black	0.000	0.369
2016*Hispanic	0.001	<.0001
2016*Other	0.000	0.005
2016*White	—	—
2017*Black	0.000	0.466
2017*Hispanic	0.000	0.182
2017*Other	0.000	0.054
2017*White	—	—
2018*Black	0.000	0.132
2018*Hispanic	0.000	0.978
2018*Other	0.000	0.022
2018*White	—	—
2019*Black	0.000	0.454
2019*Hispanic	0.000	0.978
2019*Other	0.000	0.062
2019*White	—	—
2020*Black	0.000	0.347
2020*Hispanic	0.000	0.056
2020*Other	0.001	<.0001

Year*percentage non-White*race/ethnicity

2020*White	—	—
2021*Black	0.000	0.033
2021*Hispanic	0.000	0.327
2021*Other	0.001	<.0001
2021*White	—	—
2022*Black	0.000	0.083
2022*Hispanic	0.000	0.045
2022*Other	0.001	<.0001
2022*White	—	—

Note: Non-White students refers to students from traditionally underserved racial/ethnic groups

Table A3. HLM Social Studies Model Results

Characteristic		Coefficient	Sig
Intercept		2.911	<.0001
Number of English courses		0.046	<.0001
Year	2010	—	—
	2011	0.007	0.027
	2012	0.010	0.003
	2013	0.019	<.0001
	2014	0.015	<.0001
	2015	0.020	<.0001
	2016	0.023	<.0001
	2017	0.047	<.0001
	2018	0.061	<.0001
	2019	0.092	<.0001
	2020	0.122	<.0001
	2021	0.152	<.0001
	2022	0.139	<.0001
Test type	National	0.210	<.0001
	State/District	—	—
ACT English		0.033	<.0001
Race/ethnicity	Black	-0.157	<.0001
	Hispanic	-0.045	<.0001
	Other	0.004	0.168
	White	—	—
Family income	<36K	-0.076	<.0001
	36K–60K	—	—
	60K–100K	0.051	<.0001
	>100K	0.088	<.0001
Gender	Male	—	—
	Female	0.089	<.0001
Taken advanced coursework in English	No	—	—
	Yes	0.159	<.0001
Percentage free/reduced price lunch		0.000	0.002
Percentage non-White		-0.001	<.0001
Percentage female		-0.003	0.002
Percentage taking advanced courses		-0.004	<.0001
Percentage tested		0.002	0.000
Year*gender	2010*Male	—	—

2010*Female	—	—
2011*Male	—	—
2011*Female	0.001	0.805
2012*Male	—	—
2012*Female	0.004	0.084
2013*Male	—	—
2013*Female	0.001	0.583
2014*Male	—	—
2014*Female	0.000	0.993
2015*Male	—	—
2015*Female	0.009	<.0001
2016*Male	—	—
2016*Female	0.013	<.0001
2017*Male	—	—
2017*Female	0.015	<.0001
2018*Male	—	—
2018*Female	0.015	<.0001
2019*Male	—	—
2019*Female	0.005	0.017
2020*Male	—	—
2020*Female	0.008	0.001
2021*Male	—	—
2021*Female	0.029	<.0001
2022*Male	—	—
2022*Female	0.042	<.0001

Year*race/ethnicity		
2010*Black	—	—
2010*Hispanic	—	—
2010*Other	—	—
2010*White	—	—
2011*Black	-0.002	0.713
2011*Hispanic	-0.002	0.755
2011*Other	-0.007	0.051
2011*White	—	—
2012*Black	0.000	0.954
2012*Hispanic	-0.007	0.142
2012*Other	-0.004	0.238
2012*White	—	—
2013*Black	0.002	0.579
2013*Hispanic	-0.013	0.005

	2013*Other	-0.012	0.001
	2013*White	—	—
	2014*Black	0.006	0.184
	2014*Hispanic	-0.013	0.008
	2014*Other	-0.008	0.022
	2014*White	—	—
	2015*Black	0.015	0.001
	2015*Hispanic	-0.018	0.000
	2015*Other	-0.010	0.005
	2015*White	—	—
	2016*Black	0.021	<.0001
	2016*Hispanic	-0.025	<.0001
	2016*Other	-0.018	<.0001
	2016*White	—	—
	2017*Black	0.027	<.0001
	2017*Hispanic	-0.021	<.0001
	2017*Other	-0.011	0.001
	2017*White	—	—
	2018*Black	0.041	<.0001
	2018*Hispanic	-0.017	0.000
	2018*Other	-0.013	0.000
	2018*White	—	—
	2019*Black	0.045	<.0001
	2019*Hispanic	-0.012	0.009
	2019*Other	-0.010	0.004
	2019*White	—	—
	2020*Black	0.055	<.0001
	2020*Hispanic	-0.008	0.103
	2020*Other	-0.014	0.000
	2020*White	—	—
	2021*Black	0.068	<.0001
	2021*Hispanic	-0.001	0.854
	2021*Other	-0.005	0.225
	2021*White	—	—
	2022*Black	0.085	<.0001
	2022*Hispanic	-0.002	0.637
	2022*Other	0.005	0.169
	2022*White	—	—
Year*family income	2010*<36K	—	—

2010*36K–60K	—	—
2010*60K–100K	—	—
2010*>100K	—	—
2011*<36K	0.005	0.167
2011*36K–60K	—	—
2011*60K–100K	0.004	0.215
2011*>100K	0.002	0.658
2012*<36K	0.007	0.062
2012*36K–60K	—	—
2012*60K–100K	0.004	0.266
2012*>100K	0.003	0.399
2013*<36K	0.009	0.009
2013*36K–60K	—	—
2013*60K–100K	0.004	0.221
2013*>100K	0.007	0.082
2014*<36K	0.007	0.055
2014*36K–60K	—	—
2014*60K–100K	0.005	0.136
2014*>100K	0.006	0.088
2015*<36K	0.005	0.117
2015*36K–60K	—	—
2015*60K–100K	0.002	0.537
2015*>100K	-0.001	0.806
2016*<36K	-0.002	0.610
2016*36K–60K	—	—
2016*60K–100K	0.011	0.002
2016*>100K	0.013	0.001
2017*<36K	0.002	0.616
2017*36K–60K	—	—
2017*60K–100K	0.006	0.085
2017*>100K	0.001	0.752
2018*<36K	0.003	0.383
2018*36K–60K	—	—
2018*60K–100K	0.006	0.115
2018*>100K	0.000	0.960
2019*<36K	0.006	0.103
2019*36K–60K	—	—
2019*60K–100K	0.002	0.498
2019*>100K	-0.010	0.005
2020*<36K	0.008	0.040
2020*36K–60K	—	—
2020*60K–100K	-0.010	0.006

	2020*>100K	-0.023	<.0001
	2021*<36K	0.005	0.253
	2021*36K–60K	—	—
	2021*60K–100K	-0.008	0.062
	2021*>100K	-0.036	<.0001
	2022*<36K	0.001	0.887
	2022*36K–60K	—	—
	2022*60K–100K	0.003	0.510
	2022*>100K	0.000	0.930
Year*percentage FRL	2010	—	—
	2011	0.000	0.175
	2012	0.000	0.799
	2013	0.000	0.332
	2014	0.000	0.000
	2015	0.000	<.0001
	2016	0.001	<.0001
	2017	0.001	<.0001
	2018	0.001	<.0001
	2019	0.001	<.0001
	2020	0.002	<.0001
	2021	0.002	<.0001
	2022	0.001	<.0001
Year*percentage non-White	2010	—	—
	2011	0.000	0.453
	2012	0.000	0.031
	2013	0.000	0.052
	2014	0.000	0.019
	2015	0.000	0.000
	2016	0.000	0.384
	2017	0.000	0.055
	2018	0.000	0.000
	2019	-0.001	<.0001
	2020	-0.001	<.0001
	2021	-0.002	<.0001
	2022	-0.001	<.0001
Percentage non-White*race/ethnicity	Black	0.001	<.0001
	Hispanic	0.001	<.0001
	Other	0.001	<.0001
	White	—	—
Year*percentage non-White*race/ethnicity	2010*Black	—	—
	2010*Hispanic	—	—
	2010*Other	—	—

2010*White	—	—
2011*Black	0.000	0.722
2011*Hispanic	0.000	0.595
2011*Other	0.000	0.954
2011*White	—	—
2012*Black	0.000	0.117
2012*Hispanic	0.000	0.204
2012*Other	0.000	0.541
2012*White	—	—
2013*Black	0.000	0.003
2013*Hispanic	0.000	0.525
2013*Other	0.000	0.121
2013*White	—	—
2014*Black	0.000	0.002
2014*Hispanic	0.000	0.187
2014*Other	0.000	0.609
2014*White	—	—
2015*Black	0.000	0.003
2015*Hispanic	0.000	0.868
2015*Other	0.000	0.378
2015*White	—	—
2016*Black	0.000	0.062
2016*Hispanic	0.000	0.650
2016*Other	0.000	0.148
2016*White	—	—
2017*Black	0.001	<.0001
2017*Hispanic	0.000	0.963
2017*Other	0.000	0.211
2017*White	—	—
2018*Black	0.001	<.0001
2018*Hispanic	0.000	0.956
2018*Other	0.000	0.004
2018*White	—	—
2019*Black	0.000	0.003
2019*Hispanic	0.000	0.519
2019*Other	0.000	0.094
2019*White	—	—
2020*Black	0.001	<.0001
2020*Hispanic	0.000	0.050
2020*Other	0.001	<.0001
2020*White	—	—
2021*Black	0.001	0.000

2021*Hispanic	0.000	0.984
2021*Other	0.001	<.0001
2021*White	—	—
2022*Black	0.000	0.887
2022*Hispanic	0.000	0.575
2022*Other	0.001	<.0001
2022*White	—	—

Note: Non-White students refers to students from traditionally underserved racial/ethnic groups

Table A4. HLM Science Model Results

Characteristic		Coefficient	Sig
Intercept		2.637	<.0001
Number of English courses		0.084	<.0001
Year	2010	—	—
	2011	0.010	0.002
	2012	0.014	<.0001
	2013	0.024	<.0001
	2014	0.025	<.0001
	2015	0.032	<.0001
	2016	0.030	<.0001
	2017	0.056	<.0001
	2018	0.077	<.0001
	2019	0.111	<.0001
	2020	0.147	<.0001
	2021	0.183	<.0001
	2022	0.192	<.0001
Test type	National	0.185	<.0001
	State/District	—	—
ACT English		0.049	<.0001
Race/ethnicity	Black	-0.168	<.0001
	Hispanic	-0.054	<.0001
	Other	-0.005	0.077
	White	—	—
Family income	<36K	-0.062	<.0001
	36K–60K	—	—
	60K–100K	0.044	<.0001
	>100K	0.077	<.0001
Gender	Male	—	—
	Female	0.149	<.0001
Taken advanced coursework in English	No	—	—
	Yes	0.204	<.0001
Percentage free/reduced price lunch		0.002	<.0001
Percentage non-White		-0.002	<.0001
Percentage female		-0.002	0.166
Percentage taking advanced courses		-0.005	<.0001
Percentage tested		0.003	<.0001
Year*gender	2010*Male	—	—
	2010*Female	—	—

	2011*Male	—	—
	2011*Female	0.000	0.942
	2012*Male	—	—
	2012*Female	0.002	0.406
	2013*Male	—	—
	2013*Female	0.007	0.002
	2014*Male	—	—
	2014*Female	0.004	0.066
	2015*Male	—	—
	2015*Female	0.008	0.000
	2016*Male	—	—
	2016*Female	0.017	<.0001
	2017*Male	—	—
	2017*Female	0.023	<.0001
	2018*Male	—	—
	2018*Female	0.019	<.0001
	2019*Male	—	—
	2019*Female	0.018	<.0001
	2020*Male	—	—
	2020*Female	0.012	<.0001
	2021*Male	—	—
	2021*Female	0.029	<.0001
	2022*Male	—	—
	2022*Female	0.041	<.0001
	2010*Black	—	—
	2010*Hispanic	—	—
	2010*Other	—	—
	2010*White	—	—
	2011*Black	0.016	0.001
	2011*Hispanic	0.001	0.792
	2011*Other	-0.003	0.495
Year*race/ethnicity	2011*White	—	—
	2012*Black	0.026	<.0001
	2012*Hispanic	-0.004	0.451
	2012*Other	0.003	0.500
	2012*White	—	—
	2013*Black	0.025	<.0001
	2013*Hispanic	-0.015	0.003
	2013*Other	-0.003	0.403

2013*White	—	—
2014*Black	0.031	<.0001
2014*Hispanic	-0.015	0.002
2014*Other	-0.005	0.148
2014*White	—	—
2015*Black	0.031	<.0001
2015*Hispanic	-0.017	0.001
2015*Other	-0.004	0.234
2015*White	—	—
2016*Black	0.040	<.0001
2016*Hispanic	-0.014	0.003
2016*Other	-0.004	0.273
2016*White	—	—
2017*Black	0.044	<.0001
2017*Hispanic	-0.018	0.000
2017*Other	-0.007	0.056
2017*White	—	—
2018*Black	0.059	<.0001
2018*Hispanic	-0.009	0.073
2018*Other	-0.004	0.240
2018*White	—	—
2019*Black	0.066	<.0001
2019*Hispanic	-0.008	0.083
2019*Other	-0.007	0.042
2019*White	—	—
2020*Black	0.066	<.0001
2020*Hispanic	0.002	0.620
2020*Other	-0.010	0.007
2020*White	—	—
2021*Black	0.085	<.0001
2021*Hispanic	0.001	0.829
2021*Other	0.001	0.879
2021*White	—	—
2022*Black	0.104	<.0001
2022*Hispanic	0.011	0.035
2022*Other	0.008	0.058
2022*White	—	—
Year*family income 2010*<36K	—	—
2010*36K–60K	—	—

2010*60K–100K	—	—
2010*>100K	—	—
2011*<36K	0.003	0.373
2011*36K–60K	—	—
2011*60K–100K	0.003	0.390
2011*>100K	0.000	0.933
2012*<36K	0.003	0.475
2012*36K–60K	—	—
2012*60K–100K	0.003	0.397
2012*>100K	0.006	0.129
2013*<36K	0.007	0.057
2013*36K–60K	—	—
2013*60K–100K	0.001	0.759
2013*>100K	0.004	0.271
2014*<36K	0.009	0.015
2014*36K–60K	—	—
2014*60K–100K	0.004	0.268
2014*>100K	0.004	0.294
2015*<36K	0.005	0.103
2015*36K–60K	—	—
2015*60K–100K	0.004	0.209
2015*>100K	-0.003	0.338
2016*<36K	0.002	0.468
2016*36K–60K	—	—
2016*60K–100K	0.008	0.010
2016*>100K	0.006	0.113
2017*<36K	-0.001	0.703
2017*36K–60K	—	—
2017*60K–100K	0.006	0.095
2017*>100K	-0.001	0.859
2018*<36K	0.003	0.448
2018*36K–60K	—	—
2018*60K–100K	0.003	0.480
2018*>100K	-0.005	0.142
2019*<36K	0.004	0.266
2019*36K–60K	—	—
2019*60K–100K	0.001	0.815
2019*>100K	-0.012	0.002
2020*<36K	0.005	0.201
2020*36K–60K	—	—
2020*60K–100K	-0.012	0.002
2020*>100K	-0.027	<.0001

	2021*<36K	0.000	0.989
	2021*36K–60K	—	—
	2021*60K–100K	-0.008	0.046
	2021*>100K	-0.040	<.0001
	2022*<36K	-0.007	0.114
	2022*36K–60K	—	—
	2022*60K–100K	-0.005	0.287
	2022*>100K	-0.011	0.018
Year*percentage FRL	2010	—	—
	2011	0.000	0.006
	2012	0.000	0.001
	2013	0.000	0.000
	2014	0.001	<.0001
	2015	0.001	<.0001
	2016	0.001	<.0001
	2017	0.001	<.0001
	2018	0.001	<.0001
	2019	0.002	<.0001
	2020	0.002	<.0001
	2021	0.002	<.0001
	2022	0.002	<.0001
Year*percentage non-White	2010	—	—
	2011	0.000	0.794
	2012	0.000	0.744
	2013	0.000	0.003
	2014	0.000	0.056
	2015	0.000	0.289
	2016	0.000	0.437
	2017	0.000	0.383
	2018	0.000	0.403
	2019	0.000	0.020
	2020	-0.001	<.0001
	2021	-0.001	<.0001
	2022	-0.001	<.0001
Percentage non-White*race/ethnicity	Black	0.001	<.0001
	Hispanic	0.001	<.0001
	Other	0.001	<.0001
	White	—	—
Year*percentage non-White*race/ethnicity	2010*Black	—	—
	2010*Hispanic	—	—
	2010*Other	—	—
	2010*White	—	—

2011*Black	0.000	0.502
2011*Hispanic	0.000	0.069
2011*Other	0.000	0.756
2011*White	—	—
2012*Black	0.000	0.088
2012*Hispanic	0.000	0.943
2012*Other	0.000	0.922
2012*White	—	—
2013*Black	0.000	0.541
2013*Hispanic	0.000	0.024
2013*Other	0.000	0.004
2013*White	—	—
2014*Black	0.000	0.037
2014*Hispanic	0.000	0.157
2014*Other	0.000	0.179
2014*White	—	—
2015*Black	0.000	0.002
2015*Hispanic	0.000	0.825
2015*Other	0.000	0.890
2015*White	—	—
2016*Black	0.001	<.0001
2016*Hispanic	0.000	0.009
2016*Other	0.000	0.019
2016*White	—	—
2017*Black	0.000	0.009
2017*Hispanic	0.000	0.722
2017*Other	0.000	0.043
2017*White	—	—
2018*Black	0.000	0.005
2018*Hispanic	0.000	0.941
2018*Other	0.000	0.026
2018*White	—	—
2019*Black	0.000	0.314
2019*Hispanic	0.000	0.331
2019*Other	0.000	0.119
2019*White	—	—
2020*Black	0.000	0.002
2020*Hispanic	0.000	0.354
2020*Other	0.001	<.0001
2020*White	—	—
2021*Black	0.001	<.0001
2021*Hispanic	0.000	0.075

2021*Other	0.001	<.0001
2021*White	—	—
2022*Black	0.000	0.099
2022*Hispanic	0.000	0.438
2022*Other	0.001	<.0001
2022*White	—	—

Note: Non-White students refers to students from traditionally underserved racial/ethnic groups

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