



# College Acceleration for All? Mapping Racial Gaps in Advanced Placement and Dual Enrollment Participation

**Di Xu, Sabrina Solanki, and John Fink**

DECEMBER 2020

A M E R I C A N   E N T E R P R I S E   I N S T I T U T E

# Executive Summary

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Advanced Placement (AP) and dual enrollment (DE) are the two most popular programs that allow students to earn college credits while in high school. Researchers have noted several benefits of college acceleration programs on students' postsecondary outcomes. Particularly, these programs offer the opportunity to improve college attendance rates among underrepresented students. They offer incentive and opportunity for students to attend college with a reduced financial burden, which is especially valuable and potentially appealing to students from underrepresented groups and therefore might increase their access to additional postsecondary education and credentials after high school.

Yet, persistent racial disparities in student enrollment and success rates exist in these college acceleration programs. Given the benefits of AP and DE enrollment for students' college success, especially for students from underrepresented groups, racial gaps in participation rates would be important indicators of educational inequality. However, little is

known about how racial gaps are distributed geographically and what factors may mitigate or exacerbate these disparities.

This report discusses the patterns of racial enrollment gaps in AP and DE programs across thousands of US school districts. To explain these racial disparities in college acceleration programs, we analyze how school-related and nonschool factors influence these gaps.

By mapping school districts nationwide, we find that the vast majority of districts have racial enrollment gaps in both programs, with wider gaps in AP than DE. Additionally, our results indicate that geographic variations in these gaps can be explained by local and state factors. We also find that district and state policies that seek to provide increased college acceleration programming are associated with wider racial enrollment gaps, implying that greater resources may engender racial disparity without adequate efforts to provide equitable program access to minority students.

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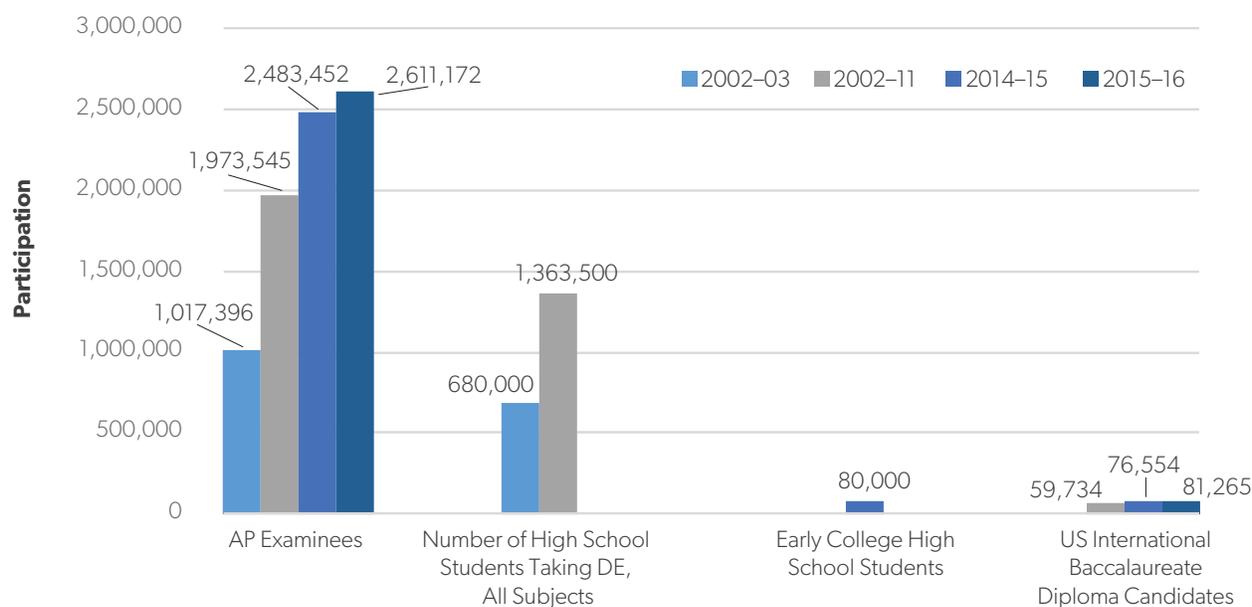
Over the past six decades, there has been increasing support nationwide for programs that allow students to earn college credit while in high school. These include several different models, such as Advanced Placement (AP), dual or concurrent enrollment (DE), early college high schools, and International Baccalaureate.

The largest and most popular of these programs are AP and DE, which together enroll millions of high school students annually.<sup>1</sup> AP, taught exclusively by high school teachers, offers more than 30 courses to high school students, giving them the potential to earn college credits after achieving a minimum score on a course-specific exam. Officially launched in 1955 under the College Board's administration, AP has become the largest mechanism through which high school students earn college credit in the US.

Different from the AP program, DE is a broad category including many types of college course-taking arrangements. DE courses are taught by either college instructors or college-approved high school teachers at colleges, in high schools, and online. Both programs are not only large and offered nationwide but also quickly growing. Between 2002 and 2010, the number of DE participants grew from 680,000 to 1.4 million, and the number of AP examinees doubled from one to two million.<sup>2</sup>

AP and DE programs offer many advantages, which explains their fast growth. These programs can increase students' competitive edge in the college application process, reduce the cost and time it takes to earn a postsecondary degree, and better prepare students for college coursework, thereby easing students' transition from high school to college.<sup>3</sup> These advantages are even more pronounced for underrepresented students, for whom the incentive of earning college credits with a reduced financial burden is especially valuable.<sup>4</sup>

Numerous studies have also provided empirical evidence for the benefits of AP and DE on student academic outcomes. Several studies of the AP program compared the academic performance of non-AP and AP students and generally found that AP students outperform their non-AP peers in various academic achievement measures, such as ACT and SAT scores, college attendance rates, admission to selective colleges, college GPAs, college graduation rates, and time to degree completion.<sup>5</sup> Quotations from college administrators suggest that regardless of the score received on an AP exam, a student's AP participation alone may help the student in admissions decisions.<sup>6</sup> Similarly, several studies also identified DE participation benefits for various academic outcomes, including high school graduation, college enrollment,

**Figure 1. National Participation in Different College Acceleration Strategies**

Note: National enrollment data do not exist for DE and career and technical education beyond 2010-11.

Source: College Board, *College Credit in High School: Working Group Report*, 2017, <https://secure-media.collegeboard.org/pdf/research/college-credit-high-school-working-group-report.pdf>.

college persistence, college GPA, and postsecondary degree completion.<sup>7</sup>

Despite the myriad benefits of AP and DE programs, they are not shared by all students equally: Racial disparities are noticeable in students' program participation.<sup>8</sup> Black students represented only 9 percent of AP test takers in 2013 despite comprising 15 percent of the 2013 graduating class.<sup>9</sup> These disparities also exist for DE programs, in which the National Center for Education Statistics (NCES) reported lower participation rates among Hispanic students (30 percent) and black students (27 percent) than white or Asian students (both 38 percent).<sup>10</sup> Studies using data from particular states echo these national patterns of racial gaps in DE participation. For example, based on administrative data from Texas, one group of researchers found that while DE participation rates generally increased from 2000 to 2015 for all students, there was a persistent racial gap in participation rates, which grew over time.<sup>11</sup>

While the existing evidence on national and state-level patterns of racial gaps in AP and DE participation provides useful information about overall educational inequality in college acceleration opportunities, these aggregate statistics are less informative about whether these gaps are smaller or larger across smaller geographic units, such as school districts. This makes it difficult to identify local contexts and factors that produce and sustain these gaps. In this report, we address this knowledge gap by providing detailed descriptive analyses of the patterns of racial gaps in AP and DE participation across thousands of school districts and identifying state- and district-level factors that are correlated with these gaps.

Our report makes the first attempt to describe racial inequity in AP and DE participation at the district level and on the national scale. This research allows us to illustrate similar or varying patterns of racial inequity across school districts between the nation's two largest college acceleration programs.

We draw on a rich body of literature and theories about racial disparities in educational choices and outcomes to analyze the complex relationship between school-related and nonschool factors that may influence racial gaps in AP and DE participation.<sup>12</sup>

In this report, we discuss five main findings. First, our results suggest the majority of districts have non-trivial racial gaps in AP and DE programs, with more pronounced gaps in AP than DE and wider white-black gaps than white-Hispanic gaps in both programs. Second, we find suggestive evidence that AP and DE programs may be used interchangeably by schools and parents. Third, among all the factors examined, the white-minority achievement gap before high school is the strongest predictor of racial gaps in AP and DE participation. Fourth, our results indicate that a handful of local factors associated with higher overall program participation, such as a larger number of AP courses offered and higher per-student instructional expenditures, are associated with wider racial gaps in AP enrollment. Finally, we find that districts in states with stronger financial support of DE participation are associated with smaller white-minority DE participation gaps.

Given the many benefits that AP and DE programs offer students, especially students from disadvantaged backgrounds, knowing the factors contributing to racial gaps in college acceleration program participation will help inform decisions for policymakers and high school administrators.

## Data and Correlates

Data for this report come from five publicly available sources, which we link to outline geographic patterns of AP and DE racial enrollment gaps among US school districts.<sup>13</sup>

Data from the Civil Rights Data Collection (CRDC) provide information on AP course-taking participation, DE program participation, and school characteristics.<sup>14</sup> As a result, for high schools that also offer eighth grade and below, using total school enrollment as the denominator to calculate AP and DE participation rates is inappropriate, since the CRDC

specifically instructed districts and schools to report AP and DE participants only among students who are in grades nine through 12. In Appendix B, we describe the selection criteria we use to identify eligible high schools to include in our analytic sample.<sup>15</sup>

Data from the American Community Survey (ACS) provide information on demographic and socioeconomic characteristics of families that live in each school district and have children enrolled in public school. Basic descriptive information on schools and school districts, including enrollment counts for each grade at each school, come from the Common Core of Data (CCD). Data from the Stanford Education Data Archive (SEDA) provide district-level measures of academic achievement and racial and socioeconomic composition. Finally, we use latitude and longitude data from the Integrated Postsecondary Education Data System (IPEDS) to calculate the nearest college to each high school.

We estimate sources of variation in AP and DE racial participation gaps that fall in one of the following six broad categories: (1) student academic preparation before high school, (2) family socioeconomic background, (3) racial composition in a district, (4) between-school segregation,<sup>16</sup> (5) average characteristics of high schools in a district, and (6) state-level AP and DE policies. Below, we briefly describe the variables included in each category. Table A1 provides the full list of explanatory variables we use and the data sources.

To capture academic preparation before high school, we include a variable that measures the average pre-high school achievement in a district. This variable is available in the SEDA dataset and is based on standardized test scores taken by over 200 million students in grades three through eight for English, language arts, and math. White-minority achievement gaps are calculated as the standardized difference in achievement between white and minority students.

We construct two variables to measure the average socioeconomic background of a district. The first measure is the percentage of students eligible for free or reduced-price lunch (FRPL) in each school district, which was retrieved from the CCD. The second measure is proportions of adults with a

bachelor's degree or higher in a district. This variable is available in the SEDA dataset and is constructed using ACS–Education Demographic and Geographic Estimates (EDGE) data for families with school-age children enrolled in public schools. White-minority gaps in both measures are also calculated and included in models that predict racial gaps in AP and DE participation.

We also construct three sets of variables to measure the local school context, including (1) measures of racial and income segregation across schools in a school district constructed using the Thiel index, in which higher values indicate greater levels of segregation; (2) indicators of a school district's racial composition, measured as the proportion of black or Hispanic students in a district; and (3) measures of average characteristics of high schools in a district, including proportions of students in a school district enrolled in urban schools, proportions enrolled in magnet schools, proportions enrolled in gifted and talented programs, average per-pupil instructional expenditures among high school students, average student-teacher ratios, and average student-counselor ratios. Given that DE opportunities rely on partnerships with local colleges, we also calculate the distance in kilometers to the closest two- or four-year public institution that offers dual enrollment or concurrent enrollment for each high school in our analytic sample and then take the average across districts.<sup>17</sup> Similarly, we also calculate the average number of AP courses offered at school to capture a district's access to AP opportunities.

Lastly, we include state-level variables to reflect policies that either directly or indirectly influence AP and DE participation.<sup>18</sup> For AP enrollment, we identify nine relevant policies, grouped into three broad categories: (1) accountability and mandates surrounding access, (2) financial incentives and program support, and (3) accountability and mandates related to student outcomes. For DE enrollment, we identify 12 policies and group them into the same three broad categories. Each category includes three values that indicate whether a state has strong, moderate, or

weak AP and DE policies for that category. A state is identified as having “strong” policies if it has at least half the policies in place in a category, “moderate” if it has more than one but fewer than half the policies in place, and “weak” if it has none or only one policy in place.<sup>19</sup> Table A2 provides details about the number and description of distinct policies included in each broad category.

## Estimation Strategy

The outcome measures in our study, such as average AP participation rates in a district, follow a fractional response nature, which typically arises from averaged binary outcomes. Binary outcomes are responses that have two values, typically equal to zero or one. When these binary responses are averaged over multiple observations, the average response becomes a proportion bounded between zero and one. In our context, students either participated or did not participate in AP or DE programs. These binary responses are used to generate participation rates at the district level. (See Appendix B for more detail.) The AP and DE participation rate is therefore a continuous variable that is bound between zero and one.

Standard linear models are not appropriate in modeling fractional responses, as they can generate predictions that are greater than one and smaller than zero.<sup>20</sup> Building on the existing literature, we instead use fractional logit regression to examine associations between district- and state-level predictors and district participation rates.<sup>21</sup> To make the coefficients easier to interpret, we report the average marginal effect for each coefficient (i.e., the estimated association between a specific predictor and the outcome measure averaged across all the observations in the analytical sample). As a result, the coefficient indicates the average changes in the predicted probabilities given one unit change in an independent variable (in the case of a continuous independent variable) or as the independent variable changes from zero to one (in the case of a binary independent variable).

**Table 1. Summary Statistics for AP and DE Participation and Racial Gaps**

	N	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
<b>Overall AP and DE Participation</b>						
AP Participation	11,741	0.110	0.123	0.000	0.080	0.180
DE Participation	11,741	0.113	0.137	0.004	0.070	0.170
<b>Racial Gaps in AP Participation Rates</b>						
White-Black Gap	3,550	0.098	0.091	0.040	0.090	0.147
White-Hispanic Gap	4,625	0.069	0.085	0.018	0.060	0.114
<b>Racial Gaps in DE Participation Rates</b>						
White-Black Gap	3,134	0.047	0.072	0.006	0.034	0.079
White-Hispanic Gap	4,211	0.042	0.079	0.002	0.028	0.072

Note: The inclusion criteria used to construct the sample for overall AP and DE participation is different from those used to construct the sample for racial enrollment gaps. Specifically, the sample for overall AP and DE participation includes all school districts with at least 20 total student enrollments. The sample for racial enrollment gaps further restricts to districts with a sufficient number of students for the two racial groups used to calculate the specified racial enrollment gap. For example, the sample for white-black AP participation gap includes school districts with at least 20 white and 20 black students. Additionally, considering that it would be misleading to report a 0 percentage point gap if the district had zero AP participation for white and black students, we further restrict the sample to districts that have a nonzero participation rate for at least one subgroup used in calculating the racial enrollment gap. Due to these additional sample inclusion criteria, the samples used for racial gaps are substantially smaller than the sample for the overall AP and DE participation. Appendix B describes these selection criteria in more detail. Although the number of districts decreases substantially as we restrict the analytic samples, these restrictions mainly exclude districts with few students overall; as a result, districts that remain in the sample still cover at least two-thirds of total students enrolled nationwide. Finally, the middle and bottom panels in Table 1 show summary statistics for racial gaps in AP and DE participation among school districts that met our inclusion criteria.

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015–16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

## Results

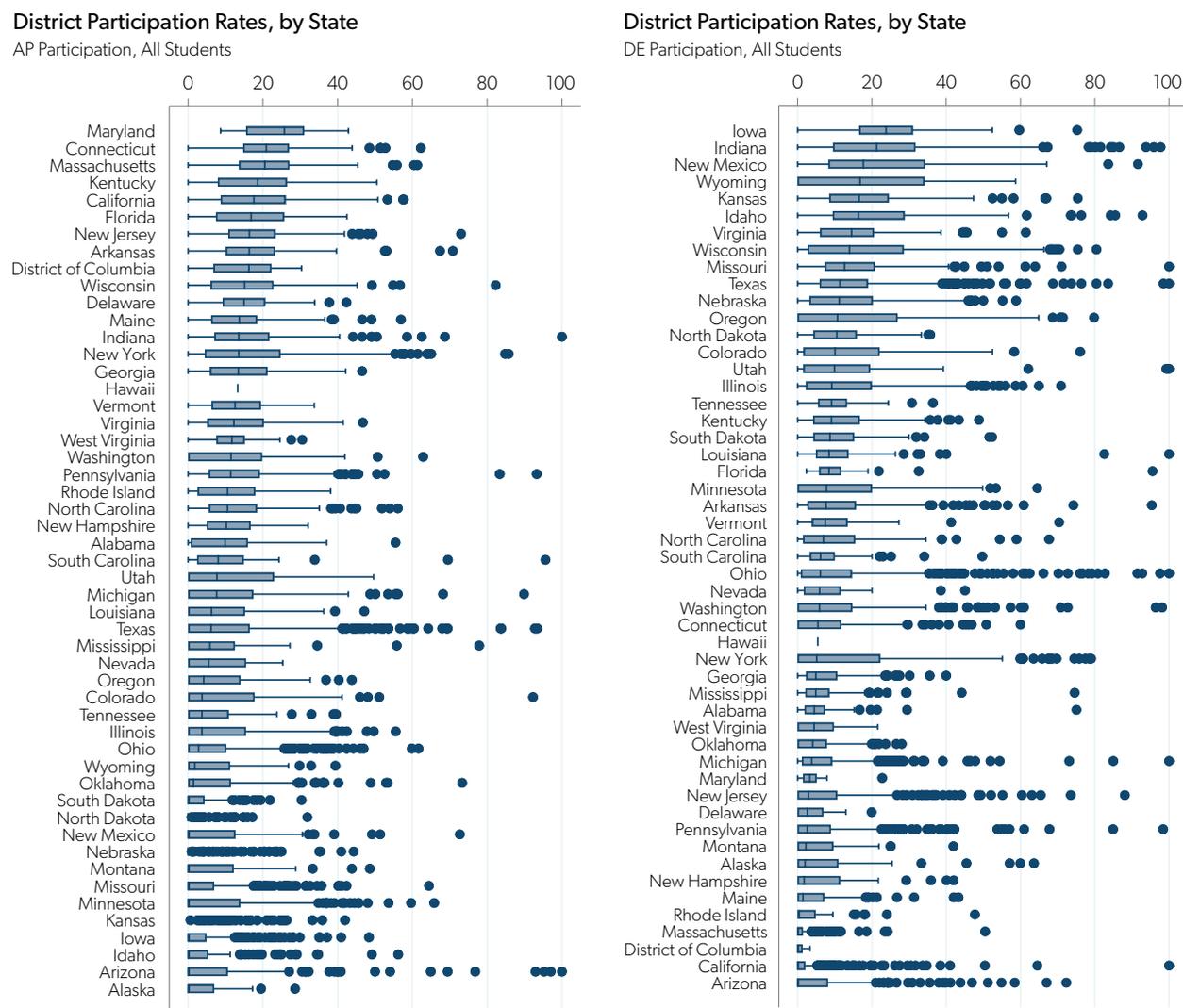
Overall, patterns of AP and DE participation are presented in Table 1, Figure 1, and Figure 2.<sup>22</sup> The top panel in Table 1 shows summary statistics for AP and DE participation among all the school districts in our sample.<sup>23</sup> Overall, there is substantial variation in district AP and DE participation across districts and both within and across states. Furthermore, racial gaps in AP participation are larger than in DE participation.

As seen in Figures 1 and 2, the states with the highest AP participation rates concentrate in coastal

areas, while the states with the highest DE participation rates are in the middle of the country.

We then examine the distribution of district racial gaps in AP and DE participation in each state. Figures 3, 4, and 5 reveal three main patterns.<sup>24</sup> First, figures suggest that nationwide, the majority of districts have racial equity gaps in AP and DE participation. Second, there is substantial variation among state districts.<sup>25</sup> Third, numerous states that have the highest AP and DE participation overall, as shown in Figure 1, also have relatively higher racial gaps in AP and DE enrollment.

**Figure 2. Distribution of AP and DE Participation Rates Among School Districts, by State**

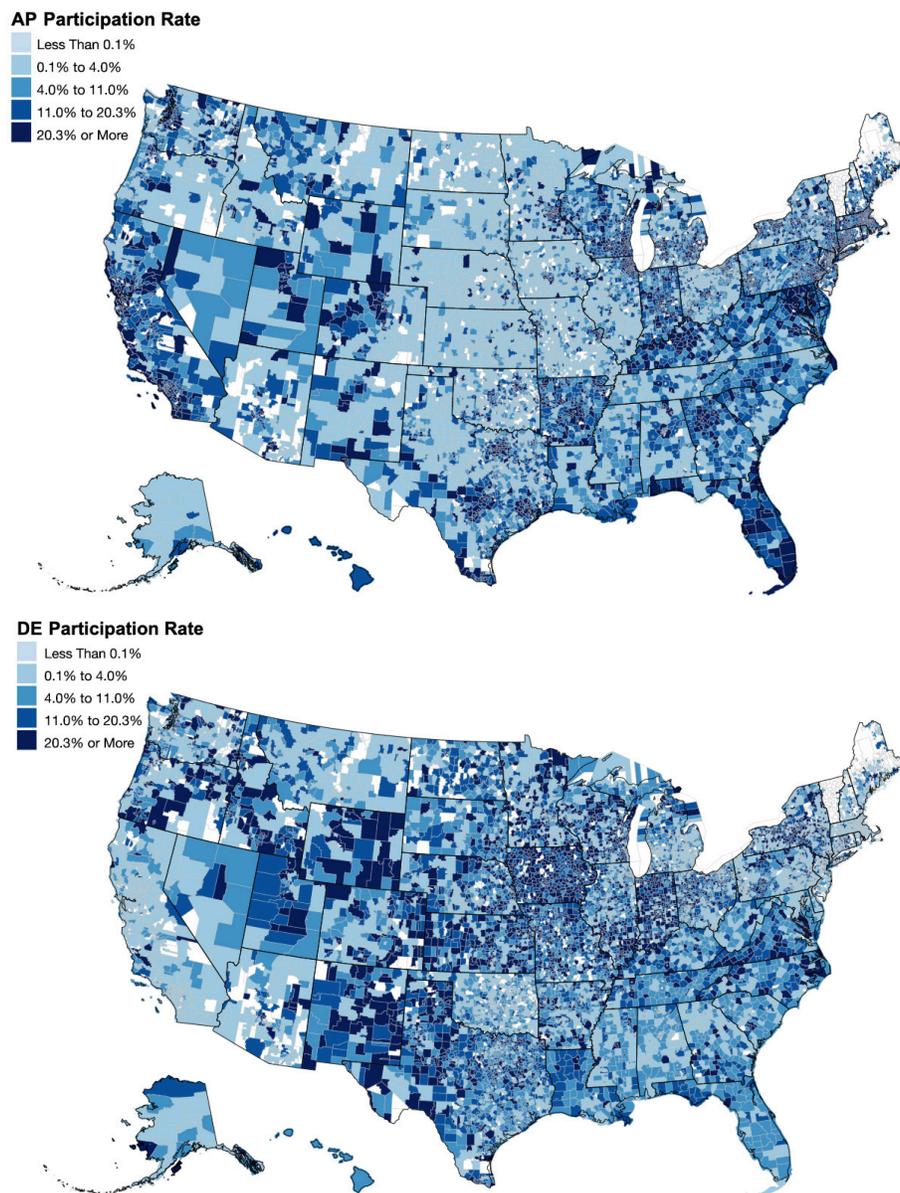


Note: Figure 2 uses box plotting to show the distribution of district AP and DE participation rates visually by state (left and right panels, respectively), in which states are ranked in descending order by the states' median district participation rate.

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015–16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

In light of the results presented above, we then examine whether there are districts where minority students have high AP and DE participation rates and white-minority gaps are small. In identifying “star districts,” we first narrow down to districts where

the AP and DE participation rates among the specified minority group reach above the national median. We then focus on districts with a white-minority gap below 1 percentage point in AP or DE enrollment rates to identify districts where minority students

**Figure 3. Maps of District AP and DE Participation Rates**

Note: To provide a more detailed overview of the distribution of AP and DE participation rates across all the districts in our sample, Figure 3 presents choropleth maps of district AP and DE participation rates. These maps show districts geographically in progressively darker shades of blue, based on quintiles of district AP and DE participation rates.<sup>9</sup> Since we use the same coloring scheme for the AP and DE choropleth maps, it allows us to compare participation rates between the two maps to gauge places of higher and lower AP or DE participation and regions that primarily offer AP or DE programs. For example, consistent with the patterns shown in Figure 2, districts in the middle of the country have higher DE participation rates compared with AP rates, whereas districts in coastal areas tend to have higher AP participation rates. For other choropleth maps and to look up results for schools, districts, and states, see John Fink, “Acceleration for All? Mapping Racial Equity in Access to AP and Dual Enrollment,” Community College Research Center, October 8, 2019, <https://ccrc.tc.columbia.edu/easyblog/mapping-racial-equity-ap-dual-enrollment.html>.

Source: Authors’ calculations using data from Department of Education, Office for Civil Rights, “2015–16 Civil Rights Data Collection,” <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

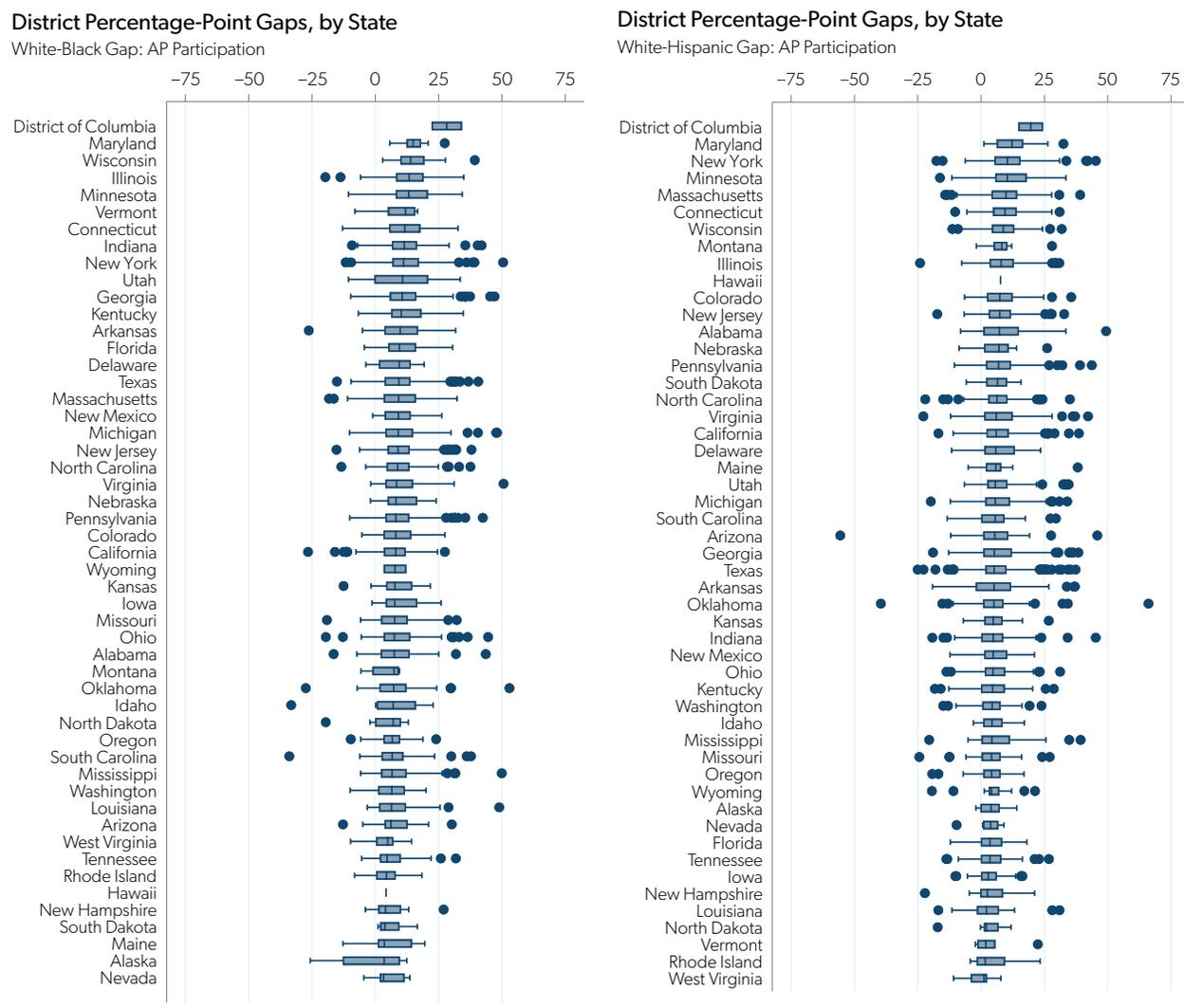
do well in absolute levels and relative to their white peers.

Among the thousands of districts examined, we identify 318 star districts in AP enrollment among black students (i.e., districts that have above-median AP enrollment among black students and below a 1 percentage point white-black AP participation gap), 649 districts in AP enrollment among Hispanic students, 595 districts in DE enrollment among black students, and 968 districts in DE enrollment among Hispanic students. The overlap among the four

district categories is fairly small, as only 15 districts are stars in all four categories.

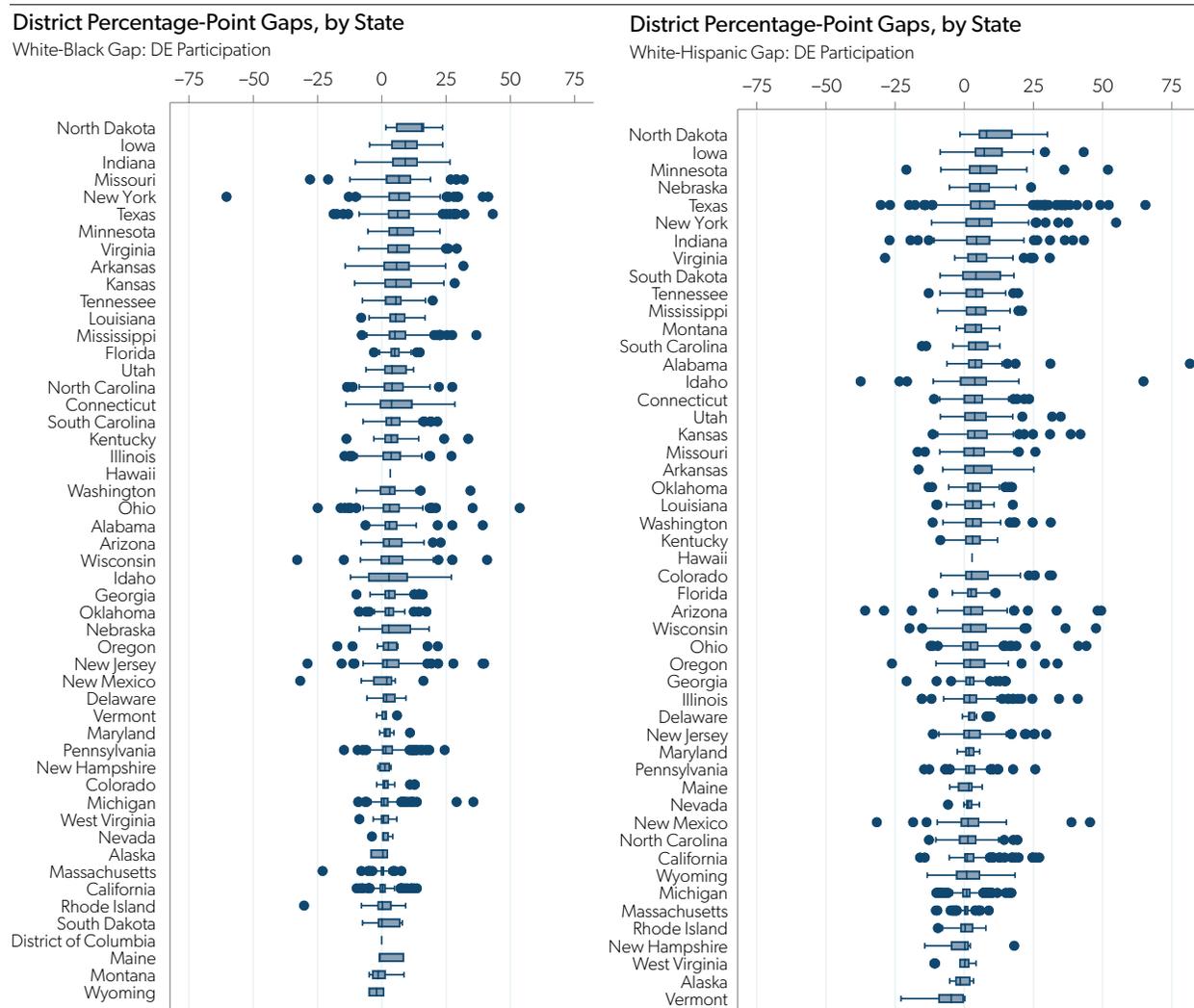
To better understand the characteristics of districts with high minority enrollment rates and smaller racial gaps, Table 2 provides the summary statistics for these star districts using the district- and state-level variables grouped into six broad categories. To ease interpretation, we standardize all the continuous variables (such as the number of AP courses offered). Thus, a positive value for a continuous variable indicates that the districts have

**Figure 4. Distribution of Racial Equity Gaps in AP and DE Participation Among School Districts, by State**



(continued on the next page)

**Figure 4. Distribution of Racial Equity Gaps in AP and DE Participation Among School Districts, by State (continued)**



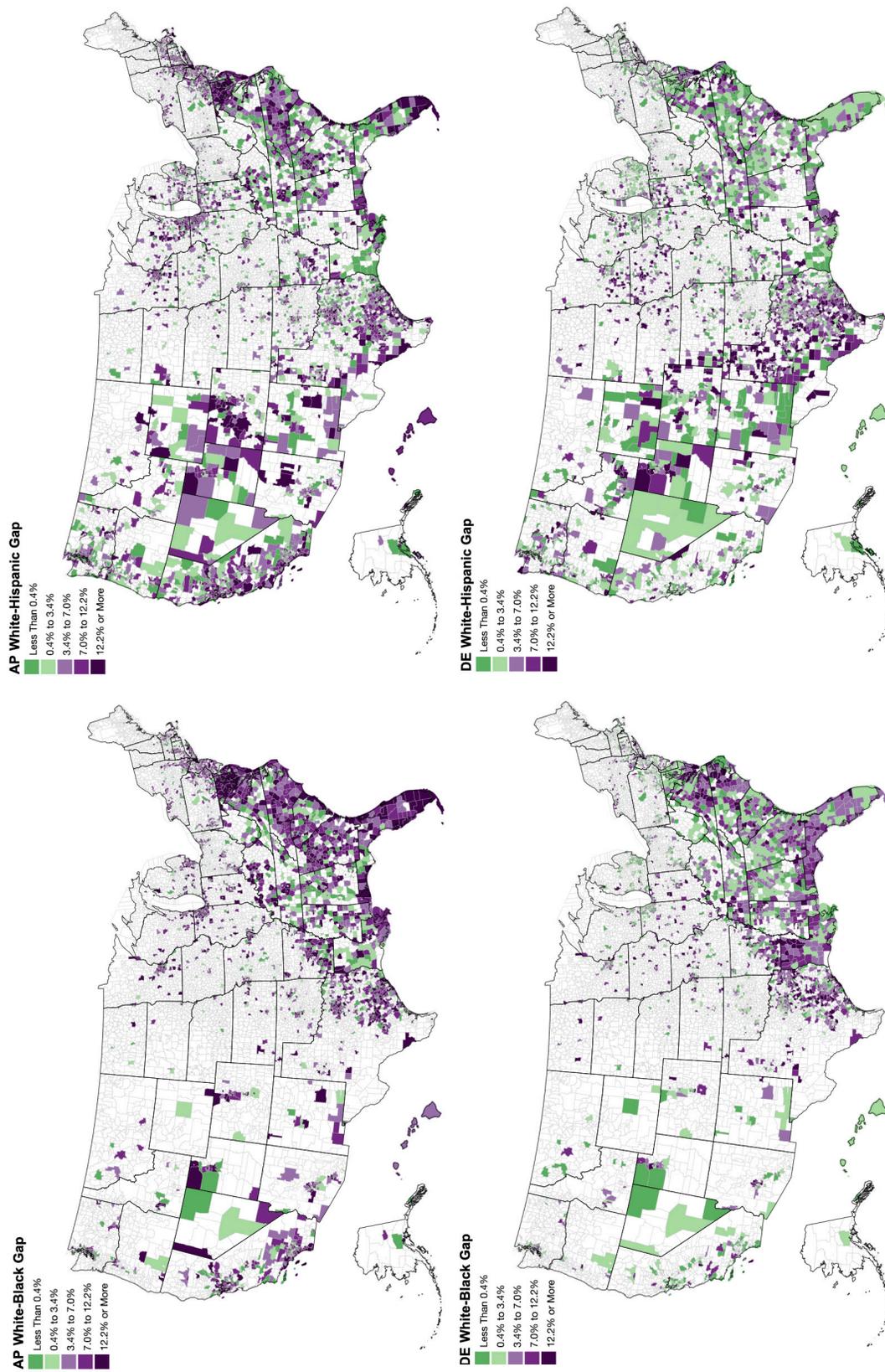
Note: States are ranked in descending order by the states' median district gap for AP and DE participation, separately for white-black and white-Hispanic gaps.

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015-16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

an average value that is above the national average. Similarly, for the binary variables (such as whether the district is in a state with strong financial incentives for AP and DE participation), we report the difference between the average value and national average.

Although the summary statistics vary widely across the four groups of star districts, shared patterns still emerge for several district- and state-level variables. Overall, these districts tend to have substantially smaller white-minority gaps in pre-high school achievement and income (as measured by

**Figure 5. Quintile Maps of District Racial Equity Gaps in AP and DE Participation**



Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015-16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileid=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/ipeds/data/ipedsdatatools/datafiles/education-demographic-and-geographic-estimates/>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ipeds/data/ipedsdatatools/datafiles/common-core-of-data/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

**Table 2. Districts with Above-Median Enrollment Rates Among Black and Hispanic Students and Less Than 1 Percentage Point Racial Enrollment Gap**

	White-Black Gap		White-Hispanic Gap	
	AP	DE	AP	DE
<b>Academic Preparation (Pre-High School)</b>				
Average District Achievement: Grades 3–8	–0.097	0.040	0.054	0.054
White-Minority Achievement Gap	–0.889	–0.226	–0.607	–0.274
<b>Family Socioeconomic Background</b>				
Proportion Receiving FRPL in Public High Schools	0.034	–0.005	–0.022	–0.027
Proportion of Adults with a Bachelor’s Degree or Higher	–0.010	0.196	0.004	0.043
White-Minority Gap: Proportion Receiving FRPL	0.259	0.348	0.127	0.175
White-Minority Gap: Proportion of Adults with a Bachelor’s Degree or Higher	–0.176	–0.138	–0.057	0.016
<b>Between-High School Segregation in a District</b>				
Between-School Free or Not Free Lunch Segregation	0.006	0.149	0.016	0.014
Between-School Segregation, White-Minority	–0.176	–0.007	–0.104	–0.051
<b>Racial Composition Among High School Students in a District</b>				
Proportion Black in a District	0.153	0.258	0.037	0.047
Proportion Hispanic in a District	0.291	0.181	0.171	0.185
<b>Average Characteristics of High Schools in a District</b>				
Proportion of Enrollment in Urban Schools	0.519	0.589	0.355	0.326
Proportion of Enrollment in Magnet Schools	0.034	0.068	–0.005	0.035
Proportion of Enrollment in Gifted and Talented Programs	0.057	0.140	0.147	0.103
Average Student-Counselor Ratio	0.006	–0.014	0.041	0.053
Average Student-Teacher Ratio	0.119	0.152	0.106	0.115
Per-Pupil Instructional Expenditures	–0.088	–0.024	–0.168	–0.112
Distance to Nearest Public Institution	–0.237	–0.279	–0.151	–0.140
Average Number of AP Courses Offered per School	0.559	0.612	0.538	0.410
<b>State-Level Policies</b>				
Moderate Accountability for Access	0.000	0.039	0.023	–0.004
Strong Accountability for Access	0.094	0.012	0.133	0.083
Moderate Financial Support	0.001	0.049	–0.037	0.007
Strong Financial Support	0.041	0.020	0.080	0.040

(continued on the next page)

**Table 2. Districts with Above-Median Enrollment Rates Among Black and Hispanic Students and Less Than 1 Percentage Point Racial Enrollment Gap (continued)**

	White-Black Gap		White-Hispanic Gap	
	AP	DE	AP	DE
Moderate Accountability for Student Outcomes	—	0.055	—	0.063
Strong Accountability for Student Outcomes	0.052	-0.012	-0.010	0.023

Note: This table includes districts where the AP and DE enrollment rates among the specified minority group are above the national median on average and the white-minority gap in AP and DE enrollment is below 1 percentage point. Each cell provides the summary statistic for the relevant explanatory variable. All continuous variables are standardized. Therefore, a positive value indicates the districts have an average value that is above the national average. For the binary variables (i.e., state-level policies), we report the difference between the average value and national average.

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015–16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

eligibility to FRPL). They also tend to be more racially diverse than the national average, more likely to be in urban areas, closer to local postsecondary institutions, and more likely to offer a greater number of AP courses. These districts are not necessarily better resourced in general than the national average. For example, districts in all four categories have a student-teacher ratio that is above the national average and per-pupil instructional expenditures below the national average. Finally, these districts concentrate in states with stronger accountability regarding access and financial support for AP and DE participation. These raw descriptive patterns suggest that star districts tend to have lower racial baseline gaps, greater access to college acceleration opportunities, and stronger financial support.

We predict racial gaps in AP and DE participation by identifying the relationship between specific variables and AP and DE gaps, holding other factors constant. These results, along with four additional variables used to capture racial gaps in pre-high school academic achievement and socioeconomic status,<sup>26</sup> are presented in Tables 2 and 3, respectively.

Since all the continuous variables are standardized, the coefficient of a continuous variable indicates the changes in AP or DE participation rates

given a one standard deviation change in that variable. The results are presented in Table 3 and reveal three general patterns. First, a handful of local-level factors are correlated with greater levels of participation in AP and DE programs. Specifically, districts that have greater levels of between-school income segregation are related to lower levels of participation in AP and DE programs. In contrast, per-pupil instructional expenditures and academic acceleration opportunities before high school, such as the proportion of students enrolled in gifted and talented programs, are associated with higher levels of AP and DE participation.

Additionally, there are numerous cases in which the local-level variables are associated with AP and DE enrollment, but in opposite directions. For example, the proportion of educated adults with schoolchildren in a district is associated with an increase in AP participation rates but a decrease in DE participation rates. Similarly, the average number of AP courses offered at a school is associated with higher participation rates in AP programs but is negatively associated with DE enrollment. These patterns suggest AP and DE programs may serve as substitutes to each other when schools are allocating resources among different college acceleration programs. These patterns also

**Table 3. Regression Estimates Predicting AP and DE Enrollment**

	<b>AP (1)</b>	<b>DE (2)</b>
<b>Academic Preparation (Pre-High School)</b>		
Average District Achievement: Grades 3–8	0.004 (0.002)	0.022*** (0.003)
<b>Family Socioeconomic Background</b>		
Proportion Receiving FRPL in Public High Schools	–0.001 (0.002)	–0.008*** (0.003)
Proportion of Adults with a Bachelor’s Degree or Higher	0.016*** (0.002)	–0.018*** (0.003)
<b>Between-High School Segregation in a District</b>		
Between-School Free or Not Free Lunch Segregation	–0.002** (0.001)	–0.003** (0.001)
<b>Racial Composition Among High School Students in a District</b>		
Proportion Black in a District	–0.001 (0.002)	–0.007*** (0.002)
Proportion Hispanic in a District	0.001 (0.002)	–0.002 (0.002)
<b>Average Characteristics of High Schools in a District</b>		
Proportion of Enrollment in Urban Schools	0.008*** (0.002)	0.000 (0.002)
Proportion of Enrollment in Magnet Schools	0.000 (0.001)	–0.006*** (0.002)
Proportion of Enrollment in Gifted and Talented Programs	0.004*** (0.001)	0.005*** (0.002)
Average Student-Counselor Ratio	–0.004*** (0.002)	0.000 (0.002)
Average Student-Teacher Ratio	0.021*** (0.004)	–0.030*** (0.006)
Per-Pupil Instructional Expenditures	0.007*** (0.002)	0.006** (0.003)
Distance to Nearest Public Institution	–0.013*** (0.004)	0.001 (0.002)
Average Number of AP Courses Offered per School	0.047*** (0.004)	–0.021*** (0.002)
<b>State-Level Policies</b>		
Moderate Accountability for Access	–0.001 (0.002)	0.021*** (0.004)

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**Table 3. Regression Estimates Predicting AP and DE Enrollment (continued)**

	AP (1)	DE (2)
Strong Accountability for Access	0.032*** (0.004)	0.059*** (0.005)
Moderate Financial Support	0.040*** (0.005)	-0.018*** (0.005)
Strong Financial Support	0.045*** (0.005)	-0.016*** (0.005)
Moderate Accountability for Student Outcomes	— —	0.030*** (0.005)
Strong Accountability for Student Outcomes	0.004 (0.003)	0.000 (0.004)
N	8,746	8,746

Note: The sample includes school districts with non-missing values for the explanatory variables. All the continuous explanatory variables are standardized; thus, the coefficient indicates the changes in AP or DE participation rates given a one standard deviation change in that variable. Average high school characteristics in a district include high schools only. All the state-level policies are dummy variables and use weak accountability as the reference group. See Table A2 for details about the coding scheme for state-level policies. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015–16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

suggest that students with more educated parents may interpret these programs' value differently.

Lastly, among the state-level variables, having strong accountability mandates is an important predictor for AP and DE participation: Districts in states with strong accountability and mandates for access to AP and DE programs are associated with higher AP and DE participation rates than are states without such mandates or with weak accountability. Additionally, strong financial incentives are important for AP participation. Specifically, states that offer moderate to strong financial incentives for participating in AP programs, such as reducing or waiving exam fees for low-income students, have AP enrollment rates that are 5 percentage points larger than states without or with weak financial incentives. Below, we discuss the key findings for each of the six categories of variables examined.

First, as seen in Table 4, among all the district- and state-level variables examined, the white-minority

gap in pre-high school academic achievement, averaged across grades three through eight, is the strongest predictor of the participation gaps for black and Hispanic students and across AP and DE programs.<sup>27</sup> In districts where black and white students have similar levels of pre-high school achievement, both groups of students would be equally likely to enroll in an AP program, holding other factors constant.

Second, racial gaps in college acceleration programs may be partly driven by disparities in family socioeconomic background. Districts with higher average poverty levels—measured as proportions of students receiving FRPL—are generally associated with wider racial gaps in AP and DE participation. Such relationships are more robust for AP than DE participation gaps.<sup>28</sup>

Third, we do not observe a clear pattern between racial participation gaps and between-school income segregation.<sup>29</sup> These results suggest that income and

**Table 4. Regression Estimates Predicting White-Black and White-Hispanic Participation Gap**

	White-Black Gap		White-Hispanic Gap	
	AP (1)	DE (2)	AP (1)	DE (2)
<b>Academic Preparation (Pre-High School)</b>				
Average District Achievement: Grades 3–8	0.005 (0.003)	0.020*** (0.004)	0.002 (0.001)	0.004** (0.002)
White-Minority Achievement Gap	0.038*** (0.002)	0.011*** (0.002)	0.016*** (0.001)	0.008*** (0.001)
<b>Family Socioeconomic Background</b>				
Proportion Receiving FRPL in Public High Schools	0.008** (0.003)	0.006* (0.003)	0.004*** (0.001)	–0.001 (0.002)
Proportion of Adults with a Bachelor’s Degree or Higher	0.004 (0.003)	–0.015*** (0.003)	0.004*** (0.001)	–0.004** (0.002)
White-Minority Gap: Proportion Receiving FRPL	0.010* (0.006)	–0.003 (0.005)	0.007*** (0.002)	–0.003* (0.002)
White-Minority Gap: Proportion of Adults with a Bachelor’s Degree or Higher	0.005** (0.002)	0.004* (0.002)	0.003** (0.001)	0.006*** (0.001)
<b>Between-High School Segregation in a District</b>				
Between-School Free or Not Free Lunch Segregation	–0.003 (0.002)	0.000 (0.002)	–0.003** (0.001)	0.001 (0.001)
Between-School Segregation, White-Minority	–0.001 (0.002)	–0.004** (0.002)	–0.001 (0.001)	–0.002** (0.001)
<b>Racial Composition Among High School Students in a District</b>				
Proportion Black in a District	0.011*** (0.002)	0.007*** (0.002)	0.006*** (0.001)	0.003** (0.001)
Proportion Hispanic in a District	0.002 (0.002)	–0.001 (0.002)	0.001 (0.001)	0.001 (0.001)
<b>Average Characteristics of High Schools in a District</b>				
Proportion of Enrollment in Urban Schools	0.007*** (0.002)	–0.001 (0.002)	0.002** (0.001)	–0.001 (0.001)
Proportion of Enrollment in Magnet Schools	0.001 (0.001)	–0.002*** (0.001)	0.000 (0.000)	0.000 (0.000)
Proportion of Enrollment in Gifted and Talented Programs	0.005*** (0.002)	–0.002 (0.001)	0.001 (0.001)	–0.001 (0.001)
Average Student-Counselor Ratio	–0.004** (0.002)	0.006** (0.002)	–0.001 (0.001)	–0.001 (0.001)
Average Student-Teacher Ratio	–0.005 (0.003)	–0.011** (0.005)	–0.003 (0.002)	–0.005*** (0.002)

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**Table 4. Regression Estimates Predicting White-Black and White-Hispanic Participation Gap (continued)**

	White-Black Gap		White-Hispanic Gap	
	AP (1)	DE (2)	AP (1)	DE (2)
Per-Pupil Instructional Expenditures	0.007*** (0.002)	0.000 (0.003)	0.004*** (0.001)	0.002 (0.001)
Distance to Nearest Public Institution	-0.012* (0.007)	-0.005 (0.007)	0.002 (0.002)	0.003 (0.003)
Average Number of AP Courses Offered per School	0.023*** (0.002)	-0.008*** (0.002)	0.007*** (0.001)	-0.004*** (0.001)
<b>State-Level Policies</b>				
Moderate Accountability for Access	0.009** (0.004)	0.012** (0.006)	0.001 (0.002)	0.006** (0.003)
Strong Accountability for Access	0.008* (0.004)	0.019*** (0.006)	-0.002 (0.002)	0.010*** (0.003)
Moderate Financial Support	0.008 (0.007)	-0.019** (0.006)	0.009** (0.004)	-0.005** (0.002)
Strong Financial Support	0.000 (0.008)	-0.037*** (0.006)	0.007 (0.005)	-0.014*** (0.003)
Moderate Accountability for Student Outcomes	—	0.001 (0.005)	—	-0.003 (0.002)
Strong Accountability for Student Outcomes	0.018*** (0.004)	0.006 (0.005)	0.007*** (0.002)	0.000 (0.002)
N	2,117	1,885	2,554	2,188

Note: The sample includes school districts with non-missing values for the explanatory variables. All the continuous explanatory variables are standardized; thus, the coefficient indicates the changes in AP or DE participation rates given a one standard deviation change in that variable. Average high school characteristics in a district include high schools only. All the state-level policies are dummy variables and use weak accountability as the reference group. See Table A2 for details about the coding scheme for state-level policies. \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015–16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

racial segregation are not necessarily directly linked to racial participation gaps in AP and DE programs. Rather, a major source of such disparity is likely to be unequal access to resources and opportunities that are linked to a school's socioeconomic and racial composition.<sup>30</sup>

Fourth, greater proportions of black students in a district are consistently associated with wider racial gaps in AP and DE participation, though the effect sizes are fairly small.<sup>31</sup> In contrast, proportions of Hispanic students are not associated with racial gaps in either AP or DE participation.

Fifth, the most striking finding from this category of predictors is that a set of factors that is correlated with greater AP participation overall (Table 2)—namely, proportions of students enrolled in urban schools, proportions of students enrolled in gifted and talented programs, average per-pupil instructional expenditures among high school students, and more AP course offerings—is also associated with wider AP racial enrollment gaps for, in most cases, black and Hispanic students.

Finally, states with stronger accountability measures for access and student outcomes have larger white-minority gaps for AP and DE compared with states with weak accountability measures. In contrast, stronger financial incentives for DE participation are associated with smaller racial enrollment gaps in DE programs, and these associations are particularly pronounced for white-black DE participation gaps.<sup>32</sup> Taken together, these results suggest that financial resources and support may be essential in expanding access and participation in DE programs among minority students.

## Conclusion

Our analysis provides several insights into the policy and practice of college acceleration programs. In this study, we find that the majority of districts nationwide have nontrivial racial gaps in AP and DE programs, with more pronounced gaps in AP than DE. Additionally, we find wider white-black gaps than white-Hispanic gaps in both programs. How can educational leaders work to mitigate these disparities?

To start, educational leaders could ensure that more elementary and middle school students from underrepresented backgrounds are equipped to participate in college acceleration programs. Our report finds that differences in pre-high school achievement gaps between white and minority students are the strongest predictors of racial gaps in AP and DE participation in a district. One consideration is for districts to improve the accuracy of the screening process by incorporating additional measures of students' likelihood of success in AP and DE programs.

To close the racial gaps in AP and DE enrollment, district leaders should work to close the racial gaps of school achievement before high school.

In addition to preparing students in the years leading up to high school, educational leaders must also work to address other barriers that may hinder students from enrolling in AP and DE programs.<sup>33</sup> Districts that offer abundant college acceleration opportunities but do not make intentional efforts to provide equitable access to such opportunities can worsen racial gaps in AP and DE participation. For example, homogenous ability grouping, such as gifted programs, provides targeted instruction early on to prepare students for more advanced coursework such as AP. They can also, however, drive school segregation along race and family socioeconomic background. Teachers and leaders must collaborate to become more aware of the racial disparities that gifted programs can cultivate and their role in closing them.

Districts with greater resources surrounding college acceleration programs may also engender racial disparity if differences in students' socioeconomic backgrounds are unaccounted for. Policymakers might consider the financial constraints of potential participants when allocating funds and targeted support for college acceleration programs. They might remove financial barriers that hinder students' participation in such programs, especially students from less affluent backgrounds.

The disruption to school districts because of the COVID-19 pandemic only increases the need for educational leaders to close these gaps. The pandemic is leaving some students further behind and exacerbating already stubborn achievement gaps. Given the opportunity for college acceleration programs to serve underrepresented students, researchers, practitioners, and policymakers should collaborate to identify the practices among districts that are highly effective to close these participation gaps.

Reformers should also acknowledge that efforts to prioritize equitable AP and DE participation should be pursued in tandem with ensuring success in such programs. As such, districts could consider that the factors underlying racial achievement gaps, such as

school resources and policies, may largely overlap with the factors that explain participation gaps. With this in mind, educational leaders may need to consider that a single policy or practice may be insufficient to narrow the gaps in AP and DE participation. They should also pursue comprehensive, persistent efforts to reform social and school structures in which racial achievement gaps are rooted.

### **Acknowledgments**

Funding for this study was provided by the Bill & Melinda Gates Foundation. The authors gratefully acknowledge Davis Jenkins, Elisabeth Barnett, Veronica Minaya, and Vivian Yuen Ting Liu for helpful comments and feedback on earlier drafts. The authors are also thankful for the staff at the National Alliance of Concurrent Enrollment Programs that were

early collaborators about using the CRDC to measure access to college acceleration opportunities.

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# Appendix A

**Table A1. Full List of Covariates**

Measure	Source
<b>Academic Preparation (Pre–High School)</b>	
Average District Achievement: Grades 3–8	SEDA
White-Minority Achievement Gap	SEDA
<b>Family Socioeconomic Background</b>	
Proportion Receiving FRPL in Public High Schools	ACS-EDGE, 2012–16
Proportion of Adults with a Bachelor’s Degree or Higher	ACS-EDGE, 2012–16
White-Minority Gap: Proportion Receiving FRPL	SEDA
White-Minority Gap: Proportion of Adults with a Bachelor’s Degree	SEDA
<b>Between-School Segregation</b>	
Between-School Free or Not Free Lunch Segregation	CCD
Between-School Segregation, White-Minority	CCD
<b>Racial and Ethnic Composition</b>	
Proportion Black in a District	CCD
Proportion Hispanic in a District	CCD
<b>Average Characteristics of High Schools in a District</b>	
Proportion of Enrollment in Urban Schools	CCD
Proportion of Enrollment in Magnet Schools	CCD
Proportion of Enrollment in Gifted and Talented Programs	CRDC
Average Student-Counselor Ratio	CCD
Average Student-Teacher Ratio	CCD
Per-Pupil Instructional Expenditures	CCD
Distance to Nearest Public Institution	IPEDS
Average Number of AP Courses Offered per School	CRDC
<b>State-Level Policies</b>	
AP	Education Commission of the States
DE	Education Commission of the States

Note: For EDGE data, see Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/Demographic/>.

Source: Authors’ calculations using data from Department of Education, Office for Civil Rights, “2015–16 Civil Rights Data Collection,” <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

**Table A2. AP and DE State Policies: Definition and Category Descriptions**

(1)	Description (2)	Category (3)
<b>AP State Policies:</b>		
AP participation and success included in high school accountability metrics and reporting	Indicates whether data on AP course or exam participation or success are included in district or high school accountability metrics and reports	<b>Accountability and mandate access</b> <b>N = 4 distinct policies</b> <b>Weak = 0–1 policies; moderate = 2 policies; strong = 3–4 policies</b>
All high schools or districts required to offer AP	Indicates whether states require high schools or districts to offer AP courses	Accountability and mandate access
Collaboration on AP between K–12 and higher education systems	Identifies states in which policy mandates or encourages K–12 and higher education entities to collaborate in the development of AP curricula and teacher training	Accountability and mandate access
State postsecondary institutions must award credit for minimum scores	Indicates whether states must award credit for minimum scores	Accountability and mandate access
State financial support for AP course offerings or AP success	Indicates whether states provide funds for (1) startup costs associated with offering new or expanded AP course offerings, (2) teacher bonuses for students' AP success, or (3) student financial rewards for their AP success	<b>Financial incentives and program support</b> <b>N = 4 distinct policies</b> <b>Weak = 0 policies; moderate = 1–2 policies; strong = 3–4 policies</b>
State programs and funding for teacher training	Indicates whether states require AP teachers to attend College Board–sponsored training, require teachers to receive special licensure to teach AP courses, or provide funds for AP or pre-AP teachers to receive AP training or professional development	Financial incentives and program support
State subsidies for testing fees	Indicates whether state (not exclusively school or district) funds are provided to supplement federal and College Board exam fee reductions for low-income students. It also identifies states that are reducing or waiving exam fees for non-low-income students, either generally or for AP exams in certain subject areas such as STEM disciplines. In spring 2016, the fee for subject-specific AP exams was \$92. The College Board provides a \$30 fee reduction for low-income students, and high schools typically waive the \$9 processing fee for low-income students.	Financial incentives and program support
State support for encouraging access to AP	Identifies state approaches to enhance student access and success in AP coursework, including supports for pre-AP instruction and online course providers affiliated with a state agency that offer AP coursework to students statewide	Financial incentives and program support
State scholarship criteria include AP scores	Indicates states that require students to achieve minimum scores on one or more AP exams or another college-ready measure to be eligible for merit-based state scholarships	<b>Accountability and mandate student outcomes</b> <b>N = 1 policy</b> <b>Weak = 0 policies; strong = 1 policy</b>

(continued on the next page)

**Table A2. AP and DE State Policies: Definition and Category Descriptions (continued)**

(1)	Description (2)	Category (3)
<b><i>DE State Policies:</i></b>		
Offering is mandatory	Indicates whether all high schools and eligible public postsecondary institutions (two-year or four-year, as defined in state policy) in a state are required to provide DE opportunities	<b>Accountability and mandate access</b> <b>N = 6 distinct policies</b> <b>Weak = 0–1 policies; moderate = 2–3 policies; strong = 4–6 policies</b>
Program reporting requirement	Indicates whether postsecondary institutions (or high school partners) are required to report (to a state agency or the public) on the number, course-taking options, demographics, or success of students participating in DE programs	Accountability and mandate access
Student eligibility requirements	Indicates a state does not have student eligibility requirements such as grade level, academic, or other criteria	Accountability and mandate access
Courses offered virtually	Indicates whether state policy specifies where DE courses may be offered and whether they are offered virtually	Accountability and mandate access
Students or parents must be notified of DE opportunities	Indicates state policy requires a high school or district to notify all students or their parents of the availability of DE programs	Accountability and mandate access
Counseling or advising is made available to students	Indicates state policy requires prospective or current dually enrolled students to receive counseling about participation in DE programs	Accountability and mandate access
Who is primarily responsible for paying tuition	Indicates who is primarily responsible for paying students' tuition (the student's family, the district, etc.) or if postsecondary institutions are required to waive tuition for DE students	<b>Financial incentives and program support</b> <b>N = 1 policy</b> <b>Weak = student or parent primarily responsible; moderate = local decision; strong = state, district, or college is responsible</b>
Postsecondary or secondary credit earned	Indicates whether students in DE programs earn high school and postsecondary credit	<b>Accountability and mandate student outcomes</b> <b>N = 5 distinct policies</b> <b>Weak = 1–2 policies; moderate = 3 policies; strong = 4–5 policies</b>
Students may take developmental or remedial coursework for dual credit	Indicates whether state policy explicitly allows high school students to access postsecondary developmental or remedial coursework for dual credit	Accountability and mandate student outcomes
Career and technical education component	Indicates whether state policy explicitly allows high school students to enroll in career or technical education courses for high school and postsecondary credit	Accountability and mandate student outcomes

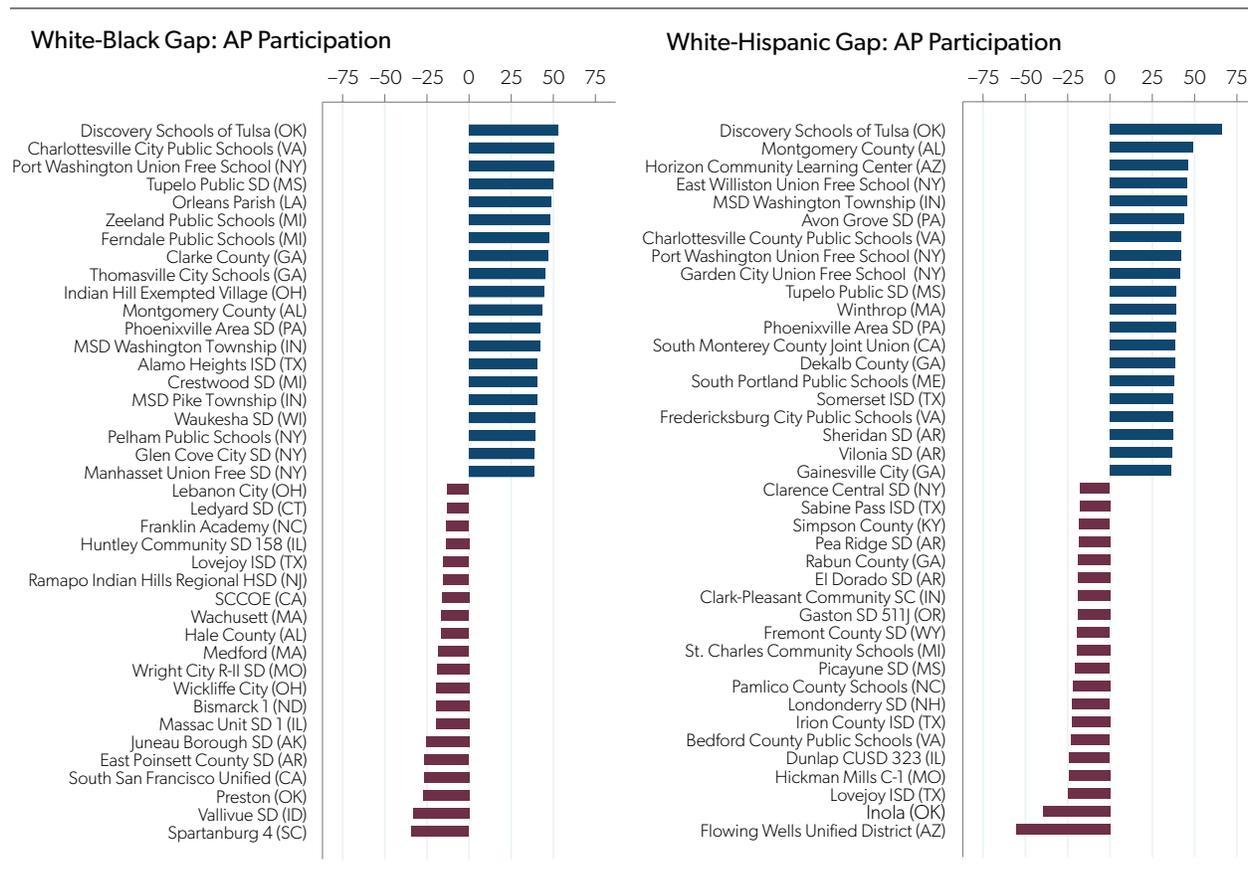
(continued on the next page)

**Table A2. AP and DE State Policies: Definition and Category Descriptions (continued)**

(1)	Description (2)	Category (3)
Cap on number of credits students may earn	Indicates that there is no cap on the number of DE credits a student may earn per semester or school year or during a student's high school career	Accountability and mandate student outcomes
Public postsecondary institutions required to accept credits	Indicates whether public two- and four-year institutions other than the institution at which the student earned postsecondary credit are required to accept postsecondary credits earned through DE programs	Accountability and mandate student outcomes

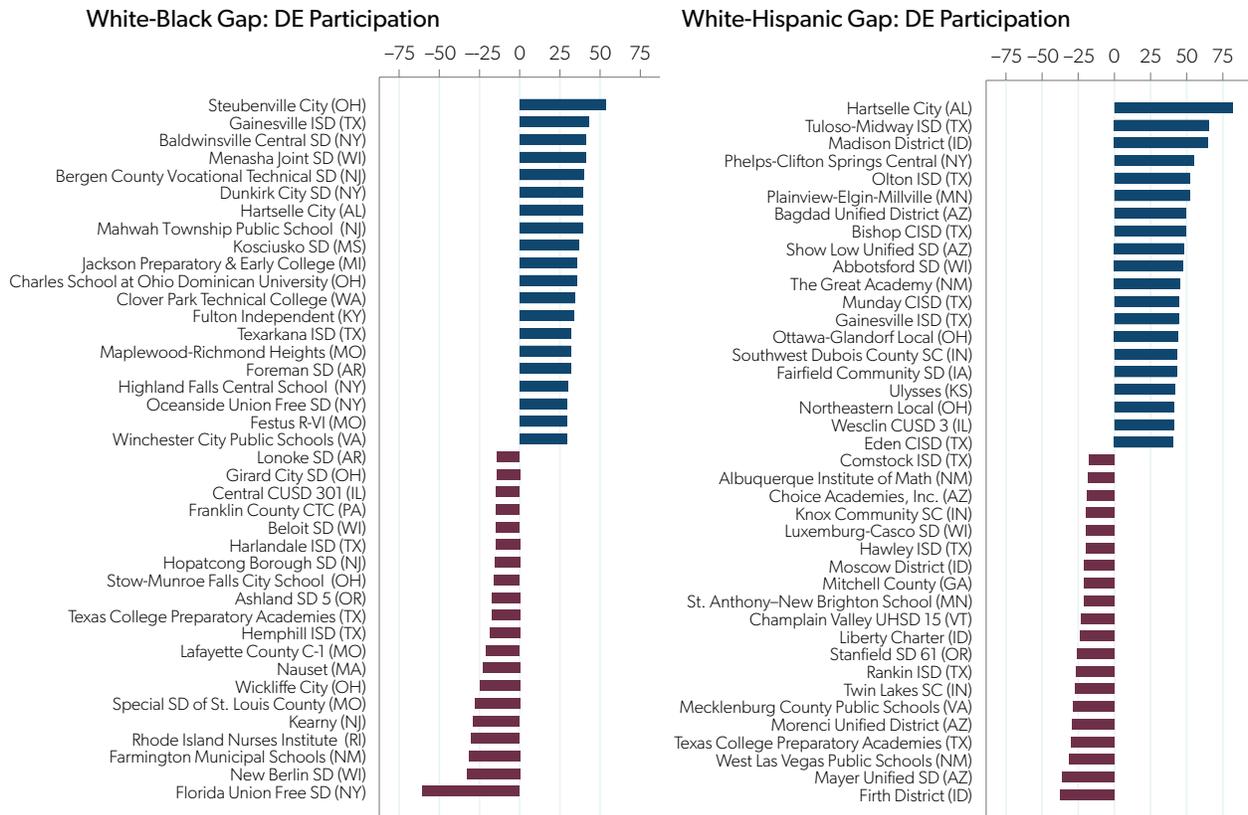
Note: Column 1 lists the state AP and DE policy. Column 2 provides a detailed description. Column 3 lists the number of policies included in each category: weak, moderate, and strong. The category "accountability and mandate student outcomes" for the AP program includes two categories: weak and strong. This is because states offer only one distinct policy that fits this category. Source: Education Commission of the States, website, <https://www.ecs.org/>

**Figure A1. Percentage-Point Racial Equity Gaps in AP and DE Participation: Top and Bottom 20 Districts**



(continued on the next page)

**Figure A1. Percentage-Point Racial Equity Gaps in AP and DE Participation: Top and Bottom 20 Districts (continued)**



Note: SD is "school district," MSD is "metropolitan school district," ISD is "independent school district," HSD is "high school district," SCCOE is "Santa Clara County of Education," SC is "school corporation," CUSD is "community unit school district," CTC is "career and technology center," CISD is "consolidated independent school district," and UHSD is "union high school district."

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015-16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

# Appendix B

## Identifying Eligible High Schools

Table B1 summarizes the steps taken to restrict the full CRDC school-level dataset to eligible high schools. The CRDC data collection on the 2015–16 school year gathered data from 96,360 schools in 16,874 districts. We first merge CRDC data with CCD data by school identification, as the latter provide detailed grade-level enrollment for each school. While CRDC and CCD school-level data should align using a unique school identifier in both datasets, approximately 1,000 schools did not match their unique identifier. Through other matching procedures (e.g., school, state, and district name combinations), we could match all but 308 CRDC schools, which were excluded from our analytic sample. We further exclude schools that do not offer 11th or 12th grade ( $N = 71,309$ ) and special education, alternative, juvenile justice ( $N = 5,512$ ), and virtual schools ( $N = 556$ ). The final sample includes 18,675 schools identified as eligible high schools located in 11,833 school districts.

## Adjusting School Enrollments

As mentioned above, the CRDC asked survey respondents to report the number of ninth- through 12th-grade students who participated in AP or DE programs. Thus, students in eighth grade or below are ineligible for the purposes of estimating AP and DE participation and should therefore be excluded from the denominator of AP and DE participation rates. Of the eligible set of high schools, 27 percent offered eighth grade or lower ( $N = 5,134$ ), and these schools will be referred to as “secondary schools” for the sake of brevity. We use the CCD school-by-grade enrollments to estimate ninth- through 12th-grade enrollments at these schools through a two-step procedure described below.<sup>34</sup>

First, if secondary schools had a CCD school enrollment that matched the CRDC school enrollment

within  $\pm 5$  percent of the CRDC enrollment, then we replace the participation rate denominator with the CCD enrollment for grades nine and above. This replacement is done specifically for all students and subgroups of students by race and gender. Second, if secondary schools did not have a CCD school enrollment that matched the CRDC school enrollment within  $\pm 5$  percent of the CRDC enrollment, then we use CCD to create a ratio capturing the proportion of the school enrollment in grades nine or above. We then use this ratio to weight the CRDC enrollment to estimate the number of students in grades nine or above.

Because of this two-step procedure, 6 percent of students in the full sample of eligible high schools are excluded (ranging from 5 to 12 percent by subgroup). Removing ineligible students from the participation-rate denominators increases the AP and DE participation rates by 1.2 and 0.5 percentage points, respectively. (This ranges from 0 and 2 percentage points by student subgroup.) Our examination of the magnitude of these adjustments by state suggests that, without this adjustment, participation in AP and DE would be underestimated in certain states (e.g., Alabama, Alaska, and Louisiana) due to overrepresentation of student enrollment in secondary schools (relative to traditional high schools offering grades nine through 12).

## Outcome Measures and Analytic Samples

For each district, we examine overall rates of AP and DE participation and the white-black and white-Hispanic gaps in AP and DE participation. The CRDC instructed schools and districts to count students as having participated in AP if they *took* at least one AP course during the 2015–16 school year. The CRDC uses a broad definition of DE program participation, including all “opportunities for high school students to take college-level courses offered by

**Table B1. Sample Restriction Procedure with Resulting Number of Remaining High Schools**

Sample Restriction Step (CRDC-CCD Variable Used)	N = Remaining Schools
1. Keep only schools with 11th or 12th grade (CRDC).	N = 25,051
2. Remove special education, alternative, and juvenile justice schools (CRDC). Includes removing schools with the words <i>adult</i> , <i>behavioral</i> , <i>juvenile</i> , and <i>correction</i> in the school name (CRDC).	N = 20,674
Merge to CCD directory; remove nonmatching NCES schools.	N = 20,366
3. Remove virtual schools (CCD). Includes removing schools with the words <i>virtual</i> , <i>cyber</i> , <i>electronic</i> , <i>internet</i> , <i>online</i> , and <i>distance</i> in the name.	N = 19,983
4. Remove elementary, middle, and level “not applicable” schools (CCD).	N = 19,810
5. Remove special education, alternative or other, and “adult” schools (CCD).	N = 18,675 high schools N = 11,833 districts

Source: Authors’ calculations using data from Department of Education, Office for Civil Rights, “2015–16 Civil Rights Data Collection,” <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

colleges, and earn concurrent credit toward a high school diploma and a college degree while still in high school.”<sup>35</sup>

Participation rates are derived by dividing the number of AP or DE participants in a given district by the total ninth- through 12th-grade high school enrollment in that district. We also calculate the AP and DE participation rates for each main racial group separately. For example, to derive DE participation rates for black students, we divide the number of black students participating in DE by the total ninth- through 12th-grade enrollment of black high school students. To calculate racial gaps in AP and DE participation, we subtract black or Hispanic student participation rates from white student participation rates, reporting *percentage-point* gaps, such that positive gaps indicate higher participation among white students and negative gaps indicate higher participation among black or Hispanic students.

Since the primary focus of our report is racial gaps in AP and DE participation, we have to condition our outcome measures on some amount of AP or DE participation among either white students or black and Hispanic students. For example, it would be misleading to report a 0 percentage point gap in white-black DE participation if the district had zero DE participation for white and black students. Specifically, for the overall AP and DE participation rates, we exclude districts where there are fewer than 20 students for total enrollment; similarly, for the participation-rate gaps, we report gaps only for districts with 20 or more students in each subgroup and with at least one subgroup having a nonzero participation rate. As a result, we use different analytic samples depending on the outcome measure. Table B2 summarizes the analytic sample for each main outcome measure. Although the number of districts decreases substantially as we restrict the analytic

samples, these restrictions mainly exclude districts with few students overall; as a result, districts that

remain in the sample still cover at least two-thirds of total students enrolled nationwide.

**Table B2. Analytic Samples**

Outcome Measure(s)	Description	Districts	
		N Districts	N Students
DE and AP Participation Rate Sample	Districts with 20+ Enrollment	11,741 (100%)	14,098,228 (100%)
White-Black AP Participation-Rate Gap Sample	Districts with 20+ White Enrollment, 20+ Black Enrollment, and Either Greater Than 0% White AP Participation or Greater Than 0% Black AP Participation	3,550 (30%)	10,857,466 (77%)
White-Hispanic AP Participation-Rate Gap Sample	Districts with 20+ White Enrollment, 20+ Hispanic Enrollment, and Either Greater Than 0% White AP Participation or Greater Than 0% Hispanic AP Participation	4,625 (39%)	11,726,685 (83%)
White-Black DE Participation-Rate Gap Sample	Districts with 20+ White Enrollment, 20+ Black Enrollment, and Either Greater Than 0% White DE Participation or Greater Than 0% Black DE Participation	3,134 (27%)	9,260,290 (66%)
White-Hispanic DE Participation-Rate Gap Sample	Districts with 20+ White Enrollment, 20+ Hispanic Enrollment, and Either Greater Than 0% White DE Participation or Greater Than 0% Hispanic DE Participation	4,211 (36%)	9,966,047 (71%)

Source: Authors' calculations using data from Department of Education, Office for Civil Rights, "2015–16 Civil Rights Data Collection," <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>; Institute of Education Sciences, National Center for Education Statistics, Education Demographic and Geographic Estimates, <https://nces.ed.gov/programs/edge/#>; Institute of Education Sciences, National Center for Education Statistics, Common Core of Data, <https://nces.ed.gov/ccd/>; Stanford University, Stanford Education Data Archive, <https://edopportunity.org/>; and Institute of Education Sciences, National Center for Education Statistics, Integrated Postsecondary Education Data System, <https://nces.ed.gov/ipeds/>.

# Notes

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6. For example, the assistant vice president for enrollment management at Florida State University indicates, "When we review transcripts and see an AP course . . . we know that students have challenged themselves. We know that they are really pushing the envelope of their own intellectual curiosity. . . . We love that spirit." College Board, *9th Annual AP Report to the Nation*, February 13, 2013, <https://secure-media.collegeboard.org/digitalServices/pdf/ap/rtn/9th-annual/9th-annual-ap-report-single-page.pdf>.
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*Achievement of Participants in Dual Enrollment: An Analysis of Student Outcomes in Two States*, National Research Center for Career and Technical Education, October 2007, <https://ccrc.tc.columbia.edu/media/k2/attachments/dual-enrollment-student-outcomes.pdf>.

8. Christina Theokas and Reid Saaris, *Finding America's Missing AP and IB Students*, Education Trust, June 2013, [https://edtrust.org/wp-content/uploads/2013/10/Missing\\_Students.pdf](https://edtrust.org/wp-content/uploads/2013/10/Missing_Students.pdf); ExcelinEd, "College and Career Pathways: Equity and Access," 2018, <https://www.excelined.org/wp-content/uploads/2018/10/ExcelinEd.Report.CollegeCareerPathways.CRDCAnalysis.2018.pdf>; and US Government Accountability Office, *Public High Schools with More Students in Poverty and Smaller Schools Provide Fewer Academic Offerings to Prepare for College*, October 2018, <https://www.gao.gov/assets/700/694961.pdf>.

9. College Board, *10th Annual AP Report to the Nation*, February 11, 2014, <https://secure-media.collegeboard.org/digitalServices/pdf/ap/rtn/10th-annual/10th-annual-ap-report-to-the-nation-single-page.pdf>.

10. Institute of Education Sciences, National Center for Education Statistics, "Dual Enrollment: Participation and Characteristics," February 2019, <https://nces.ed.gov/pubs2019/2019176.pdf>.

11. Trey Miller et al., *Dual-Credit Education Programs in Texas: Phase II*, American Institutes for Research, July 2018, <https://www.air.org/sites/default/files/Dual-Credit-Education-Programs-in-Texas-Phase-II-July-2018.pdf>; Cecilia Speroni, "Determinants of Students' Success: The Role of Advanced Placement and Dual Enrollment Programs" (working paper, National Center for Postsecondary Research, New York, November 2011); and What Works Clearinghouse, "WWC Intervention Report."

12. Specifically, we focus on six broad categories of factors. (1) Student academic preparation before high school: Students with lower academic preparedness and performance levels are less likely to enroll in Advanced Placement (AP) and dual enrollment (DE) programs. The substantial and persistent racial achievement gaps are likely to result in racial gaps in AP and DE program participation. For example, using statewide data that track cohorts of Florida public high school students, Dylan Conger, Mark C. Long, and Patrice Iatarola found that the racial disparities in AP enrollment rates are reversed when they condition on students' pre-high school achievement. Dylan Conger, Mark C. Long, and Patrice Iatarola, "Explaining Race, Poverty, and Gender Disparities in Advanced Course-Taking," *Journal of Policy Analysis and Management* 28, no. 4 (Fall 2009): 555–76. Based on a recently compiled database by the Education Commission of the States (ECS), six states included minimum high school GPA as a criterion for admission to a DE program, 17 states required written permission or a recommendation from a teacher or school official, 25 states required DE candidates to meet course prerequisites set by the departments or institutions offering DE programs, and 24 states included other eligibility criteria, such as completion of certain high school courses or passing scores on state-determined high school or postsecondary assessments. See Bryan Kelley and Julie Rowland Woods, "50-State Comparison: Dual/Concurrent Enrollment Policies," Education Commission of the States, August 6, 2019, <https://www.ecs.org/dual-concurrent-enrollment-policies/>. (2) Family socioeconomic backgrounds: Racial differences in income distribution imply that racial minority students may have less economic resources at home than their white peers do, which could lead to different educational choices and outcomes. Similarly, parents with less education may have limited access to adequate information about college preparation and the process for enrolling in AP and DE courses. National Center for Education Statistics (NCES) reported that racial disparities in parental education are likely to contribute to racial gaps in AP and DE participation. See Institute of Education Sciences, National Center for Education Statistics, "Dual Enrollment." (3) Racial composition in a district: Major sources of such disparities in students' access to and participation in college accelerated programs are unequal resources and opportunities that are linked to socioeconomic and racial and ethnic composition at a school. For example, using Programme for International Student Assessment data from 2006, Guillermo Montt highlighted ways schools reproduce inequality, and a key finding relevant to our study is that achievement inequality is a function of characteristics of educational systems themselves, such as variations in opportunities to learn and, particularly, the extent of between-school segregation. Guillermo Montt, "Cross-National Differences in Educational Achievement Inequality," *Sociology of Education* 84, no. 1 (January 2011): 49–68, <https://doi.org/10.1177/0038040710392717>. (4) Between-school segregation: Together with between-school segregation, a district's racial composition is part of the local context that shapes the constraints and opportunities available to students. A line of research attempts to uncover whether peer racial composition, as opposed to educational resources related to it, affects student achievement causally, and the findings are fairly mixed. For example, based on the sophomore cohort of the High School and Beyond Longitudinal Survey, Steven G. Rivkin used a value-added approach to measure school equality. The study found that school racial composition per se is not related to black students' education or labor market outcomes. On the other hand, using a rich panel of data of more than 200,000 students enrolled in over 3,000 public

elementary students in Texas, Eric A. Hanushek, John F. Kain, and Steven G. Rivkin exploited racial composition changes because of students switching schools and the cohort-to-cohort fluctuations in demographic composition. Steven G. Rivkin, “School Desegregation, Academic Attainment, and Earnings,” *Journal of Human Resources* 35, no. 2 (Spring 2000): 333–46; and Eric A. Hanushek, John F. Kain, and Steven G. Rivkin, “New Evidence about *Brown v. Board of Education*: The Complex Effects of School Racial Composition on Achievement,” *Journal of Labor Economics* 27, no. 3 (July 2009): 349–83. (5) Average characteristics of high schools in a district: Magnet schools are public schools that offer programs with a special curricular focus, such as STEM, the arts, and vocational or career technical education. These programs often attract students with good academic standing and thus help increase diversity in the public school system. See Kristin Klopfenstein, “Advanced Placement: Do Minorities Have Equal Opportunity?,” *Economics of Education Review* 23, no. 2 (April 2004): 115–31, [https://www.researchgate.net/publication/222559373\\_Advanced\\_Placement\\_Do\\_minorities\\_have\\_equal\\_opportunity](https://www.researchgate.net/publication/222559373_Advanced_Placement_Do_minorities_have_equal_opportunity). A large volume of research has documented that within-school tracking and other forms of homogeneous ability grouping, such as gifted programs in a school, can exacerbate educational inequity by creating a situation in which students are segregated along lines of race and socioeconomic background. See Adam Gamoran, “Tracking and Inequality,” in *The Routledge International Handbook of the Sociology of Education*, ed. Michael W. Apple, Steven J. Ball, and Luis Armando Gandin (New York: Routledge, 2010); Samuel R. Lucas and Mark Berends, “Sociodemographic Diversity, Correlated Achievement, and De Facto Tracking,” *Sociology of Education* 75, no. 4 (October 2002): 328–48, <https://doi.org/10.2307/3090282>; and Jeannie Oakes, Adam Gamoran, and Reba N. Page, “Curriculum Differentiation: Opportunities, Outcomes, and Meanings,” in *Handbook of Research on Curriculum: A Project of the American Educational Research Association*, ed. Philip W. Jackson (New York: Macmillan, 1992). (6) State-level AP and DE policies: State-level AP and DE policies may either exacerbate or ameliorate racial gaps in AP and DE participation. For example, roughly three-quarters of states include AP or DE participation and performance measures in district accountability reports. See Jennifer Dounay Zinth, “50-State Comparison: Advanced Placement Policies,” Education Commission of the States, May 11, 2016, <https://www.ecs.org/advanced-placement-policies/>.

13. The Civil Rights Data Collection (CRDC) is a biennial survey of all public schools and school districts. The data collection on the 2015–16 school year targeted 17,370 districts and 96,440 schools with 99.8 percent of districts certifying their submitted data. The CRDC has collected information previously, and the 2015–16 survey included questions about DE program participation for the first time. The American Community Survey is an annual, nationwide survey that includes demographic, social, economic, and housing characteristics for school-age children. All iterations contain data for the nation, states, and school districts. The data most relevant for our study come from the Education Demographic and Geographic Estimates. Common Core of Data is an annual survey of all US public elementary and secondary schools. The Stanford Education Data Archive is a publicly available dataset about American schools, communities, and student success. It includes a range of detailed data on educational conditions, contexts, and outcomes in school districts and counties nationwide. Integrated Postsecondary Education Data System (IPEDS) is a system of interrelated surveys conducted annually by the US Department of Education’s NCES. IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs.

14. One limitation of this dataset is that it provides enrollments only at the school level (instead of at the school-by-grade level). As a result, for schools that also offer eighth grade and below, using total school enrollment as the denominator to calculate AP and DE participation rates is inappropriate, since the CRDC specifically instructed districts and schools to report AP and DE participants only among students who are in grades nine through 12. To summarize our findings from this process, the adjustment did not change the AP and DE participation rates much overall. Yet, participation rates were adjusted upward to a greater extent in certain states and districts where a greater proportion of high schools offer eighth grade and below. These results suggest that, without this additional adjustment, AP and DE participation rates calculated based on total high school enrollment reported in the CRDC are likely to be underestimated in certain areas with relatively more high schools offering grades eight and below.

15. The CRDC instructions defined DE programs as “programs [that] provide opportunities for high school students to take college-level courses offered by colleges, and earn concurrent credit toward a high school diploma and a college degree while still in high school. These programs are for high school-enrolled students who are academically prepared to enroll in college and are interested in taking on additional coursework. For example, students who want to study subjects not offered at their high school may seek supplemental education at colleges nearby. Dual enrollment/dual credit programs do not include the Advanced Placement (AP) program or

the International Baccalaureate Diploma Programme.” Department of Education, Office for Civil Rights, “2015–16 Civil Rights Data Collection,” 35, <https://crdc.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=25614>. Survey respondents were instructed to report the number of students in grades nine through 12 that enrolled in at least one dual enrollment or dual credit program, including ungraded high school–age students. For detailed information, see Department of Education, Office for Civil Rights, “2015–16 Civil Rights Data Collection.”

16. This between-school comparison is interschool, measuring segregation across schools in a school district.

17. IPEDS does not provide an indicator for whether an institution offers dual or concurrent enrollment. We use student age to identify institutions with at least one student enrolled in the fall who is 17 or younger.

18. We include state policies outlined by the ECS. The commission has researched AP and DE policies in all states and provides a comprehensive review of these policies as a resource for public use. These are general policies in place in a nontrivial proportion of states. Certain states have unique policies to support AP and DE and therefore are not included as predictors in our models. Yet, these policies might also influence AP and DE enrollment and racial gaps in AP and DE enrollment.

19. Taking AP state policy as an example, financial incentives and program support include four distinct state policies: financial support for AP courses, funding for teacher training, testing-fee subsidies, and support to encourage access. A state that has three to four policies in place would be considered to have strong financial support for AP participation. The category “accountability and mandate student outcomes” for the AP program includes only two categories: weak and strong. This is because there is only one distinct policy under this category. See Table A2 for a more detailed description.

20. Leslie E. Papke and Jeffrey M. Wooldridge, “Panel Data Methods for Fractional Response Variables with an Application to Test Pass Rates,” *Journal of Econometrics* 145, no. 1–2 (July 2008): 121–33, <http://people.stern.nyu.edu/wgreene/Econometrics/Papke-Wooldridge-FractionalResponse.pdf>.

21. Jeffrey M. Wooldridge, *Econometric Analysis of Cross Section and Panel Data*, second edition (Cambridge, MA: MIT Press, 2010), <https://mitpress.mit.edu/books/econometric-analysis-cross-section-and-panel-data-second-edition>.

22. White areas in the choropleth maps represent districts where there are fewer than 20 high school students and that are therefore excluded from our sample.

23. The inclusion criteria used to construct the sample for overall AP and DE participation is different from those used to construct the sample for racial enrollment gaps. Specifically, the sample for overall AP and DE participation includes all school districts with at least 20 total student enrollments. The sample for racial enrollment gaps further restricts to districts with a sufficient number of students for the two racial groups used to calculate the specified racial enrollment gap. For example, the sample for white-black AP participation gap includes school districts with at least 20 white *and* 20 black students. Additionally, considering that it would be misleading to report a 0 percentage point gap if the district had zero AP participation for white and black students, we further restrict the sample to districts that have a nonzero participation rate for at least one subgroup used in calculating the racial enrollment gap. Due to these additional sample inclusion criteria, the samples used for racial gaps are substantially smaller than the sample for the overall AP and DE participation. Appendix B describes these selection criteria in more detail. Although the number of districts decreases substantially as we restrict the analytic samples, these restrictions mainly exclude districts with few students overall; as a result, districts that remain in the sample still cover at least two-thirds of total students enrolled nationwide.

24. The choropleth maps of racial gaps in AP and DE participation rates have substantial regions without color; these are districts with fewer than 20 minority student enrollments in high schools for calculating the racial gaps. (See our sample restriction detail in Appendix B.)

25. At one extreme, some school districts have white-black and white-Hispanic gaps that are greater than 50 percent. At the other end, some school districts actually have larger minority student enrollment in AP and DE programs than white enrollment. To provide a more detailed picture of where extreme cases lie, Figure A2 displays the top and bottom 20 districts nationally by the size of their white-black or white-Hispanic gap in AP and DE participation.

26. The four additional variables added to the models are (1) the white-minority gap in academic achievement averaged across grades three to eight in a district, (2) the white-minority difference in the proportion receiving free or reduced-price lunch (FRPL), (3) the white-minority difference in the proportion of adults with a bachelor’s degree, and (4) between-school racial segregation.

27. The size of the coefficient is particularly large for the white-black gap in AP enrollment. Specifically, a one standard deviation decrease in the white-black pre-high school achievement gap would be associated with smaller AP participation gaps between white and black students by almost 4 percentage points. The summary statistics of the variable indicate black students are more than two standard deviations lower than white students on average.

28. Unsurprisingly, the white-minority gap in FRPL eligibility is also associated with wider gaps in AP enrollment. In addition, a larger white-minority gap regarding the proportion of adults in a school district with a bachelor's degree is also associated with larger racial participation gaps for AP and DE programs.

29. We measured between-school segregation income by proportions of students eligible for FRPL. We found that it is only weakly correlated with the white-Hispanic AP enrollment gap. While districts with greater degrees of between-school *racial* segregation are associated with smaller racial gaps in DE participation for black and Hispanic students, the coefficients are both small in size.

30. As a result, the correlation between segregation and racial AP and DE participation gaps would be substantially reduced once differential access to resources and peer compositions are adjusted. Indeed, the raw correlation between racial gaps in AP and DE participation and between-school racial segregation is much stronger and statistically significant. (For example, the raw correlation coefficient between white-black segregation and white-black AP enrollment gap is 0.315.) However, the association reduces sharply to zero as we include other measures of racial disparities in access to resources, such as the white-black gap in FRPL eligibility in a district.

31. Using white-black AP and DE participation gaps as an example, a 19 percentage point increase in the proportion of black students at the district level (which represents one standard deviation increase) is associated with a 1.1 percentage point increase in the white-black AP and DE participation gaps (Columns 1 and 2). The same pattern also holds for white-Hispanic gaps in AP and DE participation (Columns 3 and 4), although with smaller sizes of effect.

32. When state mandates are in place for local or state agencies to cover full or part of students' tuition for DE programs (strong financial incentives), the white-black enrollment gaps in DE programs are almost 4 percentage points smaller than for districts where parents or students are solely responsible for the costs associated with DE program participation (weak financial incentives).

33. A recent playbook from the Aspen Institute and Community College Research Center details strategies for expanding access to advanced coursework for high school students, focusing on advancing equity in DE programs. The authors detailed findings from visits to school-college partnerships in three states identified as having strong results for DE access among students of color and subsequent college success after high school. The playbook identified five principles to guide practitioner strategy and practice: "(1) Set a shared vision and goals that prioritize equity, (2) expand equitable access, (3) provide advising and supports that ensure equitable student outcomes, (4) provide high-quality instruction that builds students' competence and confidence, (5) organize teams and develop relationships to maximize potential." See Gelsey Mehl et al., *The Dual Enrollment Playbook: A Guide to Equitable Acceleration for Students*, Aspen Institute and Community College Research Center, October 2020, <https://ccrc.tc.columbia.edu/publications/dual-enrollment-playbook-equitable-acceleration.html>.

34. More technical details on the procedure used to adjust school enrollments, including results showing the magnitude of the enrollment adjustments by student subgroup and state, can be found in the documentation presented by John Fink, "How Does Access to Dual Enrollment and Advanced Placement Vary by Race and Gender Across States?" Community College Research Center, November 5, 2018, <https://ccrc.tc.columbia.edu/easyblog/access-dual-enrollment-advanced-placement-race-gender.html>.

35. John Fink, "How Does Access to Dual Enrollment and Advanced Placement Vary by Race and Gender Across States?"

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