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Advanced For Whom?
A Longitudinal Analysis of Racial Advanced Placement Participation Gaps

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AUTHOR BIOGRAPHY

Rachel Yin is a senior from Wayzata High School. She currently works as an economics researcher under the Minnesota Center for Diversity in Economics. She is interested in exploring racial inequality, racial covenants, segregation, and education outcomes through econometrics and statistical modeling.

ABSTRACT

The present study investigates racial participation disparities between White and Black students in Minnesota secondary schools between 2013-14 and 2017-18 utilizing data from the Civil Rights Data Collection, Common Core Data, and Minnesota Department of Education. Several key findings about AP enrollment patterns emerged from the study. First, statistical analyses confirm the hypothesis that the AP course participation rates of all and White students increased over time, and the White-Black participation gap was substantial in 2013 and 2017, but attested minimally to the magnitude of the participation gap changing over the time period. Second, the mixed-effects model finds that the number of AP courses a school offers is significantly positively related to the magnitude of the AP participation gap, indicating that simply increasing the number of AP courses may not in effect combat observed equity gaps. Third, statistically significant relationships were not established between the AP participation gap and achievement index, racial composition, and notably, economic disadvantage, implying that poorer schools experience comparatively the same degree of participation disparities as wealthier schools. While more research should be conducted to capture a complete picture of the current secondary school environment in Minnesota, the analyses reported here do indicate that efforts to remedy the equity gaps between White and Black students should be of high consideration in future policy making.

Keywords: *advanced academics; Advanced Placement; gifted education; ethnicity gaps; racial underrepresentation; linear mixed-effects modeling; Minnesota Paradox; educational inequality*

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INTRODUCTION

The Minnesota Paradox refers to the simultaneous existence of Minnesota as ostensibly among the best states to live in, yet virtually the worst state for African Americans. Although Minnesota is home to a relatively robust public education system, cheap housing, and excellent employers, these opportunities have historically not been consumed equally between all racial groups. As seen by unemployment rates, test scores, child malnutrition, school disciplinary and suspension rates, and various other metrics, Black Americans are worse off in Minnesota than virtually any other state (Hang, Soss, & Myers, 2020). For instance, Minnesota has the highest proportion of students in the nation who meet college readiness benchmarks for reading, but has the fourth largest White-Black gap, 34 percentage points, in that same assessment (Grunewald & Nath, 2019).

As Adelman (1999) posits, the academic rigor of one's high school classes is one of the greatest predictors of the attainment of a bachelor's degree. Nationwide, it is also well documented that college graduation typically translates into higher lifetime earnings than those with only a high school diploma (Hout, 2012; Tamborini, Kim, & Sakamoto, 2015), and can also drive upward socioeconomic mobility for low-income students and sustain stability for the middle and upper class (Pew Charitable Trust, 2012). Hence, these returns on education highlight the importance of students to engage in challenging courses during their high school careers. However, inequitable participation in advanced courses may act as a bulwark to these gains for racial minorities, particularly Black and Hispanic students (Klopfenstein, 2004). White and Asian students have historically been reported to participate in such intensive courses at substantially higher rates than Black and Hispanic students.

In light of the Minnesota Paradox and existing racial gaps, I develop statistical analyses and a linear mixed-effects model to investigate school factors correlated with the White-Black gap in Advanced Placement participation from 2013 to 2017 within 80 Minnesota public high schools in 61 districts.

BACKGROUND

Advanced Placement and Racial Disparities

Advanced Placement (AP) is an academic curriculum offered by the College Board that covers first to second year university level classes in secondary schools. Following its inception in 1955, the College Board now administers forty AP courses and subsequent exams across various disciplines, including but not limited to mathematics, English, science, history, art, and foreign language. The percentage of students that are taking one or more AP exams has increased within the last decade or so, from 31.5% of the class of 2013 to 34.7% of the class of 2023 (College Board, 2024).

Following the Adelman study, numerous empirical research studies have corroborated other positive returns to taking AP courses. AP participants have been found to perform better on standardized assessment

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scores, like the SAT (McKillip & Rawls, 2013), and experience higher teacher quality in AP courses (Thomas 1991). Beyond these short-term returns, participating in AP courses have reported post-secondary and lifetime benefits as well. In comparison to their non-AP counterparts, AP students enroll more into college (Chajewski, Mattern, & Shaw, 2011), obtain higher grades in college (Ackerman, Kanfer, & Calderwood, 2013), graduate more within four years (Chajewski, Mattern, & Shaw, 2011), and even accrue greater wealth and human capital as adults (Flowers, 2008). Given the presumed benefits associated with taking an AP course, subsequent racial disparities would serve as a primary indicator of education inequality. Unfortunately, prior studies have documented a significant gap between racial groups in AP participation.

In the Tenth Annual AP Report to the Nation, White and Asian students were found to participate in AP courses at significantly higher rates than Black and Hispanic students. Nationwide, Black students in the graduating class of 2013 were the most underrepresented group in AP classrooms and in the population of successful test takers (College Board, 2014). Furthermore, Xu, Fink, and Solanki (2021) discovered that the average school district in the U.S. in the 2015-16 school year had a White-Black participation gap of 9.6. These racial disparities, though varying in magnitude and sustenance, persist at the state level as well. Kettler and Hurst (2017) reported that while AP participation in Texan suburban schools generally increased from 2001 to 2011 amongst Black and White students, a White-Black participation gap endured, staying statistically the same in size.

Research Questions and Gap

In this paper, I investigate the change in AP participation rates from 2013 to 2017, the degree to which an AP participation gap exists between White and Black students in Minnesota public secondary schools, whether the magnitude of this disparity changes from 2013 to 2017, and the basic school factors that are correlated with the AP White-Black participation gap. I hypothesize, based on prior literature, that the AP participation rates for all students and major racial groups increased from 2013 to 2017, the participation gap does indeed exist at both time intervals, and the magnitude of the disparity changed from 2013 to 2017.

Although there exists a handful of large studies on AP participation, to the best of my knowledge, this paper is the first to specifically examine AP enrollment disparities in Minnesota, which is home to among the highest racial achievement gaps in the nation (Grunewald & Nath, 2019). Furthermore, a majority of the literature on this subject matter reports aggregate descriptive statistics without analyzing the conditions that are correlated with the participation gap, therefore making it challenging to understand the local contexts that produce and sustain these disparities. Hence, by regressing the rudimentary school factors on the participation disparity, the present study may help to inform the general literature of the characteristics that schools with larger equity gaps in AP participation share in common, particularly in Minnesota.

DATA

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The final database in this study is a combination of three sources: the Civil Rights Data Collection (CRDC), the Common Core Data (CCD) under the National Center for Education Statistics, and Minnesota Department of Education (MDE).

The CRDC biennially collects information on a wide variety of school characteristics, such as discipline and curricular offerings, from virtually all U.S. public schools and school districts. I extract three waves of AP enrollment data from the Civil Rights Data Collection (CRDC): 2013-14, 2015-16, and 2017-18. In this paper, in pursuit of brevity, each wave will be referred to by its starting year: 2013, 2015, and 2017. The key longitudinal data elements in the present study are simply a binary indicator of whether each school offered at least one AP course each year, the number of AP courses offered at a school, the race-specific enrollments of AP programs, and whether a school offers self-selection into AP courses (if a student is allowed to enroll in all AP courses that a school offers without needing a recommendation or meeting any other criteria like a placement test, except for any necessary prerequisites). The CRDC requires schools to report the number of 9-12 students enrolled in at least one AP course for each racial group.

The CCD provides basic descriptive information on public elementary and secondary schools across the U.S. Across the waves 2013-14, 2015-16, and 2017-18, I use grade enrollment data to calculate the proportions of each of the seven federally defined racial groups between grades nine to twelve, the most fundamental populous eligible to take an AP course; free and reduced lunch counts to proxy for economic disadvantage for each school in my database; and the highest and lowest grade each school offers. In addition, a school's locale is determined by its proximity to urban settlements and population density. Each school's locale is classified as one of four geographical levels: city, town, suburban, or rural (Geverdt & Maselli, 2024).

The MDE reports vast detailed information on K-12 education within Minnesota. I specifically analyze mathematics and reading Minnesota Comprehensive Assessment (MCA) average scores from 2014, 2016, and 2018 from each Minnesota public secondary school in my analysis to assess the relationship of the average academic achievement at a particular school and its racial disparity. All public schools within Minnesota are mandated by state law to administer the MCA each spring as the state's primary standard assessment for academic achievement. In secondary schools, the state reading assessment is offered solely to tenth graders, while the math assessment to eleventh graders.

METHOD

Identifying Eligible High Schools

I follow a similar approach to Xu, Fink, and Solanki (2021) in confining my full CRDC dataset to only contain eligible high schools. Merging all three waves of CRDC data results in a dataset with 2052 public schools from 492 districts. I then exclude schools if they did not offer 10th, 11th or 12th grade (n = 1278), as the MCA is distributed in sophomore and junior year. I also remove schools that did not offer AP courses at least once during the three waves (n = 645), schools that did not take both the math and reading MCA in any of the

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three waves (n = 2), and juvenile, alternate, special education, or virtual schools (n = 4). Through matching school names, district names, and identification numbers to combine three data sources, I was only unable to match 2 schools. Thus, after these initial restrictions, 136 high schools remained in 107 districts.

As mentioned earlier, the CRDC asks schools to input the number of grade 9-12 students who enroll in at least one AP course. Thus, a substantial proportion of schools in my dataset (n = 49) offered 8th grade or below. I calculate the number of 9-12 students in each school by summing the ninth, tenth, eleventh, and twelfth grade populations as provided by the CCD. These counts were utilized to calculate the participation index of each school, as described in the next section.

Participation and Achievement Indices

The participation rate measures the degree to which a particular race/ethnicity is represented in AP courses at a particular school, as follows.

$$\frac{\#\ of\ students\ enrolled\ in\ at\ least\ one\ AP\ course\ at\ a\ particular\ school}{total\ \#\ of\ 9{-}12\ grade\ students\ at\ that\ school} \times 100\%$$

In addition to determining the participation rate for all students, I calculated the participation rate of each main racial group separately. For instance, the Black participation rate would be the number of Black students enrolled in at least one AP course at a particular school divided by the total number of 9-12 grade Black students at that school. Since students must be in ninth, tenth, eleventh, or twelfth grade in order to take an AP course, I use the adjusted grades 9-12 school enrollment in the denominator for schools that serve eighth graders and below instead of total enrollment at that school to better account in my index the populuses that are able to take an AP course. Due to time constraints and the nature of the study, I solely study racial differences in participation between White and Black students. I calculate the White-Black percentage point gap by subtracting the Black participation rate from the White participation rate. A positive gap indicates higher participation amongst White students, while a negative value signifies higher participation amongst Black students.

The raw mathematics and reading MCA average scores fall on different scales, rendering them incomparable in that state (Minnesota Department of Education, 2018). In order to aggregate achievement, I construct a singular latent achievement index by converting the average scores of both examinations in my dataset to z-scores as a proxy for average academic achievement at a particular school. I then took the average of the math and reading z-scores to calculate an overall achievement index to weigh the math and reading scores equally.

As the main focus of the present study is to examine racial participation gaps, I restrict my dataset to only contain non-zero Black and White school 9-12 enrollment proportions (n = 9). For instance, it is illogical to claim that there is a zero percent Black AP participation rate if there are no Black students enrolled at a

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particular school. In addition, I remove unique schools from my dataset that contain less than 15 Black students (n = 47). Although the move significantly decreases the pool of eligible schools within my dataset, it also reduces the potential error that arises from random fluctuations occurring from small sample sizes. Thus, the final dataset contains 80 secondary schools from 61 districts.

Statistical Analyses

To answer the first three research questions, I employ paired two-tailed t-tests to produce *p* values that indicate if the difference of means of two groups is statistically significant ($p < 0.05$). In particular, these statistical analyses investigate whether participation rates as a whole meaningfully increased, decreased, or stayed the same over the time frame of the study; the statistical significance of White-Black participation gaps in 2013 and 2017, respectively; and the degree to which the White-Black participation gap between 2013 and 2017 grows, shrinks, or is constant.

Mixed-Effects Regression Model

Through the lme4 package in R, the study explores the rudimentary school factors (independent variables) that correlate with the White-Black AP participation gap (dependent variable) over time using a linear mixed-effects model (LMM), which accounts for within-group and between-group variation (Brown, 2021). Using a LMM to analyze this particular longitudinal dataset has advantages over other models, such as a pooled ordinary least squares regression (OLS), random-effects model, or fixed-effects model (Cameron & Travedi, 2010). First, a pooled OLS is not viable as longitudinal data, which contains multiple observations for a unique school, would violate one of the model's primary assumptions: independence between entries. Furthermore, a fixed-effects model is unable to explore the relationship between time-invariant variables and the outcome variable since it inherently controls for all time-invariant characteristics. As my study includes time-invariant variables (e.g. locale), a fixed-effects model is impractical. Finally, although a random-effects regression is able to include time-invariant variables, the model assumes that the unobserved school-level characteristics, such as teacher quality or culture surrounding APs, is not correlated to the predictor variables. As the dataset in this study is likely to have such correlations, the assumption would be violated, and a random-effects model would then produce unreliable results.

The LMM is modeled as follows.

$$y_{ij} = \beta_0 + \sum_{k=1}^{11} \beta_k X_{kij} + b_i + \epsilon_{ij}$$

In the equation, y_{ij} is the White-Black AP course participation gap for school *j* at wave *i,* while β_0 is the overall fixed intercept, which represents the average AP participation gap when all predictors are zero (such as

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urban locale and no self-selection). $\sum_{k=1}^{11} \beta_k X_{kij}$ is the combined contribution of all independent variables, also referred to as covariates or predictors. b_j is the random intercept for school j that accounts for unobserved school-specific factors between schools. The random intercept structure allows each school to have its own baseline AP gap, reflecting unobserved heterogeneity in initial conditions across schools and counteracting endogeneity. Finally, ϵ_{ij} is the error term that captures individual, unexplained variation within schools.

The disparity is a function of eleven different covariates: (1) the proportion of Black students enrolled at a particular school, (2) the proportion of historically underrepresented minorities– Hispanic, Native Hawaiian/Pacific Islander, Alaskan Native/American Indian, and multiracial enrolled, (3) the degree of economic disadvantage as measured by the proportion of free or reduced price lunch students, (4) a latent index as a proxy for a school's academic achievement, (5) the number of AP courses a school offers, (6) a dummy variable for self-selection, with "No" coded to 0 and "Yes" coded to 1, (7) a dummy variable for the 2015-16 school year, and (8) a dummy variable for the 2017-18 school year. The regression also includes a categorical variable for school locale. Locale is treated as a factor variable with four levels—city, suburban, town, and rural—with city serving as the reference category. The model therefore includes dummy variables for (9) suburban, (10) town, and (11) rural schools to measure their correlations relative to urban schools.

The regression generates coefficients and their corresponding standard errors that indicate the strength and the direction of the association of each independent variable with the dependent variable. Furthermore, for each of the eleven predictors, by estimating degrees of freedom through Satterthwaite's method, which is commonly utilized in small sample sizes, the regression calculates valid p values that suggest the statistical significance of relationships between covariates and the outcome variable (Kuznetsova, Brockoff, & Christensen, 2017).

RESULTS

Overall Patterns in AP Participation

Figure 1 visually illustrates the distribution of AP participation rates of White, Black, Hispanic, and Asian students in the sample of 80 schools through three waves of box and whisker plots. The analysis excludes students identifying as Native Hawaiian/Pacific Islander, Alaskan Native/American Indian, or multiracial due to their small percentage makeup in AP classrooms in the present sample (in 2013, M = 1.96; SD = 2.10). For instance, in schools that only contain one student of a particular race, which is quite common in the sample, that single student's enrollment status dictates the entire group's participation rate. This instability makes meaningful comparisons with larger racial groups (White, Black, Hispanic, and Asian) unreliable and potentially misleading due to the increased influence of random fluctuations and the lack of generalizability from such small subgroups.

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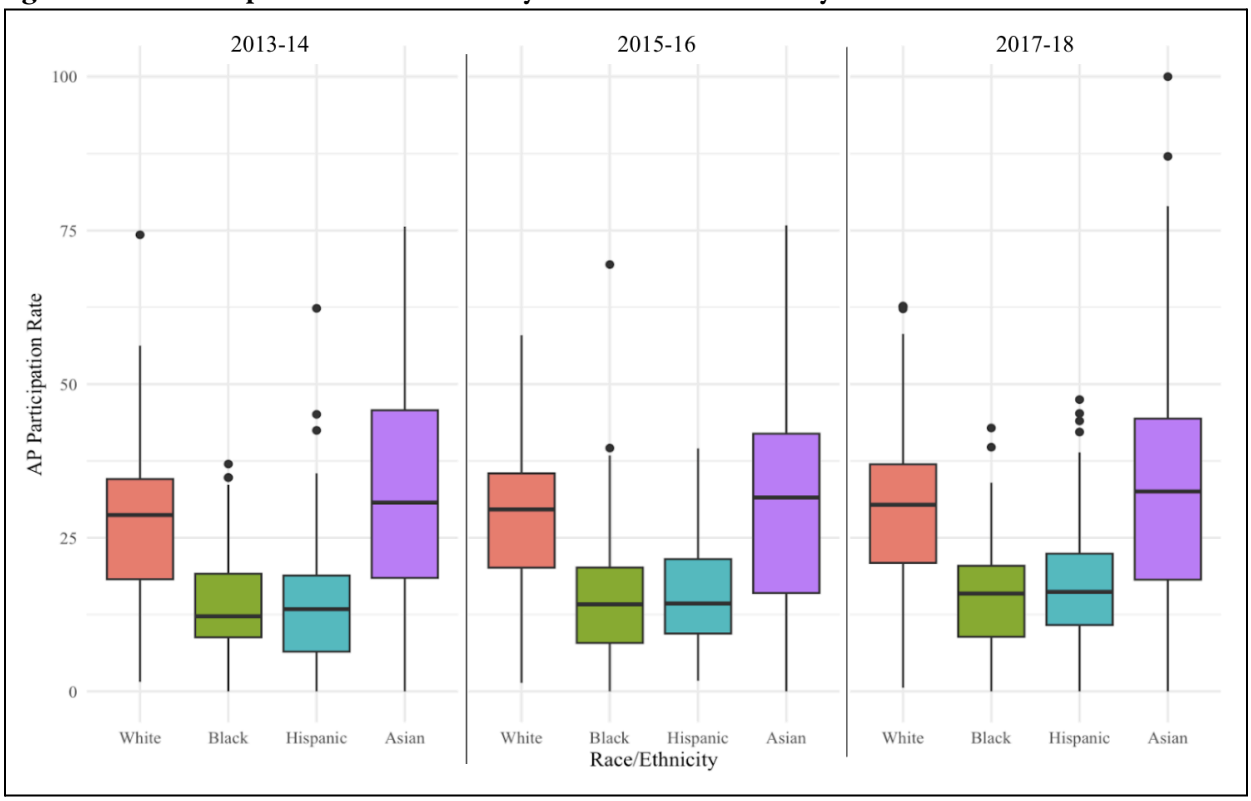
From examining Figure 1, White students on average consistently enroll into at least one AP course at nearly twice the rate as Black and Hispanic students, and at a comparable rate to Asian students in all three time periods. Thus, the data exemplifies substantial disproportion in AP enrollment rates between racial groups experienced over time in the sample.

***Figure 1*: AP Participation Rate Patterns by Student Race/Ethnicity Over Time**



I further investigate whether AP participation rates for all, Black, and White students increase, decrease, or are constant over the time frame of the study. In the 80 schools, the mean AP participation rate for all students in 2013 is 24.3 (*SD* = 11.27), and in 2017, it marginally increased to 25.83 (*SD* = 11.38). However, a paired two-tailed t-test reveals that the participation rate for all students did not statistically significantly change in size as the mean difference between the 2013 and 2017 participation rate was 1.52 (*SD* = 8.11), with t = -1.68 p = 0.097, and 95% CI = [-0.28, 3.33], meaning that any small changes observed could simply be due to random variation. This finding opposes the nationwide pattern observed by the College Board (2014) that the participation rate of all students grew between 2013 and 2023.

The mean White AP participation rate increased from 27.71 in 2013 to 30.16 in 2017 (*SD* = 9.71), the change being statistically significant (t = 2.26; p = 0.027; 95% CI = [0.29, 4.61]). Despite the mean Black AP participation rate slightly growing from 14.67 (*SD* = 9.39) to 15.52 (*SD* = 9.10), the change is not statistically

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significant (t = 0.78; p = 0.43; 95% CI = [-1.30, 3.00]), implying that Black students participated in AP courses at a similar rate from 2013 to 2017. This juxtaposition suggests that since White students on average are participating at greater rates from 2013 to 2017 while Black students are participating at the same rate, the White-Black AP racial disparity appears to be exacerbated over time. I confirm such racial disparities in the subsequent section (5.2).

White-Black Participation Gap

As stated within the second research question, I analyze the existence of a participation gap at two time intervals, 2013 and 2017. As seen in the results of paired two-tailed t-tests detailed in Figure 2, the mean difference between White and Black AP class participation rates in 2013 was 13.04 percentage points (SD = 11.25; $p < 0.001$), indicating that a substantial White-Black gap exists. Similarly, the mean difference between White and Black participation rates in 2017 was 14.65 (SD = 9.49; $p < 0.001$), also confirming the occurrence of a racial disparity in AP participation at this time interval. The existence of the gap is consistent with national patterns reported in 2015-16 by Xu, Fink, and Solanki (2021). This White-Black participation gap is more pronounced when examining the 75th percentile of schools at both time intervals, where the AP enrollment rate of White students is 34.54%, which is significantly higher than the third quartile Black AP enrollment rate of 20.16% in 2013, and 36.96% and 20.44% in 2017.

***Figure 2*: White-Black Gap Results from Statistical Analyses**

	Mean	t	95% CI for change
2013 White-Black gap	13.04[1] (11.25)	10.36***	[10.54, 15.54]
2017 White-Black gap	14.65[1] (9.49)	13.80***	[12.53, 16.76]
Change in White-Black gap between 2013 and 2017	1.60[2] (10.70)	1.34	[-0.77, 3.99]

Note: CI = confidence interval; the values within the parentheses in the mean column are corresponding standard deviations. All statistical analyses are two-tailed t-tests.
*** $p < 0.001$

To see if the White-Black disparity grows, shrinks, or stays the same between 2013 and 2017, I compare the mean White-Black participation gap from both time intervals. The mean difference in the White-Black gap is 1.60 percentage points (SD = 10.70; p = 0.184), implying that interestingly, the discrepancy is growing statistically insignificantly. Coupled with the earlier finding that the White-Black gap appears to be exacerbated over time, the results seem to suggest that the growth of the magnitude of the White-Black gap is slow, not dramatic, between 2013 and 2017.

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In summary, statistical analyses confirm my hypothesis that the AP participation rates of all students and White students increased over time, and the White-Black participation gap was substantial in 2013 and 2017. But they minimally attested to the magnitude of the participation gap changing over the time period. They also provided evidence toward a stagnant Black participation rate.

School Factors and Participation Gap

I examine patterns between rudimentary school factors and the degree of the White-Black participation gap in AP courses over the 2013 to 2017 time period through a linear mixed-effects model. The model accounts for not only within-school variation in the White-Black participation disparity, but also substantial between-school variation in the White-Black gap (variance = 32.63; SD = 5.71), supporting the inclusion of a random intercept for schools. Fixed effects accounted for 22.4% of the variance of the White-Black participation gap (marginal r^2 = 0.224), while the full model with fixed and random effects, the school-specific baselines, explained 50.8% (conditional r^2 = 0.508) of the variance. I regress the percentage point White-Black participation gap on eleven predictor variables. The results are displayed in Figure 3.

***Figure 3*: Mixed-Effects Model of AP Participation Gap on School Factors**

	Coefficient	*SE*
Intercept	10.668*	4.577
Proportion of Black students in entire school	18.387	12.715
Proportion of non-Black underrepresented minorities in entire school	15.750	11.986
Proportion of free and reduced price lunch students in entire school	-3.719	9.467
Number of AP courses offered	0.337***	0.096
AP self-selection	-1.192	2.593
Achievement index	1.726	2.286
Locale Town Suburb Rural	 -8.141** -7.500*** -6.593*	 3.143 2.221 2.922
2015-16 school year	1.147	2.669

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2017-18 school year	1.935	2.717

Note: Asterisks indicate significant p-values for the covariate's relationship to the outcome variable as determined by hypothesis tests. The fixed intercept is the model's overall baseline level of the outcome, i.e. the grand mean outcome when all predictors are at their reference or set to zero (e.g. city, no self-selection, in the 2013-14 school year).
*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ (two-tailed t-tests)

Notably, the number of AP courses offered has a positive relationship ($t = 3.487$; $p = 0.000631$) with the outcome variable, indicating that as the availability of AP courses increases, so too does the White-Black participation gap. This result reinforces the concerns raised by Klopfenstein (2004) regarding racial inequities in access to advanced coursework even when educational offerings expand. Furthermore, and perhaps unexpectedly, schools in rural ($t = -2.590$; $p = 0.01145$), suburb ($t = -3.378$; $p = 0.00118$), and town ($t = -2.257$; $p = 0.0268$) areas experience significantly smaller AP racial disparities in comparison to their urban counterparts. Upon closer examination of the participation rates and racial gaps of the three locales, these results most likely stemmed from the trend that suburban, rural, and town schools enroll fewer Black students, resulting in participation rates that may experience higher sensitivity to random fluctuations and sampling variability– a potential limitation in my method. Thus, the relationship between locale and participation gap should be interpreted with caution. As seen by the fixed intercept, when all predictors are held at zero, the expected White participation rate is approximately 10.7 percentage points higher than the Black participation rate ($t = 2.331$; $p = 0.0211$) confirming significant initial racial disparities in AP participation in the model.

Although the number of AP courses offered is a significant predictor of the AP enrollment ethnicity gap, the regression reports no such relationship with AP self-selection. Contrary to expectations based on socioeconomic theories of educational access (Pew Charitable Trust, 2012), the regression did not find a statistically significant relationship between school-level economic disadvantage and AP participation disparities. Furthermore, perhaps strikingly, the racial composition and overall academic achievement at a school is also not statistically meaningful. As seen by the 2015-16 and 2017-18 school year variables, the magnitude of the AP participation disparity is not strongly associated with the passing of time, though they are slightly positively correlated, reinforcing the earlier t-test results that the magnitude of the AP participation gap remained increased very marginally and or was comparatively equal in size across the time frame of the study.

DISCUSSION AND CONCLUSION

Under the premise of the Minnesota Paradox, the present study investigates racial participation disparities between White and Black students in Minnesota secondary schools in 2013-14, 2015-16, and 2017-18 utilizing data from the Civil Rights Data Collection, Common Core Data, and Minnesota Department of Education. Several key findings about AP enrollment patterns emerged from the study. First, statistical analyses confirm the hypothesis that the AP course participation rates of all and White students increased over time, and

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that White-Black participation gap was substantial in 2013 and 2017. They also report that the magnitude of the participation gap marginally increased over the time period.

Second, the mixed-effects model attempts to explain sources of variation in the White-Black participation gap. The number of AP courses a school offers is significantly positively related to the degree of the White-Black participation gap, indicating that merely increasing the number of AP courses may not in effect combat these equity gaps. The study also establishes that smaller participation gaps are experienced in schools located in rural, suburban, and town areas, though the observed disparities may be overestimated simply due to smaller sample sizes of Black and minority students in those locales. The model's estimated intercept was positive and statistically significant, suggesting that, relative to other groups, schools in urban locations with no self-selection in 2013-14 are associated with larger participation disparities.

Third, statistically significant relationships were not established between the AP participation gap and achievement index, self-selection, racial composition, and notably, economic disadvantage, implying that schools with greater concentrations of low income students experience comparatively the same degree of participation disparities as "wealthier" schools, and that self-selection may not be an adequate tool to combat persisting racial disparities. While more research should be conducted to capture a complete picture of the current secondary school environment in Minnesota, the analyses reported here do indicate that efforts to remedy the equity gaps between White and Black students should be of high consideration in future policy making.

Limitations

Given severe time constraints, the scope of participation rates is limited to solely White and Black AP students; other racial and ethnic groups, such as Hispanics and Asians, should be subject to future examination. In particular, as represented by Figure 1, the White-Hispanic participation gap 10.5 percentage points, and marginally shrunk across the timespan of the study, reemphasizing the severity of the participation disparity between underrepresented minorities and White students. Limited access to data resulted in the achievement index to be an elementary proxy for the average academic achievement at a school; hence, the strength of the relationship with the White-Black AP participation gap may experience underestimation. Thus, future researchers could consider a more sophisticated index for advanced achievement, such as the one proposed by Burney (2010), to improve the accuracy of achievement-adjusted participation analyses. Furthermore, much discourse has surfaced recently regarding the efficacy of standardized tests such as the MCA as an accurate assessment for academic ability. Future researchers may need to reevaluate the usage of these exams as a proxy for intelligence, albeit they are virtually the most available and accessible. Another facet to consider is that the two-tailed t-tests simply capture the difference in participation and gaps between 2013 and 2017. It does not explain or capture any variation between 2013 to 2015, or 2015 to 2017.

It is also important to note that the present study does not capture the picture of racial disparities in advanced coursework. Future research should investigate the role of other factors on racial gaps beyond the covariates in this study. For instance, within and between-school racial segregation may result in clustering that

exacerbates the academic achievement gaps (Reardon et al., 2022). Furthermore, it may be interesting to examine the school characteristics associated with other advanced, rigorous high school curriculums such as dual enrollment and International Baccalaureate, as the participation gaps between racial groups in such programs may be different in severity than in AP. Finally, the COVID-19 pandemic may have had monumental impacts on AP participation as a whole, and thus, future researchers could extend this study by incorporating additional longitudinal waves post-2017 to quantify the hit of the pandemic to racial participation disparities.

Policy Implications

Despite the aforementioned caveats to the study, the paper presents several robust key findings that may help to inform future policy on minimizing advanced coursework participation gaps. The study finds that schools with lower student poverty experience comparatively the same degree of participation disparities as schools with higher student poverty, suggesting that policymakers may need to reevaluate whether to solely direct aid to schools with more low-income students, or perhaps consider "wealthier" schools as well to remedy equity gaps. Furthermore, the study suggests that commonly proposed structural interventions, such as increasing AP course offerings or permitting self-selection, may not meaningfully reduce racial disparities, unveiling a gap in understanding how deeper institutional norms affect AP enrollment. Hence, policies such as the Automatic Enrollment Pilot Program introduced under Senate File 510 that have shown to engender significant AP participation gains could increasingly be potentially considered for permanency (Minnesota Legislature, 2025). Finally, although most schools in the dataset experience substantial racial disparities, a few standout schools experience virtually zero or even negative participation gaps. Hence, much may be learned by school administrators and policymakers alike in investigating the conditions, practices, and policies in such schools that are highly effective in increasing and sustaining Black and underrepresented minority participation in AP courses.

REFERENCES

Ackerman P. L., Kanfer R., Calderwood C. (2013). High school Advanced Placement and student performance in college: STEM majors, non-STEM majors, and gender differences. *Teachers College Record*, 115(10), 1-43.

Adelman, C. (1999). Answers in the Tool Box. Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment. In *ERIC*. ED Pubs, P. https://eric.ed.gov/?id=ED431363

Brown, V. A. (2021). An Introduction to Linear Mixed-Effects Modeling in R. *Advances in Methods and Practices in Psychological Science*, *4*(1), 251524592096035. https://doi.org/10.1177/2515245920960351

Burney, V. H. (2010). High achievement on advanced placement exams: The relationship of school-level contextual factors to performance. *Gifted Child Quarterly, 54*(2), 116–126. https://doi.org/10.1177/0016986209355972

SCHOLARLY REVIEW

SCHOLARLY REVIEW JOURNAL

E-ISSN: 2996-8380
Published by Leadership & Innovation Lab

FALL 2025

Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics using Stata* (Rev. ed.). Stata Press.

Chajewski, M., Mattern, K. D., & Shaw, E. J. (2011). Examining the Role of Advanced Placement® Exam Participation in 4-Year College Enrollment. *Educational Measurement: Issues and Practice*, *30*(4), 16–27. https://doi.org/10.1111/j.1745-3992.2011.00219.x

College Board. (2014). *ANNUAL AP ® Report to the Nation*. College Board. https://secure-media.collegeboard.org/digitalServices/pdf/ap/rtn/10th-annual/10th-annual-ap-report-to-the-nation-single-page.pdf

College Board. (2024, February 29). *Student Advanced Placement Participation and Performance Increase Over Last Ten Years – Newsroom*. Newsroom.collegeboard.org; College Board. https://newsroom.collegeboard.org/student-advanced-placement-participation-and-performance-increase-over-last-ten-years

Flowers, L. (2008). Racial Differences in the Impact of Participating in Advanced Placement Programs on Educational and Labor Market Outcomes. *Educational Foundations*, 22(1-2), 121-132. https://files.eric.ed.gov/fulltext/EJ839501.pdf

Geverdt, D. and Maselli, A. (2024). Education Demographic and Geographic Estimates Program (EDGE): Locale Boundaries Technical Documentation. *U.S. Department of Education, National Center for Education Statistics.* Washington, DC. Retrieved from https://nces.ed.gov/programs/edge/Geographic/LocaleBoundaries.

Grunewald, R., and Nath, A. (2019). A Statewide Crisis: Minnesota's Education Achievement Gaps. *Federal Reserve Bank of Minneapolis.* https://www.minneapolisfed.org/~/media/assets/pages/education-acheivement-gaps/achievement-gaps-mn-report.pdf

Hang, M., Soss J., & Myers, S. (2020). The Minnesota Paradox. Retrieved from the University Digital Conservancy, https://hdl.handle.net/11299/214945.

Hout, M. (2012). Social and Economic Returns to College Education in the United States. *Annual Review of Sociology*, *38*(1), 379–400. https://doi.org/10.1146/annurev.soc.012809.102503

Kettler, T., and Hurst, L. T. (2017). Advanced Academic Participation: A Longitudinal Analysis of Ethnicity Gaps in Suburban Schools. *Journal for the Education of the Gifted*, 40(1), 3-19. https://doi.org/10.1177/0162353216686217 (Original work published 2017)

Kim, C., Tamborini, C. R., & Sakamoto, A. (2015). Field of study in college and lifetime earnings in the United States. *Sociology of Education, 88*(4), 320–339. https://doi.org/10.1177/0038040715602132

SCHOLARLY REVIEW

SCHOLARLY REVIEW JOURNAL

E-ISSN: 2996-8380
Published by Leadership & Innovation Lab

FALL 2025

Klopfenstein, K. (2004). Advanced Placement: do minorities have equal opportunity? *Economics of Education Review*, *23*(2), 115–131. https://doi.org/10.1016/s0272-7757(03)00076-1

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). LmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

McKillip, M. E. M., & Rawls, A. (2013). A Closer Examination of the Academic Benefits of AP. *The Journal of Educational Research*, *106*(4), 305–318. https://doi.org/10.1080/00220671.2012.692732

Minnesota Department of Education (2018). Understanding MCA Scale Scores What is a scale score and what do the numbers represent? How do the MCA scale scores translate into MCA Achievement Levels? In *education.mn.gov*. Minnesota Department of Education. https://testing123.education.mn.gov/cs/groups/educ/documents/basic/mdaw/mdaw/~edisp/000091.pdf

Minnesota Legislature. (2025). *Senate File No. 510, 94th Legislature (2025)*. Minnesota Revisor of Statutes. https://www.revisor.mn.gov/bills/text.php?number=SF510&version=0&session=ls94&session_year=2025&session_number=0

Pew Charitable Trust (2012). Pursuing the American Dream: Economic Mobility across Generations. Economic Mobility Project.

Reardon, S.F., Weathers, E.S., Fahle, E.M., Jang, H., & Kalogrides, D. (2022). Is Separate Still Unequal? New Evidence on School Segregation and Racial Academic Achievement Gaps.

Tamborini, Christopher R., ChangHwan Kim, and Arthur Sakamoto. 2015. "Education and Lifetime Earnings in the United States." *Demography* 52: 1383–1407.

Thomas, J. (1991). The Numbers Game: History in the Schools. *Humanities*, *12*(4), 20–21. https://eric.ed.gov/?id=EJ438404

Xu, D., Solanki, S., & Fink, J. (2021). College Acceleration for All? Mapping Racial Gaps in Advanced Placement and Dual Enrollment Participation. *American Educational Research Journal*, 58(5), 954-992. https://doi.org/10.3102/0002831221991138