



Summary of: *Ahead of the Game? Course-Taking Patterns under a Math Pathways Reform* by Elizabeth Huffaker, Sarah Novicoff, and Thomas S. Dee

Research Brief - March 2023

This research brief summarizes the report, *Ahead of the Game? Course-Taking Patterns under a Math Pathways Reform* by Elizabeth Huffaker, Sarah Novicoff, and Thomas S. Dee.¹ The report highlights findings from an investigation of new math course pathways created by the San Francisco Unified School District (SFUSD) to address equity concerns about access to advanced math coursework. For example, the authors observe that, “among SFUSD students who started high school in 2012, only five percent of Black students and seven percent of Hispanic students had enrolled in AP Calculus by graduation (rates that were three and five times higher among their White and Asian/Pacific Islander peers, respectively).”

In 2014, as new California Common Core State Standards recommended a more rigorous three-year middle school math curriculum, SFUSD chose to move Algebra I to ninth grade for all students. In this analysis, the authors analyze longitudinal, student-level data for six cohorts of SFUSD high-school students (23,309 unique students) to determine how course-taking patterns changed in the years following the reform.

Findings

The new policy led to large changes in course taking patterns among ninth and 10th graders, creating more heterogeneous peer groups in early high school math.

- **Ninth graders:** After the policy change, beginning with the Class of 2019, Geometry enrollment fell by 45 percentage points to only seven percent while enrollment in Algebra I jumped 53 percentage points to 90%. This change attenuated slightly for the 2020 and 2021 cohorts who participated in acceleration options like summer-school Geometry.
- **10th graders:** After the policy change, beginning with the Class of 2019, Geometry enrollment increased by 38 percentage points to 78% while exclusive enrollment in Algebra II decreased by 33 percentage points to 5%. These changes attenuated somewhat for the 2020 and 2021 cohorts who participated in acceleration options.

Enrollment in specific advanced math courses at any time in high school varied across cohorts both among all students as well as among the four largest racial/ethnic groups in the District (i.e., Asian or Pacific Islander, Hispanic, White, and Black). Changes in credit attainment paralleled changes in course enrollment suggesting that the preparation students received for these courses remained stable over time.

- **Pre-Calculus:** There was a small overall increase in the percentage of students enrolling in Pre-Calculus (53% in the Class of 2018 and 55% in the Class of 2019). However, “both before and after the reform, White and Asian students in SFUSD enrolled at rates roughly two to four times higher than Black and Hispanic students.” Although large racial and ethnic enrollment gaps remained, the percentage of Black student enrollment increased from 13% in 2018 to 20% in 2019. Credit attainment mirrored the enrollment data.

¹ Huffaker, Elizabeth, Sarah Novicoff, and Thomas S. Dee. (2023). *Ahead of the Game? Course-Taking Patterns under a Math Pathways Reform*. (EdWorkingPaper: 23-734). Retrieved from Annenberg Institute at Brown University: <https://doi.org/10.26300/yk56-yy47>

- **Probability and Statistics:** Enrollment decreased after the policy change from 12% to 10% and then rebounded, with 17% of the Class of 2021 enrolling in the course. Over time, the course became more popular across all racial/ethnic groups. “Black students enrolled in Probability and Statistics at the highest rate, while Asian/Pacific Islander students enrolled in AP Statistics at the highest rate,” likely reflecting disparate course offerings.² Credit attainment mirrored the enrollment data.
- **AP Calculus:** The percentage of enrolled students decreased after the policy’s implementation by six percentage points (21%). There were large gaps in course enrollment by racial/ethnic subgroups and a lack of access for Black and Hispanic students. These trends persisted before and after the policy, with less than 10% of Black and Hispanic students enrolled in AP Calculus each year of the study.
- **AP Statistics:** Enrollment increased slightly by one percentage point, continuing a pre-policy trend. This enrollment increase is seen for all racial/ethnic subgroups except Black students. Credit attainment mirrored the enrollment data.
- **AP Math Overall:** In the first class after the policy change, the authors observe a five-percentage point (or 15%) decrease in the percent of students enrolling in an AP math course. As more students enrolled in acceleration options, AP math enrollment was restored to its 2018 levels for the class of 2021.

Implications for the San Francisco Unified School District

With ninth grade Algebra I, the wide availability of acceleration options is vital.

According to the authors, “delaying Algebra I until ninth grade made it difficult for some students to complete the sequence of course prerequisites that would position them to take AP Calculus before graduating.” This led to a six percentage point drop in AP Calculus (21%) in the first year of the policy. However, this initial difficulty diminished over time such that participation in AP Calculus among the graduating class of 2021 was about two percentage points (6%) below the graduating class of 2018. The data demonstrate that students increasingly participated in the acceleration options. This implies that if the District wants to maintain AP Calculus as a high-school capstone for some, it has to confront the trade-off of offering acceleration in middle school (e.g., grade-8 Algebra) or the continued and extensive use of acceleration in high school.

To expand access to AP math for historically underrepresented groups, SFUSD must expand course offerings and focus on the course selection process.

The large ethnoracial gaps in advanced math course-taking remained in the post-reform period. The authors state, “In the post-policy period, the percent of Black students enrolling in any AP math course has remained statistically significantly indistinguishable from the pre-policy period while Hispanic student enrollment in advanced math increased by 1 percentage point.” This implies the need to reconsider the possible barriers that limit equitable access to advanced math. For example, this could point to the need to support teacher practices in earlier math courses that promote and sustain students’ sense of engagement and belonging in the subject. This could also be due to insufficient course offerings, challenges in the course selection process, or some combination of both. Currently, not all SFUSD high schools offer an AP math course, with availability less common in certain high schools with large Black and Hispanic populations. In addition, as acceleration in the post-policy period is based solely on a student’s request when they have passed the prior course, SFUSD should consider whether there are ways to improve the course selection process, such as training counselors and encouraging enrollment in a senior-year math course.

² In SY 2021-22, the six high schools with the highest percentages of Asian/Pacific Islander students all offered AP Statistics while only two of the six high schools with the highest percentages of Black students offered that course.