



EXECUTIVE SUMMARY

**INTEGRAL VOICES:
EXAMINING MATH EXPERIENCES OF
UNDERREPRESENTED STUDENTS**

By Elisha Smith Arrillaga, Shakiyya Bland,
Katrina Goto, and Marcelo Almora Rios

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ABOUT JUST EQUATIONS

Just Equations reconceptualizes the role of mathematics in ensuring education equity for students. An independent resource on the equity dimensions of math education in the transition from high school to college, Just Equations advances evidence-based strategies to ensure that math policies give all students the quantitative foundation they need to succeed in college and beyond. Just Equations' work is supported by College Futures Foundation, the Bill & Melinda Gates Foundation, and Valhalla Foundation.

ABOUT THE AUTHORS

Elisha Smith Arrillaga, a faculty member at the College of Education at the University of Texas at Austin, has served in numerous leadership roles to increase education and workforce opportunities for students of color. Most recently, as the managing director of the Charles A. Dana Center at UT Austin, she led work to change K–12 and postsecondary math education policy in more than 35 states. She oversaw several statewide research and advocacy initiatives as the executive director of the Education Trust–West. Smith Arrillaga holds a B.A. in mathematics from Smith College, an M.S. in survey methodology from the University of Maryland at College Park, and a Ph.D. from the Princeton School of Public and International Affairs. She has taught at both the K–12 and postsecondary levels.

Shakiyya Bland, Just Equations' math educator in residence, is a longtime math instructor and curriculum specialist with experience in culturally responsive education. She was an Albert Einstein Distinguished Educator Fellow in 2020-22, serving in the U.S. Congress and U.S. Department of the Interior. She has more than 27 years of experience in math instruction in roles including teacher, instructional coach, curriculum developer, and Courageous Conversation practitioner. She holds a B.S. in education; an M.A. in education, with a specialty in math curriculum and instruction; and an Ed.D. in education leadership.

Katrina Goto, a program associate at Just Equations, graduated from the University of California, Berkeley with high distinction and highest honors in 2022. Goto was a finalist for the Political Science Departmental Citation, a William K. (Sandy) Muir Jr. Leadership Award nominee, a University Medal nominee, and a Phi Beta Kappa inductee. During her senior year, Goto was accepted into UC Berkeley's Political Science Department Honors Program. Her thesis examined support for holistic college admissions among Asian Americans.

Marcelo Almora Rios, a research fellow at Just Equations, recently completed an M.A. in the Department of Mathematics at the University of Montana. He has supported students in mathematics in many roles, including as a graduate student instructor. Almora Rios' research interests lie at the intersection of math education, psychology, and philosophy. A Peruvian immigrant and first-generation college student, Almora Rios is the recipient of a 2023 National Science Foundation Graduate Research Fellowship and a 2020 Latinos in Technology scholarship.

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High school and college students make a multitude of academic choices that are consequential to their postsecondary education and career trajectories. Among those choices, selecting which mathematics courses to take in high school has significant implications for a student's opportunity to attend college, as well as to pursue a STEM major. For students applying to college, access to accurate information about the college admissions process is a critical determinant of their math course choices.

Although many new careers and college majors require preparation in areas of mathematics such as data science and statistics, calculus still dominates as a signal of academic rigor. Leading math associations have challenged this messaging. They argue that pressure to rush through the math curriculum to reach calculus can undermine development of foundational math skills and increase educational stratification. However, when it comes to college admissions, some students receive the message that they need to take AP Calculus—as one student said, “just so colleges would see that you're competitive.”

Mixed messages concerning colleges' math expectations can create a confusing landscape for students and families to navigate. As prior Just Equations reports have shown, the lack of clear signals from admissions offices may disproportionately create barriers for Black, Latinx, and other underrepresented students, reinforcing inequitable access to the most selective institutions. This report examines the perspectives of underrepresented students on the role of high school math in college admissions to shed light on the processes, policies, and strategies that help or hinder students in preparing for college success.

ABOUT THIS REPORT

The first two reports in this series examined the perspectives of admissions officers and high school counselors. This report provides insight into how students interpret the advice and information they receive from high school teachers, counselors, and college admissions officers about the role of mathematics in college planning. Its focus is on students who are historically underrepresented in higher education, particularly Black and Latinx students, and those who are low income or in the first generation of their family to attend college.

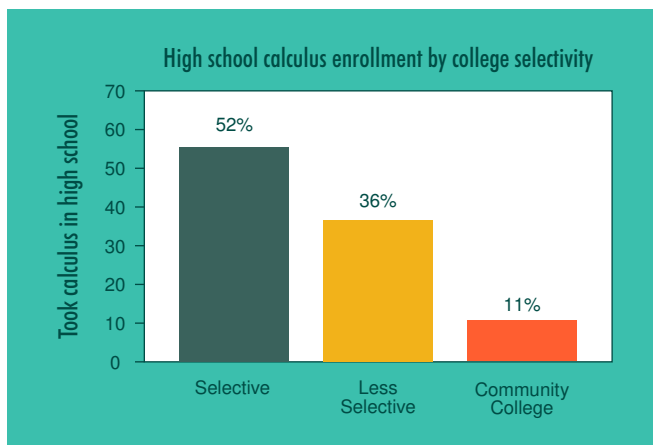
For this report, Just Equations partnered with the Southern California College Attainment Network through its Let's Go to College California project and with the National Association for College Admission Counseling. A survey and set of focus groups conducted with Let's Go to College California allow a deep dive into students' decision-making, and a NACAC survey adds a national perspective. The vast majority of students in the Let's Go to College California sample met our definition of underrepresented and/or first generation. About three-quarters were Latinx, and a similar proportion said their parents don't have college degrees. The students were predominantly enrolled in California public institutions, and 47 percent reported plans to major in STEM.

ACCESS TO HIGH SCHOOL MATH COURSES

Calculus in high school is an important stepping stone to STEM fields. And some selective colleges expect it even for non-STEM students. However, **high school calculus enrollment is limited to a small number of students**, correlating starkly with socioeconomic status and race.

When students attend a high school that offers calculus and they plan to attend college, do they take calculus?

In the NACAC poll, nearly 75 percent of students report that calculus was offered at their high school. However, just 45 percent of students report having taken the course. In the Let's Go to College California sample, with its higher proportion of underrepresented students, 84 percent of students report that calculus was offered by their high school, but only 37 percent report taking the course. Students who currently attend the most selective colleges were more likely to say they took calculus in high school.



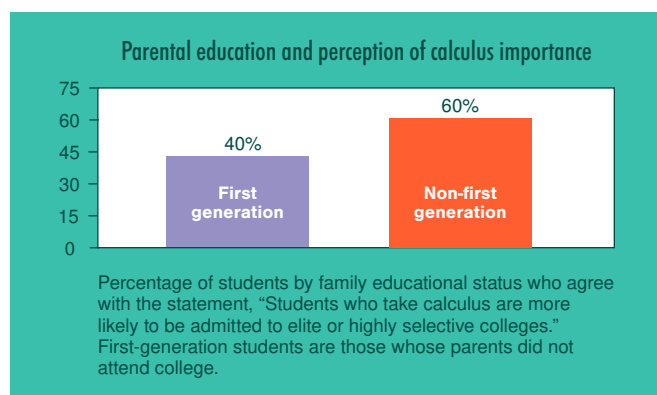
Tracking, in which students are sorted into low- and high-level classes, often based on a perception of student ability, influences whether students make it to calculus. Many students in the sample were not on track to take calculus in their senior year because they started ninth grade taking algebra or pre-algebra. Others said they had difficulty taking calculus because their high schools didn't offer it or had limited sections.

STUDENT BELIEFS ABOUT COLLEGE EXPECTATIONS

Gaps in access to information about college preparation and the admissions process are correlated with traditional barriers to college, namely low socioeconomic status, first-generation status, and membership in racial or ethnic groups historically underrepresented in higher education. Compared to public high schools, private high schools allocate more resources to assist students in the college selection and application process. And, even among public schools, students in higher-income communities have better access to such services than those in lower-income ones. Such disparities diminish the ability of students to base decisions on the best possible information. **Students who do not know that colleges may prioritize calculus could be at a disadvantage in the admissions process.**

When students were asked which math courses are most important to colleges, the majority (67 percent) chose calculus. Statistics ranked second at 40 percent. Students majoring in STEM were more likely to choose calculus than other students.

Nearly half of students (45 percent) said they believed that students who take calculus are more likely to be admitted to highly selective colleges. STEM majors (49 percent) were more likely than non-STEM majors (41 percent) to agree that a calculus course enhances a student's chance of being admitted to college. Unlike students whose parents attended college, the majority of first-generation students did not believe that students who take calculus are more likely to be admitted to highly selective colleges.



In focus group discussions, many students exposed the information disconnects that may have disadvantaged them during the college admissions process. Some students said they received coursetaking information too late for it to be helpful for college planning, or that they were not given input on decisions about which courses to take. "I did not even know I could choose or change my classes until senior year of high school," one student said. In some cases, students felt pressure to take math classes over the summer in order to get to calculus. "There was like this major rush to get into AP Calculus like your junior year," one student recalled.



STUDENT PERCEPTIONS OF COUNSELORS' ADVICE

About half of the students said their high school counselors recommended they take calculus. Fifty-three percent said that one reason they chose their high school math coursetaking was that they believed it would help them get into college.

However, **there is clear stratification by racial group in math coursetaking recommendations.** Asian American respondents report receiving recommendations to take calculus courses at a higher rate than other racial groups—61 percent, compared to 41 percent of Black respondents, 50 percent of White respondents, and 52 percent of Latinx respondents. A similar pattern emerged in the NACAC poll: 54 percent of Asian American respondents said they were recommended to take calculus, compared to 45 percent of Hispanic, 42 percent of White and 36 percent of Black students.

Furthermore, more than one-third of Black respondents (38 percent) and more than one-quarter of Latinx respondents (27 percent) report not receiving recommendations to take any advanced math course by their high school counselor, while only 21 percent of Asian American respondents and 18 percent of White respondents report no math course recommendation.

Such patterns may reflect racial differences in students' prior math preparation, but they also raise questions about the consistency of the advice provided by counselors. Discrepancies in which students are advised to take calculus or other advanced math courses may have significant repercussions for equitable college access.

STUDENT PERCEPTIONS OF THE ADMISSIONS PROCESS

Students express concern about colleges emphasizing a course that isn't universally accessible. In the NACAC survey, 76 percent of surveyed students agreed, "It is unfair for colleges to prioritize courses not offered in many high schools." But colleges that do prioritize calculus are not always transparent about it, which is also unfair. When colleges tell students to take the most rigorous courses available, do they mean calculus? Though many colleges say they evaluate students' transcripts in the context of courses available to them, a lack of clear information appears to loom large for students. In our survey, students, particularly Latinx students, ranked lack of "access to information about college admissions" as the biggest hurdle in the college application process.



LOOKING AHEAD

The absence of clearly identified math expectations may serve to reinforce inequities in who is represented at the most competitive institutions, with fewer Black, Latinx, and first-generation students enrolling. It also has repercussions for the math sequences high schools offer.

New policies and practices are needed to ensure that students, their families, and their counselors have the information necessary to make good decisions about math coursetaking in high school and for college access. The student perspectives described in this report point to the following recommendations.

Adopt broader, more transparent math requirements for admission. Colleges and universities should broaden the range of math courses they accept for admission and communicate those policies transparently. Institutions should also review any requirements they have for a specific high school course, such as calculus, to determine whether they are essential for success at the college or in particular majors. Furthermore, students' records should be considered in the context of the courses available to them, so that they aren't penalized for not having access to specific courses.

Increase access to counseling and support. States, districts, and other funders should invest more in school counseling, particularly in lower-resourced schools that serve students of color, first-generation students, and students from low-income backgrounds. To ensure students receive the support needed to promote college access, the number of counselors should be increased to meet the American School Counselor Association's minimum recommended student-to-counselor ratio of 250-to-1.

Engage college-access organizations. State education departments, districts, and other funders should support college-access organizations to help ensure that all students are receiving appropriate information about their math coursetaking options and alignment with college admissions. Students in our survey frequently mentioned college-access organizations, which often work with students in lower-resourced schools, as trusted sources of information concerning college admissions.

Adopt more equitable K–12 course-enrollment policies. So that students don't reach high school off track for college preparation, states, districts, departments, and schools should enact more equitable course-placement policies. The National Council of Teachers of Mathematics has also promoted the principle of "appropriate acceleration," to de-emphasize the practice of rushing students through math sequences regardless of whether they've mastered foundational concepts.

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