Partnerships to Improve Equity in Math Course-taking

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Policy Analysis for California Education

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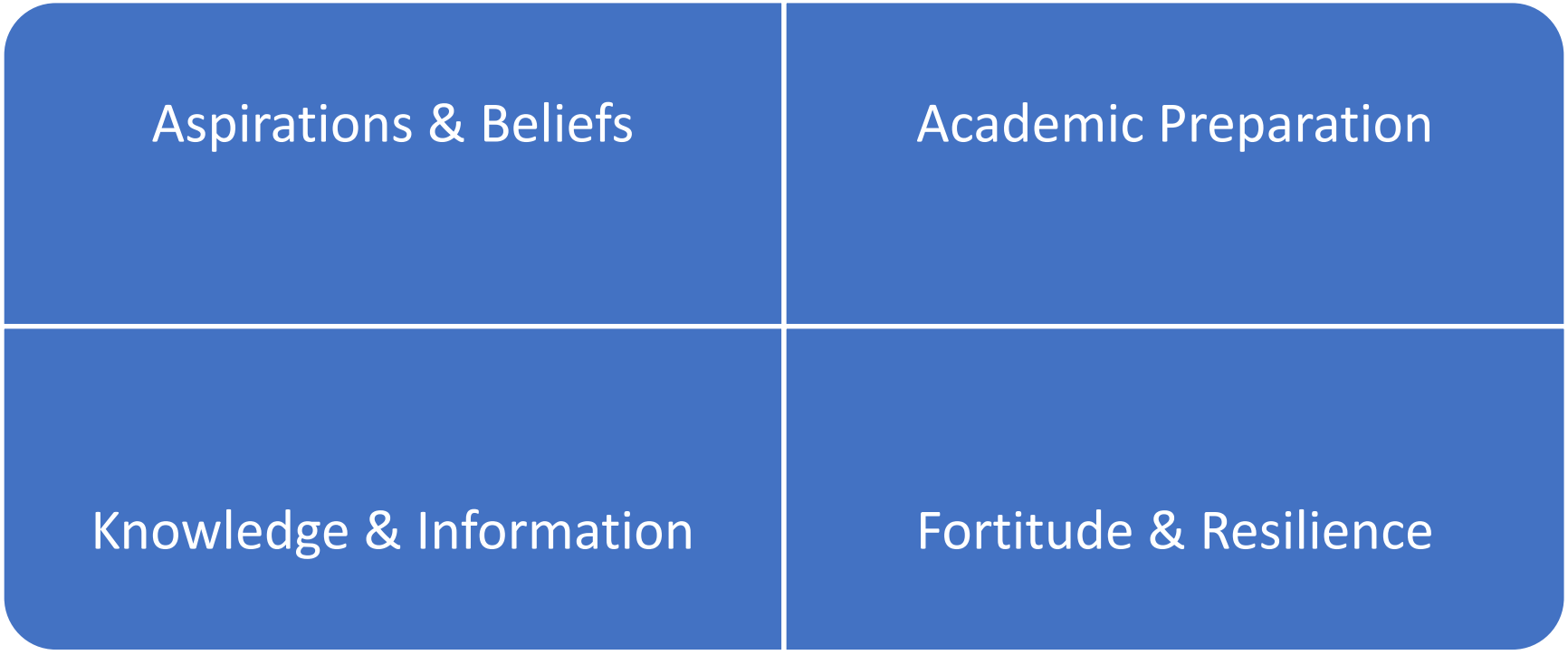
Key predictors of educational attainment



(Kurlaender, Reed, & Hurtt, 2019)

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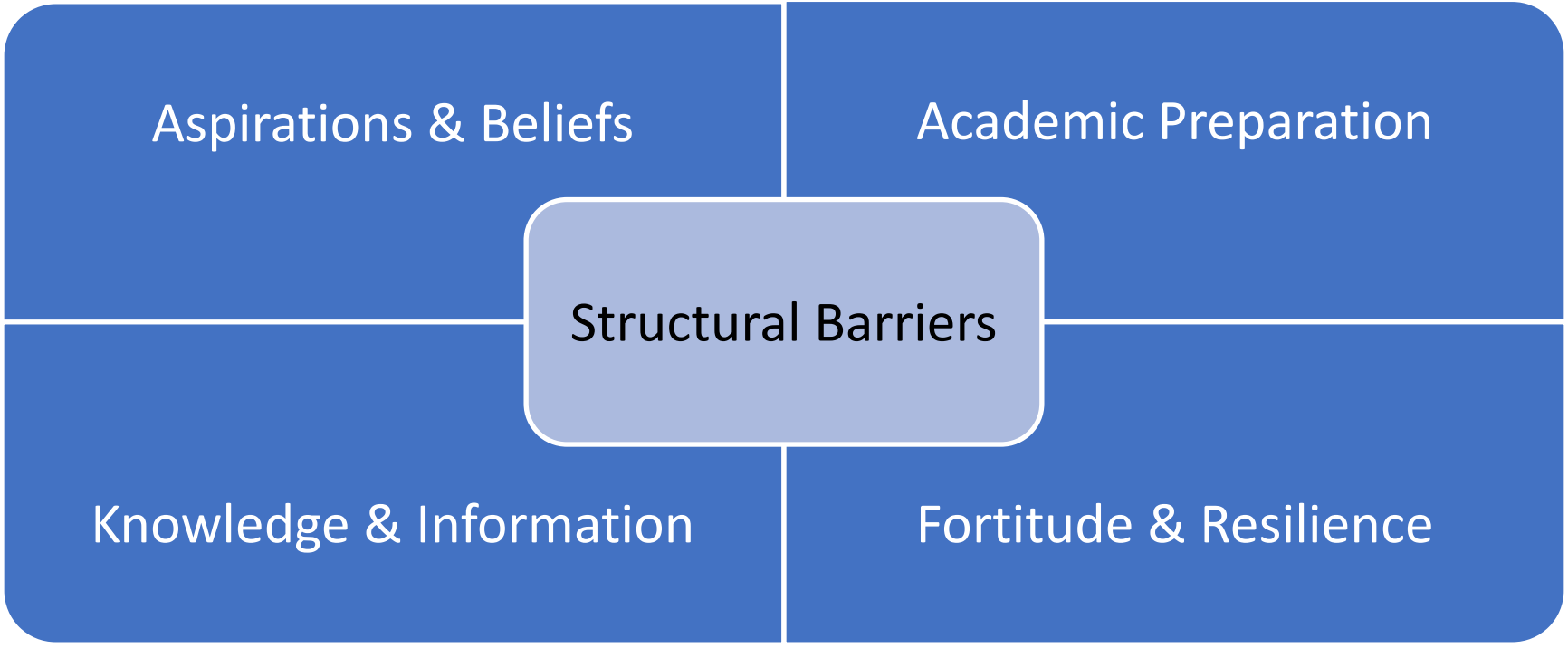
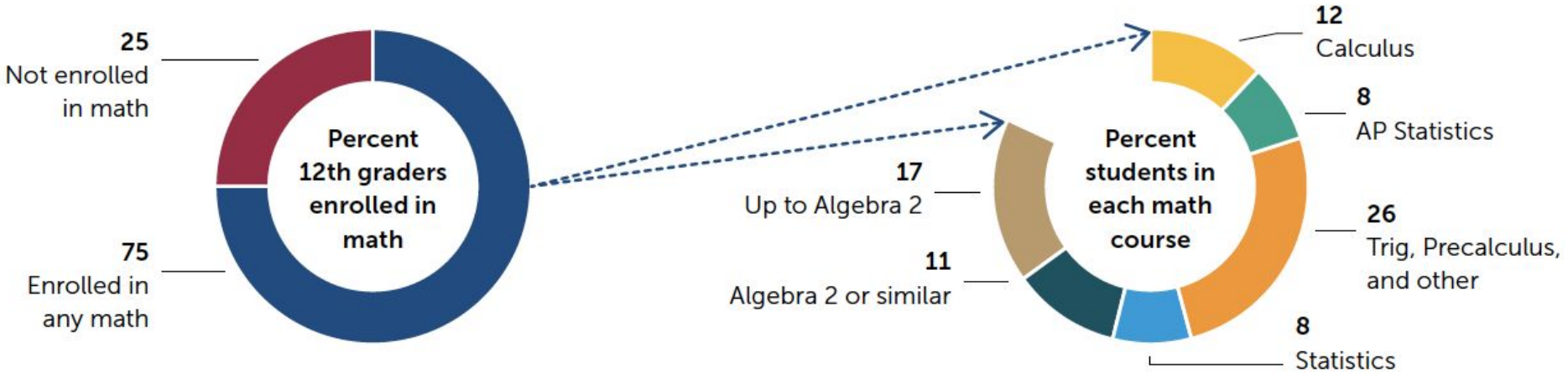


(Kurlaender, Reed, & Hurtt, 2019)

High school math courses matter

- Academic preparation in high school is a key predictor of college success
- Advanced math courses are associated with postsecondary outcomes
  - College entry
  - Type of college entry (2-yr vs. 4-yr; selectivity)
  - College completion
  - Wages
- More recently, a California study found taking math in 12th grade has a positive impact on college eligibility, enrollment, and persistence
- Persistent disparities in academic preparation by student & school characteristics
- Course “selection” is a key factor in student/school decisions

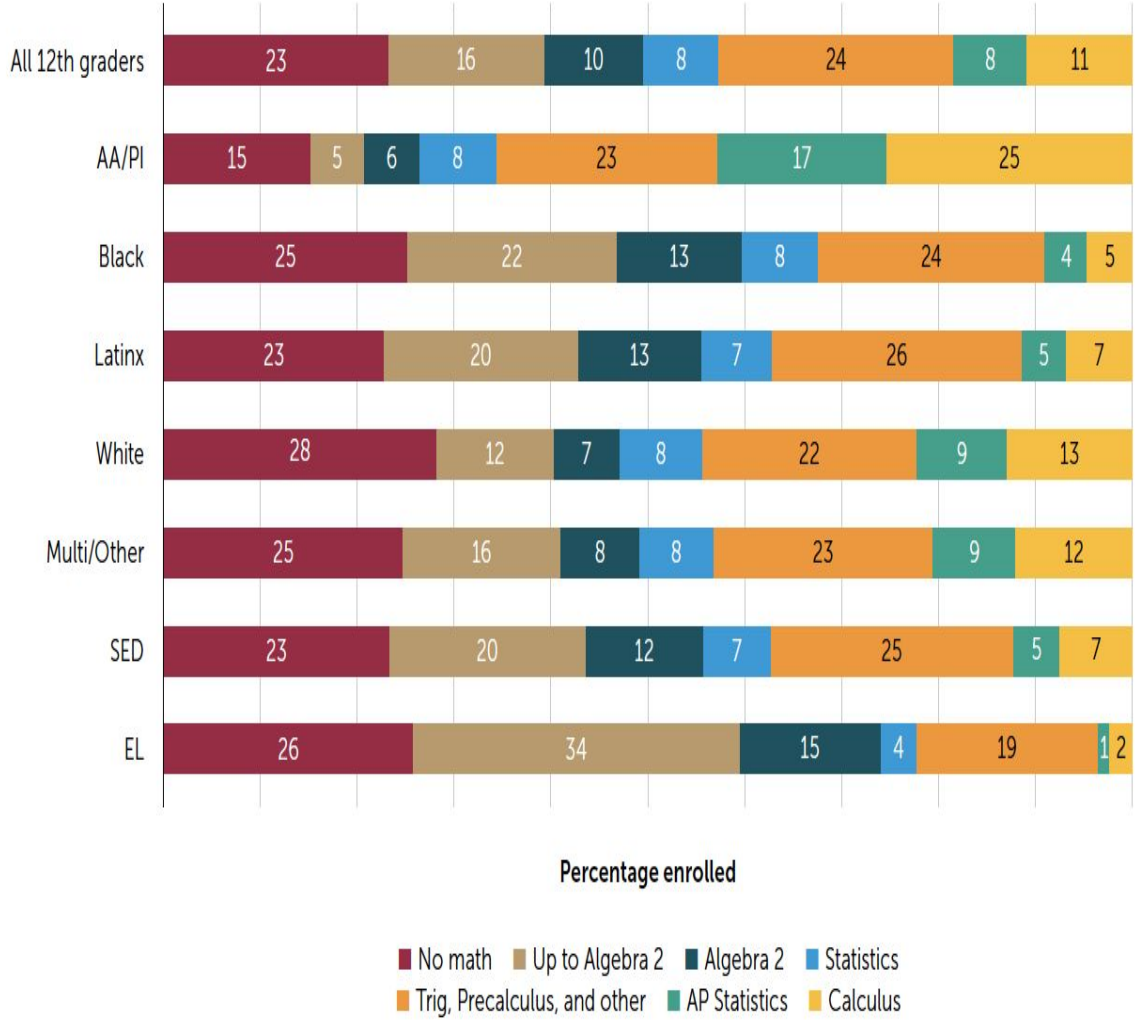
1/2 of high school seniors take an advanced math course
25% of seniors do not take any math



12th-Grade Math Course Enrollment, 2018–19

(Reed, Merritt, & Kurlaender, 2023)

12th grade math course-taking varies by student race/ethnicity



(Reed, Merritt, & Kurlaender, 2023)

Race-to-calculus and unintended consequences

- High school math course-taking largely oriented around a path to calculus
- Calculus pathway perceived as the strong foundation for higher education
- Inconclusive evidence about the impact of student placement in Algebra in 8th grade
- 1/3 of students on accelerated pathways repeating math courses

Expanding high school math course-taking opportunities

- Better align high school coursework with the preparation needed for college
- Calculus unnecessary for students entering diverse non-STEM fields
  - statistics, data analysis and computer science may be more relevant
- Develop quantitative literacy and reasoning for all students

Policy context: Diversifying high school math courses

- California Math Readiness Challenge Initiative (CMRCI)
  - funding to create 12th grade math courses that would "prepare students for college-level mathematics, with expected collaboration between high schools and CSU campuses"

- Reflected in the proposed revisions to CSU admission criteria, that were not ultimately adopted
  - students complete an additional year-long course in quantitative reasoning (including math, science, or computer science) in high school in order to be eligible for admission

- Reflected in the proposed *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve*

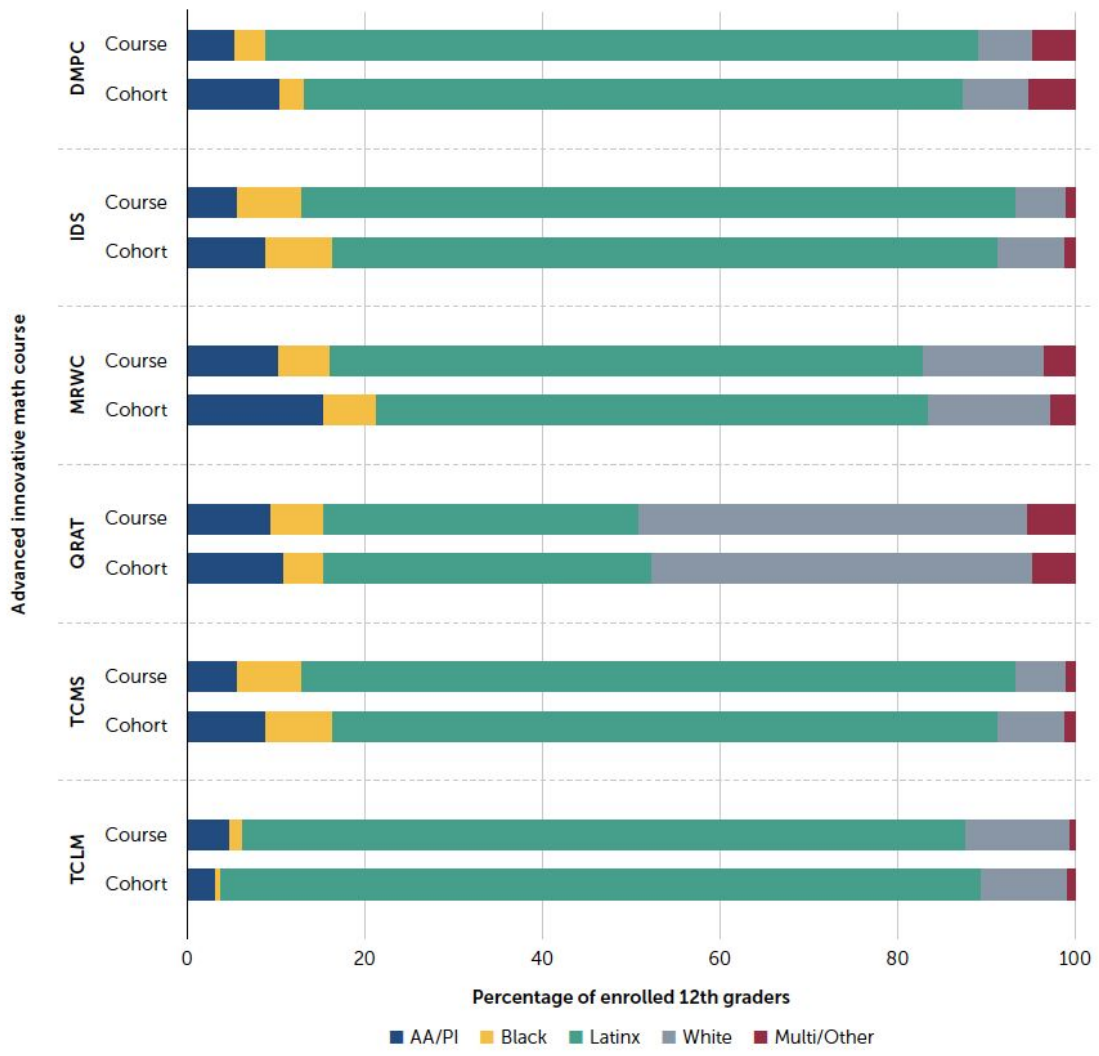
In practice: Diversifying high school math courses

Advanced Innovative Math Course	University - Lead Partner	Number K-12 Districts	Number Students	Percent Cohort
Mathematical Reasoning with Connections (MRWC)	Cal Poly Pomona	17	2,756	16%
Transition to College Level Math (TCLM)	California State University, Monterey Bay	5	99	14%
Transition to College Math & Statistics (TCMS)	California State University, Northridge	1	2,437	19%
Quantitative Reasoning with Advanced Mathematical Topics (QRAT)	Sacramento State University	15	1,093	13%
Discrete Math for Pre-College Students (DMPC)	San Diego State University	3	1,066	12%
Introduction to Data Science (IDS)	University of California, Los Angeles	12	1,558	16%

(Reed, Bracco, Kurlaender, & Merritt, 2023)

Enrollment in AIM courses is representative

(Reed, Bracco, Kurlaender, & Merritt, 2023)



Intersegmental partnerships for Advanced Innovative Math

- Math course developed by higher education faculty & high school math specialists
  - Benefit from state resources (CMRCI) & philanthropic resources
- Shared purpose
  - Target college-bound students not interested/ready for calculus
  - Improve quantitative reasoning and student confidence in math
- Commitment to equity
- Build community & develop capacity
  - Through extensive & ongoing professional development
- Goal of improved student outcomes

Innovative Pedagogy

"I can create opportunities for students to learn and discover things on their own,

and that is a much more powerful way of learning for students when they come

to a discovery on their own and they make sense of it in their own way."

– High school math teacher

(Reed, Bracco, Kurlaender, & Merritt, 2023)

Develop Capacity of Teachers

"I was already wanting to move in that direction, but actually being trained in teaching this course has kind of given me the **tools to be more confident** in allowing that to happen in my other classes… **I've grown in the ability to choose student work, and to ask students to present and to lead whole class discussions about that work**, and so all of those things ."

– High school math teacher

(Reed, Bracco, Kurlaender, & Merritt, 2023)

Changing Student Mindsets

"I'm finally not dumb in math. I finally understand what's going on."

- High school math teacher quoting a former student

"We do get a lot of **student** comments about **how successful they feel for the first time**. For the **first time they** can come to **believe that they can do mathematics** and that mathematics is not ... about being a human computer."

- High school math teacher

(Reed, Bracco, Kurlaender, & Merritt, 2023)

Positive Impact on Student Outcomes

Enrollment in an AIM course:

Increases the likelihood of completing the courses required for UC/CSU eligibility by 3 to 10 percentage points

Improves high school math GPA

Increases the likelihood of postsecondary enrollment

(Reed, Bracco, Kurlaender, & Merritt, 2023)

Implications

- Promising early results about the impact of AIM courses on student outcomes
- Continued state and education segment investments
- Alignment of high school math and college admissions
- Additional teacher training
- Involvement of school counselors

Discrete Math Pre Collegiate

Discrete Math Project Collaborative

Dr. Osvaldo “Ovie” Soto

Director *Discrete Math Project Collaborative (SDSU)*

Discrete Math Pre Collegiate

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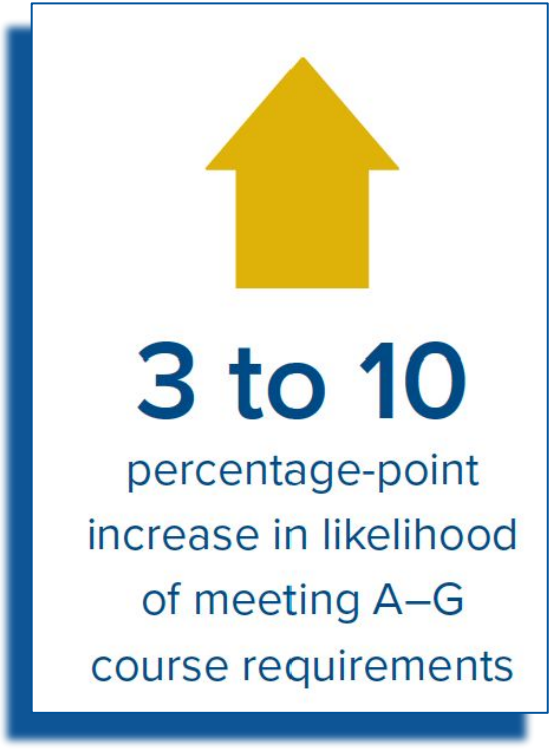
About DMPC

Discrete Math Project Collaborative

- Since 2016
- (Accessible) Curriculum + **Professional Development**
- More than 60 teachers trained
- Approaching 7,000 students served
- Curricular Innovation (In Progress): Adding CS (Python) projects

Improved Student Outcomes: For Who?

Discrete Math Project Collaborative



Over **1,000** 12th graders enrolled in DMPC in 2018–19 (16% of seniors in the schools offering the course)

80% of enrollees identified as Latinx (compared to 74% of seniors in the cohort)

59% of enrollees were designated as socioeconomically disadvantaged (the same percentage as in the cohort)

18% of 12th graders enrolled in DMPC *Met* or *Exceeded Standards* on math SBAC (compared to 31% of seniors in the cohort)

88% of 12th graders enrolled in DMPC took Algebra 2/ Integrated Math III the previous year

Approx. 7000 total students served as of June 2022

Nearly 20% of Seniors Enrolled in Math at SUHSD

What Do Students Study?

Goal: Help students find something to love in mathematics by attending to the Standards for Mathematical Practice through the study of introductory…

- Game Theory
- Graph Theory
- Cryptography
- Sequences and Series
- Iteration & Recursion
- Combinatorics

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Equitable Access: Meet Grace and Hannah

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Equitable Access: Teachers

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Heinzman (2020): Math Is No Longer a Four Letter Word

“Because other years, I've just been, okay, I got the answer.... I want to put it on a projector and be like, this is my work. I did it like this. Is there anybody else that relates to me?... I genuinely get happy... I have an urge to push myself and show it to other people. Whereas, I didn't like math before.”

Jayden, Black DMPC Senior

Discrete Math Project Collaborative

"Overall, early evidence of DMPC and similar courses is clearly promising: AIM courses contribute positively to student outcomes, offering students alternatives to traditional calculus pathways and increasing four-year college eligibility."

Reed, Bracco, Merritt, and Kurlaender (2023)

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Discussion