Partnerships to Improve Equity in Math Course-taking

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March 6, 2023
Acknowledgements

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Kathy Bracco, Angora Ridge Partners

Research supported by the College Futures Foundation, through grants to the Education Insights Center at Sacramento State University and the California Education Lab at the University of California Davis, and by the Institute of Education Sciences, U.S. Department of Education, through Grant R305E150006 to the Regents of the University of California. Research leverages data available to the research team through a data sharing agreement with the California Department of Education (Michal Kurlaender, PI). The findings and conclusions here are those of the authors and do not necessarily reflect the positions or policies of the California Department of Education, the Institute of Education Sciences or the funders of the California Education Lab.
Key predictors of educational attainment

Aspirations & Beliefs  Academic Preparation
Knowledge & Information  Fortitude & Resilience

(Kurlaender, Reed, & Hurtt, 2019)
Key predictors of educational attainment

- Aspirations & Beliefs
- Academic Preparation
- Knowledge & Information
- Fortitude & Resilience

(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

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

(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
“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)
“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)
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

Dr. Osvaldo “Ovie” Soto
Director *Discrete Math Project Collaborative (SDSU)*
Acknowledgements & Gratitude

University Faculty + High School Specialists:

• Drs. Bill Zahner, Randy Philipp (and Michael O’Sullivan)
• DMPC Leadership & Authorship Team: Trang Vu, Anne Marie Almaraz, Clara Mateo, Nina Potter, Kris Siy, Clara Mateo

Funders:

• CA Dept. of Education
• College Futures Foundation
• CSU Chancellor’s Office: Center for Advancement of Quantitative Reasoning

Research and Evaluation:

• Nina Potter (SDSU)
• Dr. Erica Heinzman (UC San Diego)
• Sherrie Reed, Michal Kurlaender et al (Ed Insights @ Sac State, California Education Lab @ UC Davis)
• Pamela Burdman (Just Equations)
About DMPC

• 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?

3 to 10 percentage-point increase in likelihood of meeting A–G course requirements

- 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
Equitable Access: Meet Grace and Hannah
Equitable Access: Teachers
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
“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)
Discussion