ADVANCED INNOVATIVE MATH COURSES

Transition to College Level Mathematics and Statistics

Transition to College Mathematics and Statistics (TCMS) is designed to review and extend students' understanding of important and broadly useful concepts and methods from algebra and functions, statistics and probability, discrete mathematics, and geometry. Cal State Northridge faculty have taken this commercially available resource and tailored it to the needs of students and teachers in the LA Basin. It is a UC approved college-preparatory class that provides a fourth-year option for students who might have otherwise opted out of an additional year of mathematics. TCMS utilizes real-world applications with "direct transfer to workplace and life skills."

Topics of Study

- Interpreting Categorical Data
- Functions Modeling Change
- Counting Methods
- Mathematics of Financial Decision-Making

Optional:

- Binomial Distributions and Statistical Inference
- Informatics
- Spatial Visualization and Representations
- Mathematics of Democratic Decision-Making

Who Enrolls in TCMS?

TCMS is currently offered in over 150 high schools, primarily in the LA Unified School District. As the demographics highlighted below indicate, the course has a fairly large footprint in the schools in which it is offered, and that enrollment is representative of the diversity of the overall twelfth grade cohort in those schools.

2,430
12th graders enrolled in TCMS in 2018–19
(19% of seniors in the schools offering the course)

80%
of enrollees identified as Latinx
(compared to 75% of seniors in the cohort)

87%
of enrollees were designated as socioeconomically disadvantaged
(compared to 84% of seniors in the cohort)

17%
of 12th graders enrolled in TCMS *Met* or *Exceeded Standards* on math SBAC
(compared to 27% of seniors in the cohort)

83%
of 12th graders enrolled in TCMS took Algebra 2/ Integrated Math III the previous year

To better understand who the students are who enroll in TCMS, it is helpful to understand the distribution of 12th graders across the different math courses. The figures that follow provide information on characteristics of twelfth grade math enrollment for all students in schools offering TCMS.

CALIFORNIA EDUCATION LAB
UC DAVIS SCHOOL OF EDUCATION

Education Insights Center

January 2023

Table 1. 12th Grade Math Enrollment in Schools Offering TCMS

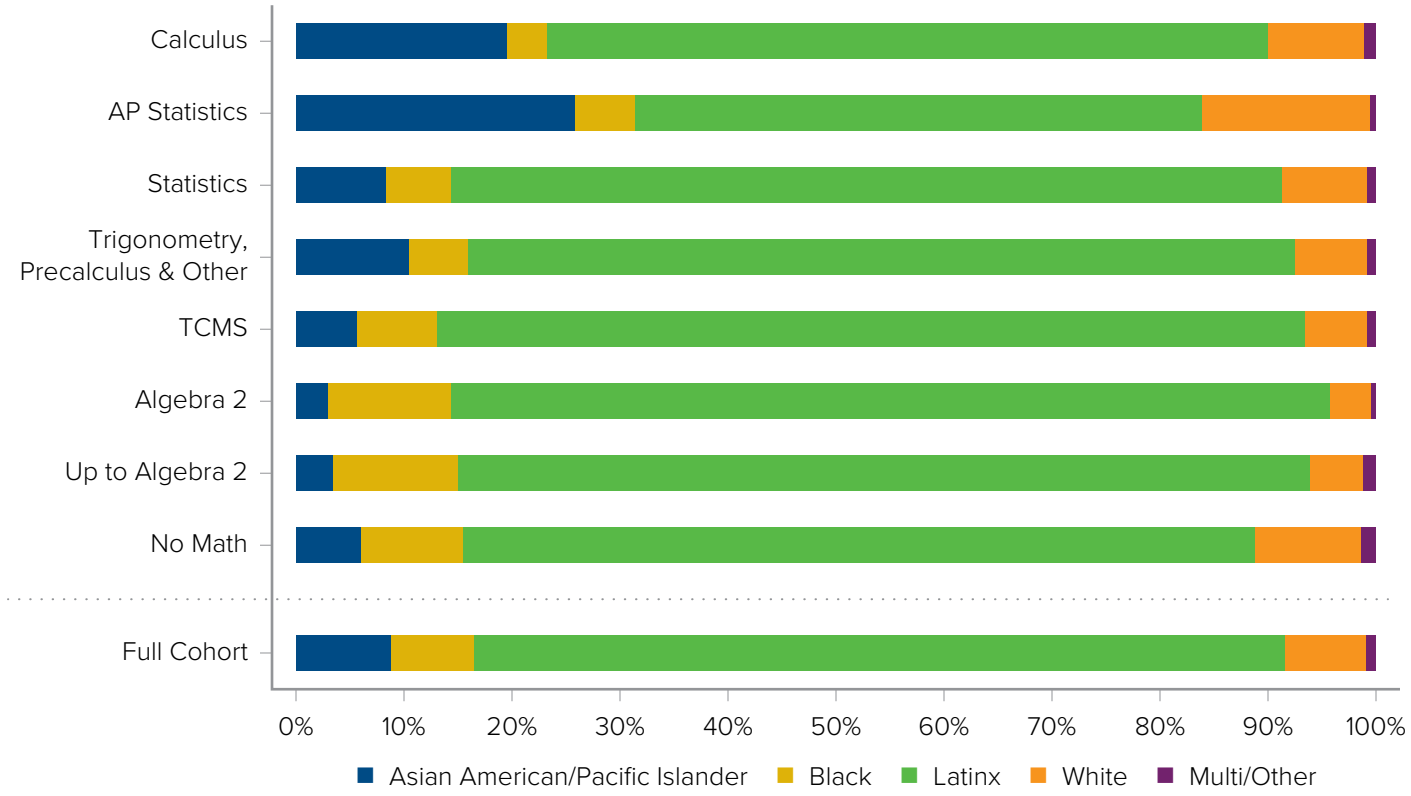
Math Course Category	Percent of 12th Graders Enrolled	
	2017–18	2018–19
Advanced Math Courses		
Calculus	11	10
AP Statistics	8	6
Statistics	10	10
Trigonometry, Precalculus & Other	14	20
TCMS	**18**	**19**
Algebra 2	12	13
Up to Algebra 2	9	9
No Math	27	22
Total 12th Graders	**10,087**	**12,841**

Note: Percentages do not add to 100% because some students enroll in more than one math course.

DATA

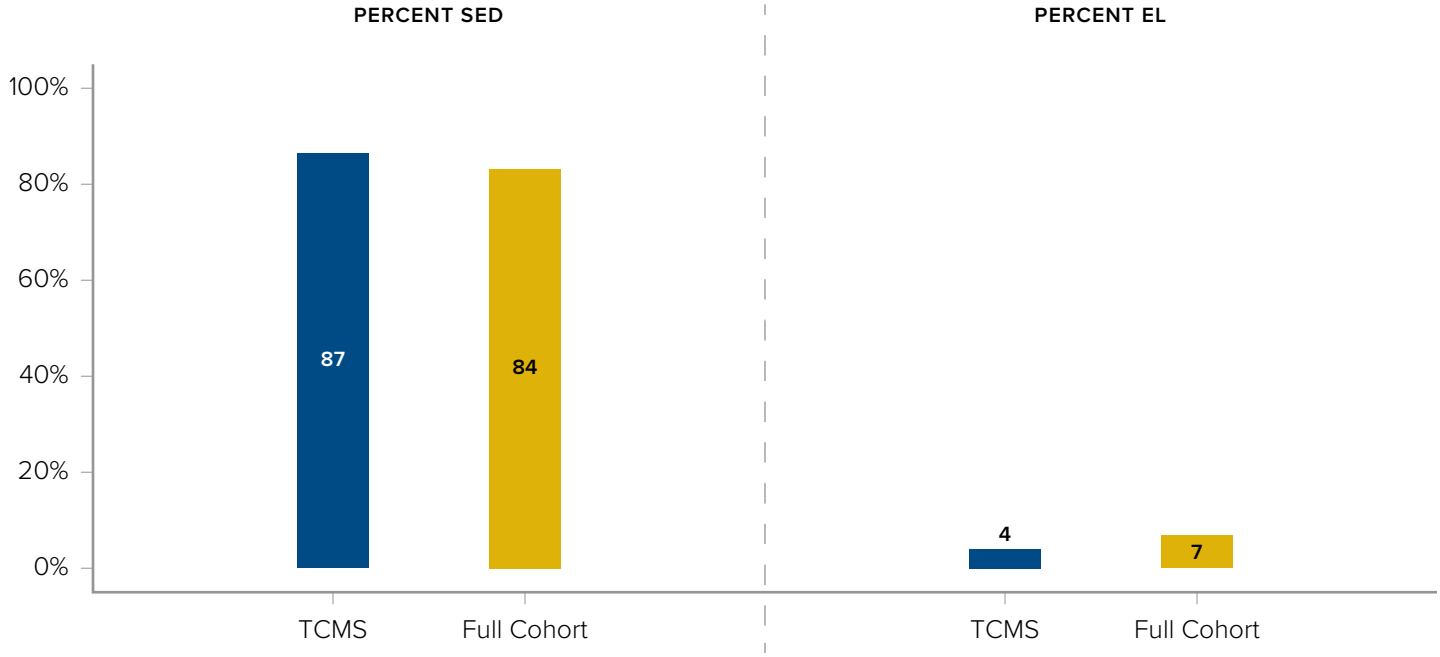
Statistics calculated from student-level and course-level data in the California Longitudinal Pupil Achievement Data System (CALPADS). Figures 1 through 3 include 12th graders in the 2018–19 academic year derived from participation in the 11th grade Smarter Balanced Assessments (SBAC) in 2017–18. Statistics may vary from other reports due to sample differences and data limitations.

Figure 1. Racial/Ethnic Composition of 12th Grade Math Courses in Schools Offering TCMS



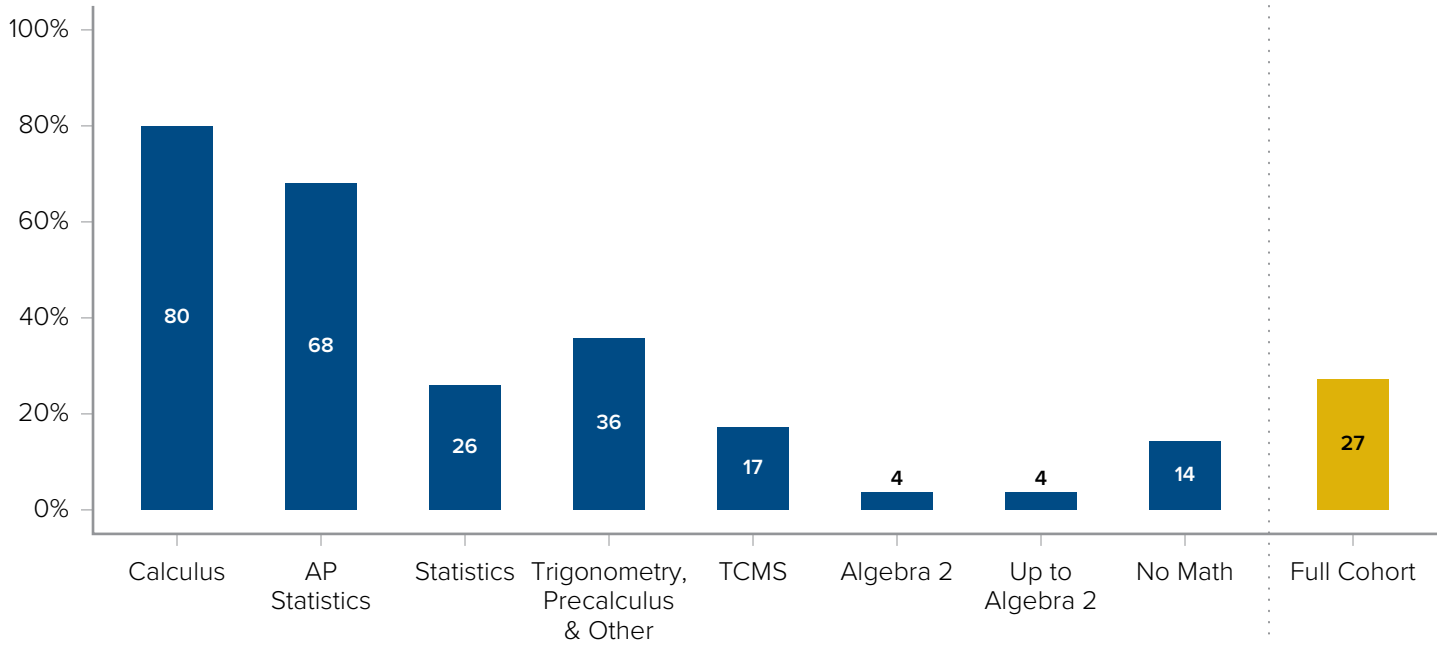
Note: Multi/Other includes students of Native American ancestry, students who identify with multiple racial/ethnic groups, and those for whom race/ethnicity information is missing.

Figure 2. Percent of SED and EL Students in 12th Grade TCMS Courses Compared to Full Cohort in Schools Offering TCMS



Notes: SED = Socioeconomically disadvantaged. EL = English Learner. SED status is defined by the California Department of Education as students who either qualify for the free or reduced-price school lunch program or do not have a parent who graduated from high school. For our analysis, we use the student-level SED and EL identifiers in the 11th grade SBAC data.

Figure 3. Percent of Students Meeting or Exceeding 11th Grade Standards on SBAC Math by 12th Grade Math Courses Enrollment in Schools Offering TCMS



Note: Students included in this figure achieved *Met Standard* (level 3) or *Exceeded Standard* (level 4) on the 11th grade math SBAC and were enrolled in high school courses the following year.

What Do Teachers Say about TCMS?

While ultimately it will be helpful to understand how well students who enroll in TCMS do once they go on to college and take additional math courses, the reactions from teachers to date have been positive and suggest that the course can make a difference for students. Several teachers interviewed for this larger study noted that they believe the TCMS course provides a solid foundation for students in preparation for college and college-level math, particularly those who are not planning on majoring in STEM fields:

> **I would recommend TCMS for all students because I think that it gives you a solid foundation in things that are sometimes passed through in high school mathematics courses. And so, it can give students ... a higher level of confidence, when they're going into college-level math.**
>
> **(TCMS Teacher)**

> **I feel it's creating a course where now students are saying, I'm prepared for college math. I can do this now. I'm not going into a calculus field, I'm not going into this field, but I feel strong enough that I'm ready college-level math, at wherever campus I'm at.**
>
> **(TCMS Teacher)**

A real benefit for students, according to teachers, is the emphasis on real-world problems. This helps students engage more in the course and see more relevance in mathematics than they may have done previously:

> **I wasn't thrilled to teach the class at first but then I did the summer training and realized how applicable it is and how many things I could really do with my students to make math relevant in their lives.... And I think it's changed my teaching in that I feel like I can more directly apply real-world events and real-world experiences for my students.**
>
> **(TCMS Teacher)**

For more information on teachers' experiences with TCMS, see our **full report on teacher perspectives**.

What Is the Impact of TCMS for Students?

Analysis of TCMS and similar courses reveals a consistent positive story for students enrolled in advanced innovation math (AIM) curricula.

Leveraging high school course-taking data along with a rich set of student- and school-level characteristics linked to postsecondary enrollment data allowed for a causal analysis of the impact of enrollment in six AIM courses on key high school and postsecondary outcomes, including grades in 12th grade math courses, UC/CSU eligibility (completion of A–G course requirements), and college enrollment. Methods included advanced matching techniques to compare students enrolling in an AIM course to those who enroll in other (or no) math courses, controlling for a variety of factors that likely influence both math course placement and our outcomes of interest (e.g., prior student achievement in math as measured by test scores, previous math courses, demographic characteristics). Analyses for each AIM course were conducted respectively, and cannot be directly compared given unique course content, schooling environment, and the number of students and schools served. However, all courses demonstrate a positive impact for various postsecondary outcomes.

Results of these analyses indicate that AIM courses provide an additional math pathway that supports students' readiness for and, in some cases, increases in college enrollment. Specifically, AIM courses increase the likelihood that a student will meet the course requirements for UC/CSU eligibility by 3 to 10 percentage points. In some cases, AIM course enrollment improves grades in 12th grade math courses and increases the likelihood of college enrollment. Even when strong evidence of a positive impact on grades is absent, results are still promising. In fact, we may expect that rigorous curricula can engage and challenge students, which could result in a shift in grades, while increasing college preparation. Nevertheless, we are cautious about interpreting changes in grades given the many factors (i.e., teachers, peers, homework time, motivation) that influence grades and the observed effects of the AIM courses are small in magnitude. Moreover, there is limited potential for 12th grade math course performance to change college enrollment trajectories given fall due dates of four-year college applications.

Overall, early evidence of TCMS 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.

For more information on the development and implementation of TCMS and the other AIM courses, see our **full report**.

AUTHORS AND ACKNOWLEDGEMENTS

Information sheet prepared by Sherrie Reed, Kathy Bracco, Cassandra Merritt, and Michal Kurlaender as part of a broader project examining college and career readiness course-taking patterns in California public high schools.

Research was supported by the College Futures Foundation, through grants to Education Insights Center (EdInsights) at Sacramento State University and the California Education Labat 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. Statistics calculated from data available to the research team through a research partnership and data sharing agreement with the California Department of Education (Michal Kurlaender, PI). The authors are grateful to colleagues from EdInsights for their engagement with the advanced innovative math course partnership leaders and their support of the research, and to Maureen Carew, Andrea Venezia, and Pamela Burdman for their expertise, advisement and review of research protocols and products.

For more information on these courses or the statistics included in this report, contact Sherrie Reed at **slreed@ucdavis.edu**.