ADVANCED INNOVATIVE MATH COURSES

Transition to College Level Mathematics

Transition to College Level Mathematics (TCLM), designed by a team of higher education and K–12 mathematics faculty and math educators across Monterey County, focuses on both new concepts as well as developing a deeper understanding of content covered in earlier courses and the relationships between them. The course emphasizes modeling, problem solving and applications of mathematics to the real world and serves as a senior year option to precalculus and calculus pathways.

TCLM was first implemented in the 2017–18 school year in eight schools throughout five districts in the region.

Topics of Study

- Modeling Change with Functions
- Interpreting Categorical Data
- Statistical Inference
- Voting and Apportionment
- Financial and Business Decision Making
- Counting Methods
- Graph Theory
- Informatics
- Representations in 3D
- Symmetries and Tessellations

Who Enrolls in TCLM?

To meet the prerequisites for this course, students are supposed to have achieved a grade of C or better in Integrated Math III. Enrollment in TCLM grew from 114 students in 2017–18 to almost 400 seniors in 2018–19. Students enrolled in TCLM in 2018–19 were fairly representative of the seniors in the schools that offered the course:

399
12th graders enrolled in TCLM in 2018–19
(12% of seniors in the schools offering the course)

82%
of enrollees identified as Latinx
(compared to 86% of seniors in the cohort)

64%
of enrollees were designated as socioeconomically disadvantaged
(compared to 72% of seniors in the cohort)

15%
of 12th graders enrolled in TCLM *Met* or *Exceeded Standards* on math SBAC
(compared to 19% of seniors in the cohort)

95%
of 12th graders enrolled in TCLM took Integrated Math III the previous year

To better understand who the students are who enroll in TCLM, 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 TCLM.

CALIFORNIA EDUCATION LAB
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Table 1. 12th Grade Math Enrollment in Schools Offering TCLM

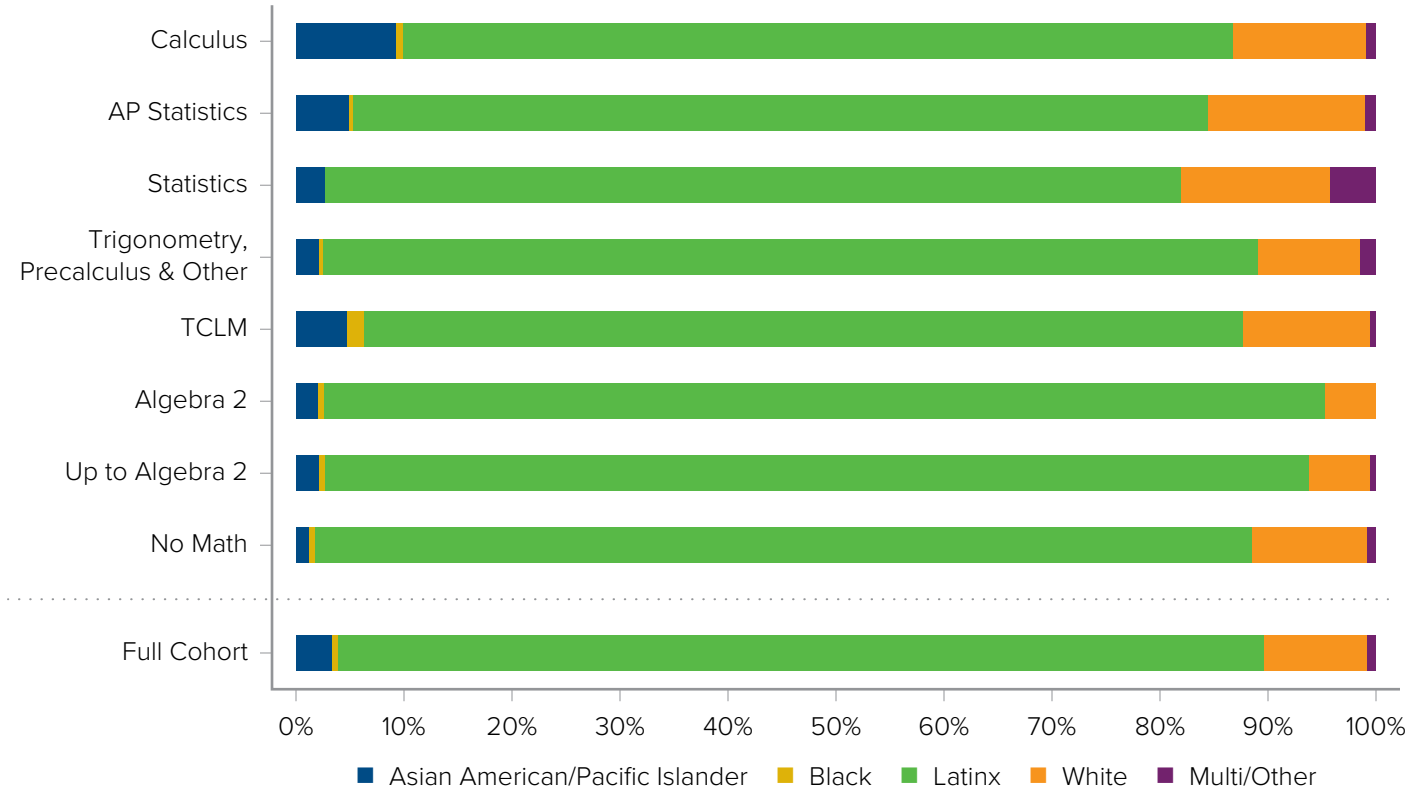
Math Course Category	Percent of 12th Graders Enrolled	
	2017–18	2018–19
Advanced Math Courses		
Calculus	15	11
AP Statistics	13	9
Statistics	2	2
Trigonometry, Precalculus & Other	19	17
TCLM	**11**	**12**
Algebra 2	14	5
Up to Algebra 2	8	28
No Math	22	28
Total 12th Graders	**1,021**	**3,287**

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

DATA

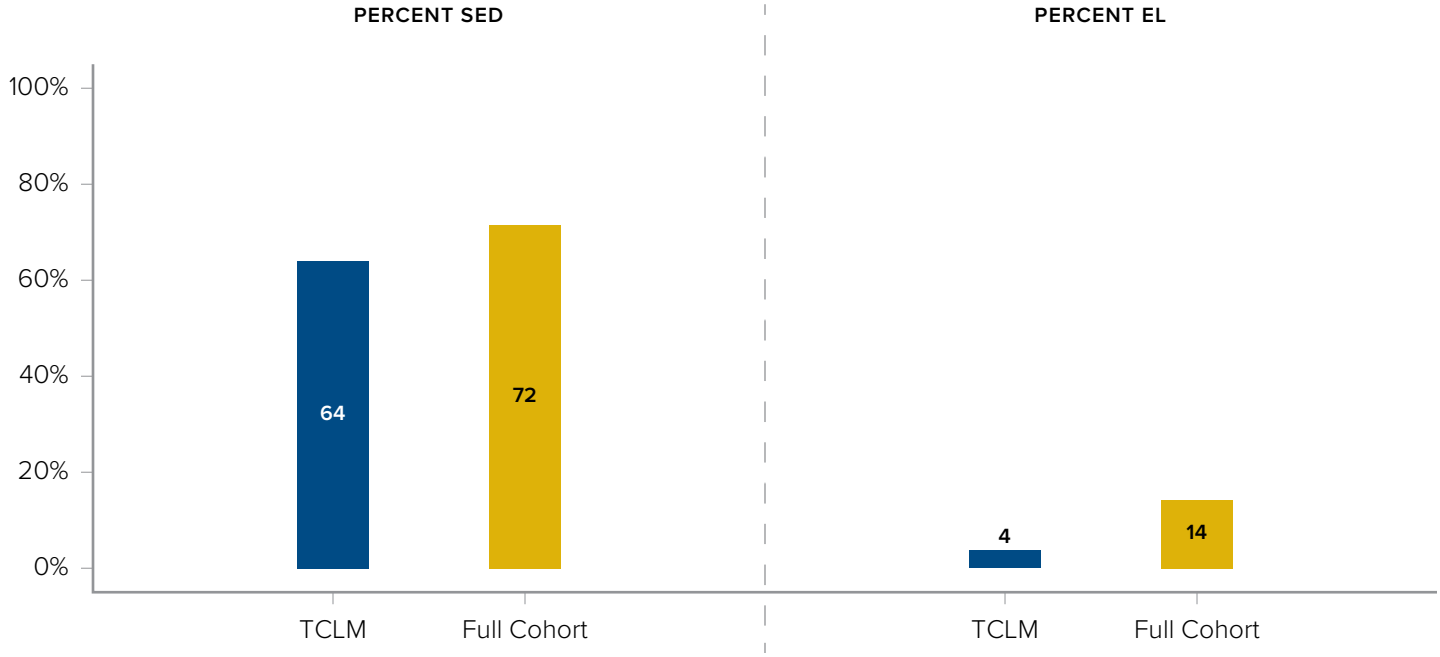
Statistics calculated from student-level and course-level data in the California Longitudinal Pupil Achievement Data System (CALPADS). Figures 1 through 3 include 12th graders in the 2018–19 academic year derived from participation in the 11th grade Smarter Balanced Assessments (SBAC) in 2017–18. Statistics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



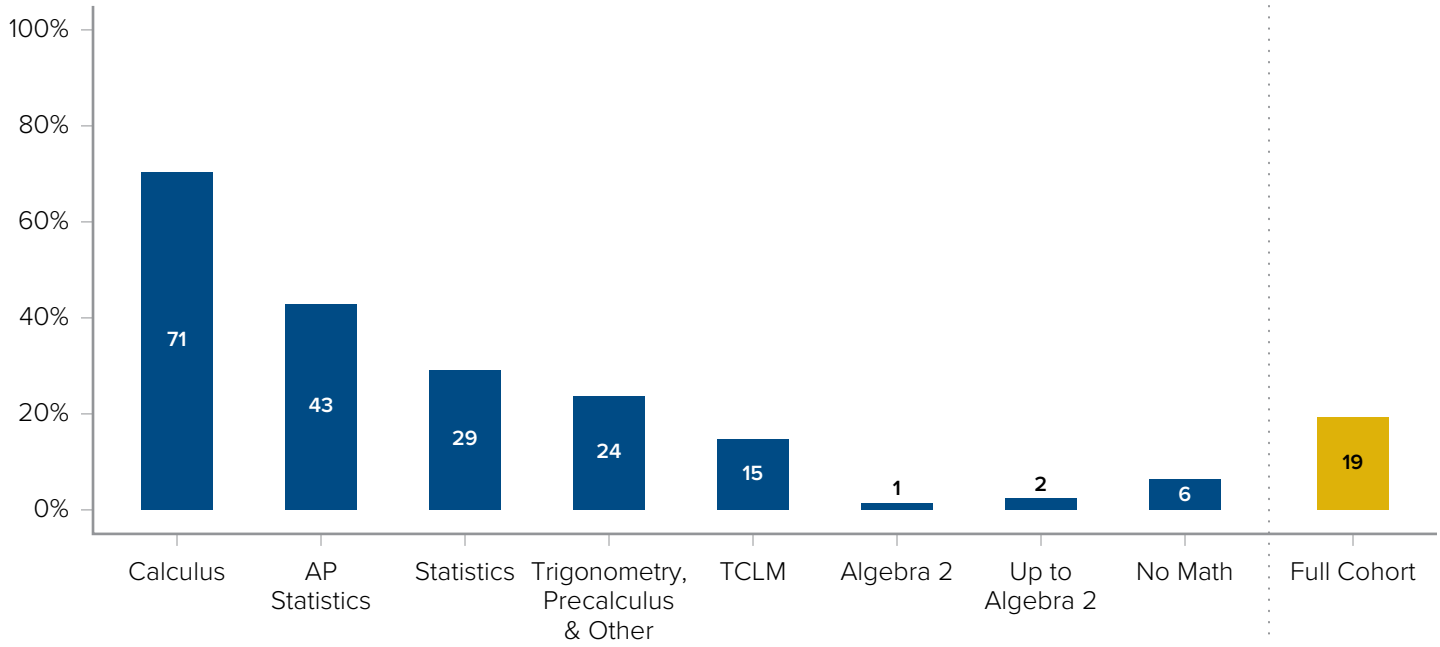
Note: Multi/Other includes students of Native American ancestry, students who identify with multiple racial/ethnic groups, and those for whom race/ethnicity information is missing.

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



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 TCLM



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 TCLM?

While it is too soon to determine the extent to which enrollment in the TCLM course aided students in their college math courses, teachers are generally positive about the course and its potential benefit to students, particularly because of the different pedagogical approach:

> **There might be a little bit of a connection to what they did in the past, but this class makes them realize how to think like a mathematician, and not just think to the answer. And it's not even about the answer, it's about the process and about the exploration of mathematics.**
>
> **(TCLM Teacher)**

> **It's not so much prescribed, and students learn differently, and they learn a lot more from each other than they do sometimes from the teacher. Just having more of that chance to communicate their ideas allows them to grow more and to ask questions and to dig in deeper into the math than doing it on their own.**
>
> **(TCLM Teacher)**

Teachers noted that it can take a while for students to feel comfortable with the approach taken in the course, but noted that ultimately students begin to develop more positive attitudes towards mathematics:

> **Once they kind of realize 'Oh, sometimes we're going to have the same answer and sometimes we're going to have different answers,' the students that are receptive to that do well. Even if their grade doesn't reflect that, their attitude and their perception of what math is has changed.**
>
> **(TCLM Teacher)**

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

What Is the Impact of TCLM for Students?

Analysis of TCLM 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.

3 to 10

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

Overall, early evidence of TCLM 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 TCLM and the other AIM courses, see our **full report**.

AUTHORS AND ACKNOWLEDGEMENTS

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