

# Introduction to Data Science

**Introduction to Data Science (IDS)**, developed by a team at UCLA, emphasizes teaching students to reason with, and think critically about, data in all forms. IDS provides access to rigorous learning that fuses mathematics with computer science using R/RStudio, an open-source programming language/environment that has long been the standard for academic statisticians and analysts in industry.

## Topics of Study

- Data and Visualization
- Distributions, Probability and Simulations
- Data Collection Methods
- Predictions and Models

## Who Enrolls in IDS?

The course, which is approved to meet the “C” (mathematics) requirement of the University of California A–G admissions criteria, provides an option for students who may have previously struggled in the traditional math pathway and can be used as an alternative to Algebra 2. First implemented in 2014–15, IDS has grown from 12 sections in California to over 100 sections offered in the 2019–20 academic year. Because Algebra 2 is not a pre-requisite for IDS, there are more 11th graders enrolled in IDS than is the case for the other math courses in this study.



**2,017**

students enrolled in IDS in 2018–19  
(459 of whom were 11th graders)



**12%**

of all seniors in schools where IDS was offered were enrolled in the course



**80%**

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



**79%**

of enrollees were designated as socioeconomically disadvantaged (compared to 74% of seniors in the cohort)



**15%**

of 12th graders enrolled in IDS *Met or Exceeded Standards* on math SBAC (compared to 30% of seniors in the cohort)



**70%**

of 12th graders enrolled in IDS took Algebra 2 the previous year

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

**Table 1. 12th Grade Math Enrollment in Schools Offering IDS**

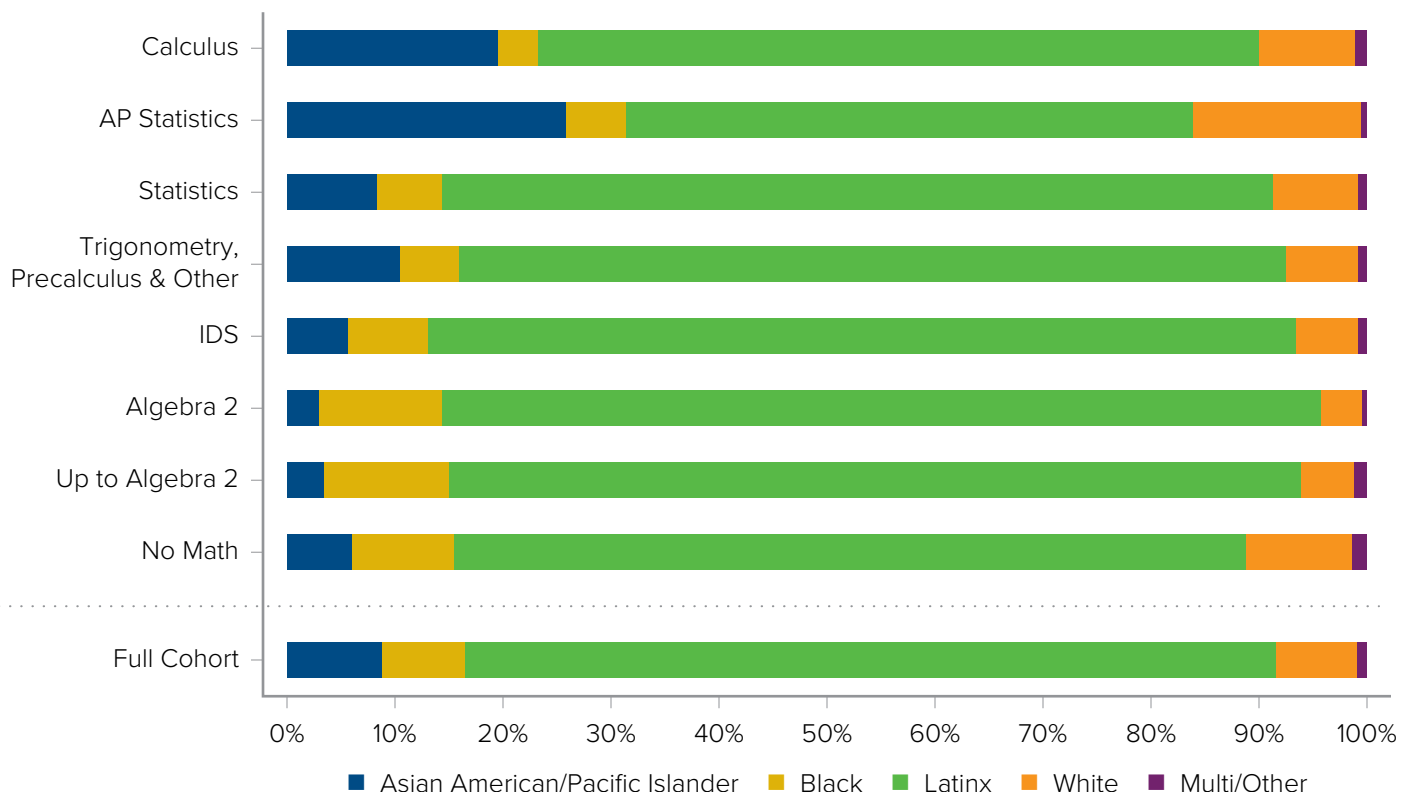
Math Course Category	Percent of 12th Graders Enrolled	
	2017–18	2018–19
Advanced Math Courses		
Calculus	12	11
AP Statistics	9	8
Statistics	13	12
Trigonometry, Precalculus & Other	14	26
<b>IDS</b>	<b>12</b>	<b>12</b>
Algebra 2	11	9
Up to Algebra 2	9	12
No Math	26	19
<b>Total 12th Graders</b>	<b>9,162</b>	<b>13,375</b>

**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.

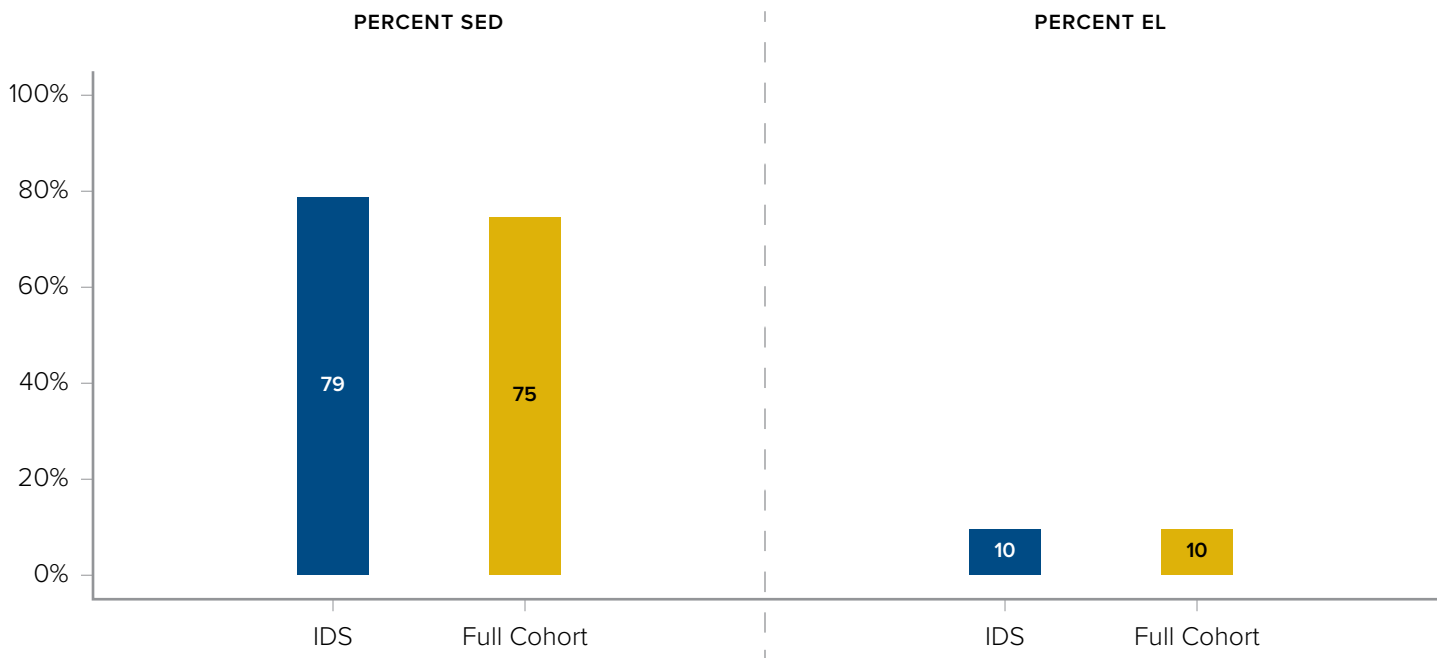
Note: Percentages do not add to 100% because some students enroll in more than one math course.

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



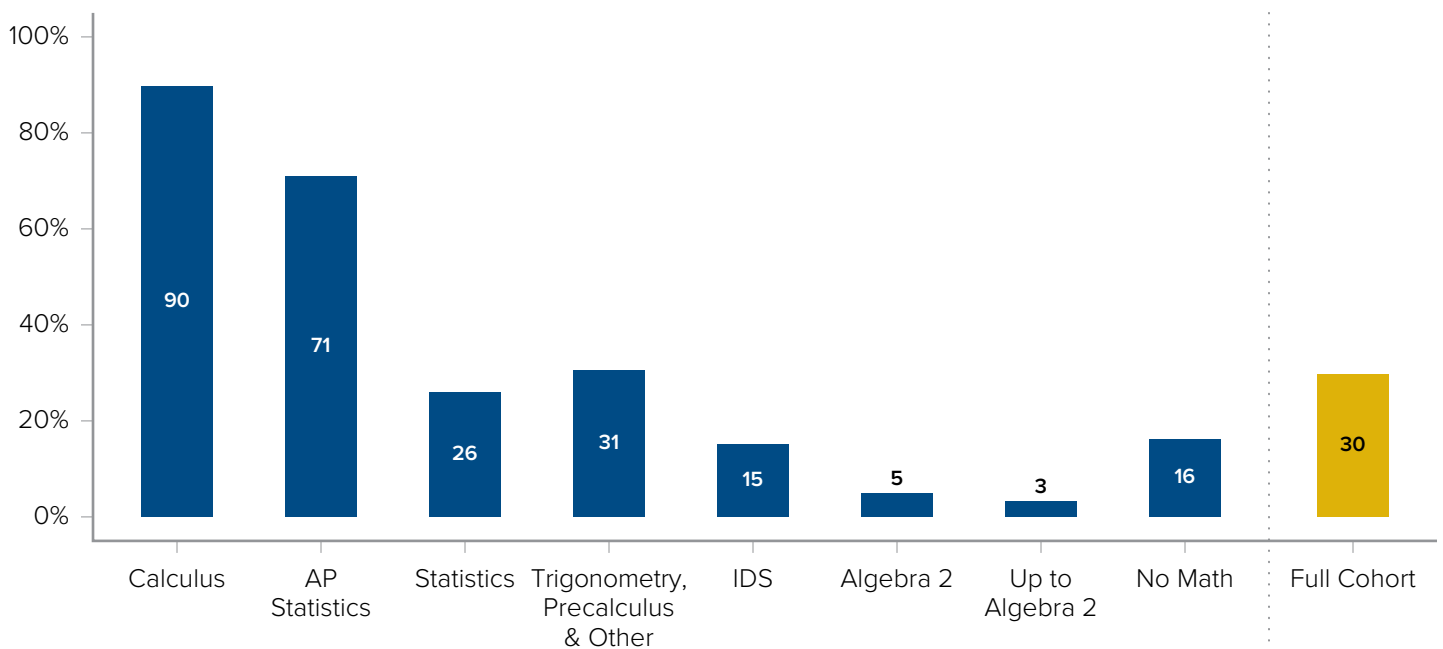
Note: Multi/Other includes students of Native American ancestry, students who identify with multiple racial/ethnic groups, and those for whom race/ethnicity information is missing.

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



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 IDS**



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 IDS?

IDS teachers interviewed as part of this larger study were overall quite positive about the course and its impact on students. Most importantly, the teachers noted that the emphasis on real-life problems makes students see the relevance and importance much more easily than in traditional math courses:

“

**And I think IDS does a really good job of [making math relevant], by putting things into understandable contexts. And sometimes the context is sort of humorous and lighthearted, sometimes it's a little more serious, but it's kind of seeing how mathematics can help us describe what's going on in the world around us.**

(IDS Teacher)

”

Teachers talked about how the pedagogical approach, which required collaborative work, problem-solving, and communication provided more opportunities for students to demonstrate success in math courses than is typically the case:

“

**You could find those skills that they were good at, even though maybe math wasn't always their thing.... because sometimes in math classes, you don't see that side of them.... like their speaking or their presentation or their creativity in their presentation or their graphics, or even in their coding.**

(IDS Teacher)

”

Communicating about the process and the findings are a key component of the IDS course, and one that teachers note is important to apply in other math courses as well:

“

**You're asking them to use those critical thinking skills and to really think about the content and all that kind of thing, and I teach Calculus and [I think] 'I've got to get these kids doing some of the same stuff.' .... I've got to get them engaged in conversation more.**

(IDS Teacher)

”

For more information on teachers' experiences with IDS, see our [full report on teacher perspectives](#).

## What Is the Impact of IDS for Students?

**Analysis of IDS 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 IDS 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 IDS 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 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. 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](mailto:slreed@ucdavis.edu).