PUBLIC POLICY INSTITUTE OF CALIFORNIA

# Community College Math in California's New Era of Student Access

## Technical Appendices

CONTENTS



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# Appendix A. Data

## Student Longitudinal Data

Our quantitative analyses use student-level longitudinal data from the California Community Colleges Chancellor's Office Management Information System (MIS). The dataset includes students enrolled across the 115 community colleges that comprise the California Community College system, and includes demographic information, transcripts (grades and credits earned), and course elements (levels below transfer-level, credit status, transfer status and minimum/maximum number of credits).

Please see the glossary of terms in the main report for a description of key variables derived from the MIS data.

## Variables

***Outcomes***: Direct access to TL, one-term, one-year, and fall-fall throughput, subsequent enrollment in TL courses, subsequent success in TL courses, persistence, and racial equity gaps (percentage point gap and proportionality index).

***Student-level variables***: student goal, first-time college student, non-traditional-age student, gender, race/ethnicity, citizenship status, disability status, Limited English Proficiency status, College Promise or Pell grant recipient, full-time status, foster student, EOPS recipient, prior dual-enrollment, targeted program participation, GPA first-term (excluding math), TL units earned first-term as a share of units attempted, BSTEM major status, enrollment in corequisite support.

***College-level variables***: access rate tier, early implementer status, corequisite intensity, BSTEM pathway length, and an indicator of whether a college was implementing a placement policy that deviated from the system office recommendations

## Programs coded as BSTEM

We identified students' majors by matching program information from the Chancellor's Office Curriculum Inventory System (COCI) with program codes provided by MIS. Possible BSTEM majors were then flagged using Taxonomy of Programs (TOP) codes and subsequent word searches, which included terms commonly found in BSTEM major titles such as "Engineering" and "Computer Science."[1] We then verified BSTEM identifications through a general examination of course requirements for each TOP Code. Of primary interest was the identification of majors with calculus sequence requirements.

Specifically, we chose a random sample of majors within each TOP code, and gathered information on course requirements for these majors from department websites, course schedules, and college catalogs. In some cases, within certain TOP codes, we chose to flag only a few majors as BSTEM. For example, among TOP codes categorized under interdisciplinary studies, including Liberal Arts and Sciences, General (4901.00), Transfer Studies (4901.10), and Liberal Studies (4901.20), we only flagged majors explicitly listed as math, physical science, engineering, or computer science programs. Similarly, when examining majors broadly categorized under business TOP codes, we only flagged those identified as "Business Administration" programs.

Given the constraints of our methodology, and the wide variation in majors across colleges within TOP codes, it is likely that we did not appropriately identify all BSTEM majors as such in our analyses. Nevertheless, we are

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[1] The Taxonomy of Program (TOP) is a system of numerical codes used by the California Community Colleges system to collect and report information on similar programs across different colleges throughout the state (https://bit.ly/TOP-Code-Manual).

confident that our multi-step identification process resulted in an accurate classification of majors within the BSTEM sample. Furthermore, our BSTEM categorizations match up closely with the STEM categorizations developed in a recent report by the RP Group. Most importantly, our report similarly includes the identification of what the RP Group classifies as the 16 most concentrated STEM TOP codes in the California community college system, which account for over 96% of the student sample in their report.

Table A1 lists the TOP codes we categorized as BSTEM in our report, and provides frequency data for all first-time math students among the fall 2019 cohort. TOP codes for which we categorized only some majors as BSTEM are identified as such. Overall, most of first-time math students we identified as BSTEM majors (about 96%) fall into one of the following six broad areas of study:

- Biological & Physical Sciences (37.9%)
- Business (28.7%)
- Information Technology (13.4%)
- Engineering (11.7%)
- Mathematics (4.1%)

**TABLE A1**

List of TOP Codes identified as BSTEM with frequency distribution among sample of first-time math students in fall 2019

| TOP Title | TOP Code | BSTEM Majors | Count | Percent |
|---|---|---|---|---|
| Business Administration | 0505.00 | All | 11,107 | 22.92% |
| Biology, General | 0401.00 | All | 8,879 | 18.32% |
| Biological and Physical Sciences (and Mathematics) | 4902.00 | Some | 7,503 | 15.48% |
| Engineering, General (requires Calculus) (Transfer) | 0901.00 | All | 3,914 | 8.08% |
| Computer Science (Transfer) | 0706.00 | All | 3,067 | 6.33% |
| Business and Commerce, General | 0501.00 | Some | 2,319 | 4.79% |
| Mathematics, General | 1701.00 | All | 1,970 | 4.07% |
| Computer Programming | 0707.10 | All | 1,683 | 3.47% |
| Chemistry, General | 1905.00 | All | 879 | 1.81% |
| Computer Information Systems | 0702.00 | All | 741 | 1.53% |
| Architecture and Architectural Technology | 0201.00 | All | 713 | 1.47% |
| Economics | 2204.00 | All | 708 | 1.46% |
| Physics, General | 1902.00 | All | 518 | 1.07% |
| Computer Networking | 0708.10 | All | 429 | 0.89% |
| Electronics and Electric Technology | 0934.00 | All | 423 | 0.87% |
| Engineering Technology, General (requires Trigonometry) | 0924.00 | All | 352 | 0.73% |
| Drafting Technology | 0953.00 | All | 318 | 0.66% |
| Biotechnology and Biomedical Technology | 0430.00 | All | 287 | 0.59% |
| Business Management | 0506.00 | Some | 226 | 0.47% |
| Information Technology, General | 0701.00 | All | 176 | 0.36% |
| Liberal Arts and Sciences, General | 4901.00 | Some | 172 | 0.35% |
| Civil and Construction Management Technology | 0957.00 | All | 171 | 0.35% |

| TOP Title | TOP Code | BSTEM Majors | Count | Percent |
|---|---|---|---|---|
| Environmental Science | 0301.00 | All | 167 | 0.34% |
| Liberal Studies | 4901.20 | All | 162 | 0.33% |
| Computer Electronics | 0934.10 | All | 158 | 0.33% |
| Transfer Studies | 4901.10 | Some | 126 | 0.26% |
| Geology | 1914.00 | All | 117 | 0.24% |
| Physical Sciences, General | 1901.00 | All | 101 | 0.21% |
| Software Applications | 0702.10 | All | 97 | 0.20% |
| Other Engineering and Related Industrial Technologies | 0999.00 | All | 92 | 0.19% |
| Architectural Drafting | 0953.10 | All | 88 | 0.18% |
| Computer Infrastructure and Support | 0708.00 | All | 87 | 0.18% |
| Management Development and Supervision | 0506.30 | Some | 78 | 0.16% |
| Computer Systems Analysis | 0707.30 | All | 60 | 0.12% |
| Computer Software Development | 0707.00 | All | 59 | 0.12% |
| Small Business and Entrepreneurship | 0506.40 | Some | 51 | 0.11% |
| Accounting | 0502.00 | Some | 49 | 0.10% |
| Astronomy | 1911.00 | All | 48 | 0.10% |
| Computer Support | 0708.20 | All | 46 | 0.09% |
| Mechanical Drafting | 0953.40 | All | 32 | 0.07% |
| Banking and Finance | 0504.00 | Some | 31 | 0.06% |
| Other Business and Management | 0599.00 | Some | 30 | 0.06% |
| Manufacturing and Industrial Technology | 0956.00 | Some | 30 | 0.06% |
| Electro-Mechanical Technology | 0935.00 | All | 24 | 0.05% |
| Microbiology | 0403.00 | All | 21 | 0.04% |
| Electrical, Electronic, and Electro-Mechanical Drafting | 0953.30 | All | 20 | 0.04% |
| Database Design and Admnistration | 0707.20 | All | 19 | 0.04% |
| Electrical Systems and Power Transmission | 0934.40 | All | 17 | 0.04% |
| Other Information Technology | 0799.00 | All | 12 | 0.02% |
| Ocean Technology | 1920.00 | All | 12 | 0.02% |
| Laboratory Science Technology | 0955.00 | All | 11 | 0.02% |
| Oceanography | 1919.00 | All | 11 | 0.02% |
| Earth Science | 1930.00 | All | 11 | 0.02% |
| Telecommunications Technology | 0934.30 | All | 10 | 0.02% |
| Surveying | 0957.30 | All | 10 | 0.02% |
| Civil Drafting | 0953.20 | All | 9 | 0.02% |
| Electron Microscopy | 0934.70 | All | 8 | 0.02% |
| Landscape Architecture (Transfer) | 0201.10 | All | 1 | 0.00% |
| Chemistry for UC Transfer | 1905.00 | All | 1 | 0.00% |

SOURCE: Authors' calculations using MIS data, COCI program information, and TOP code identifications

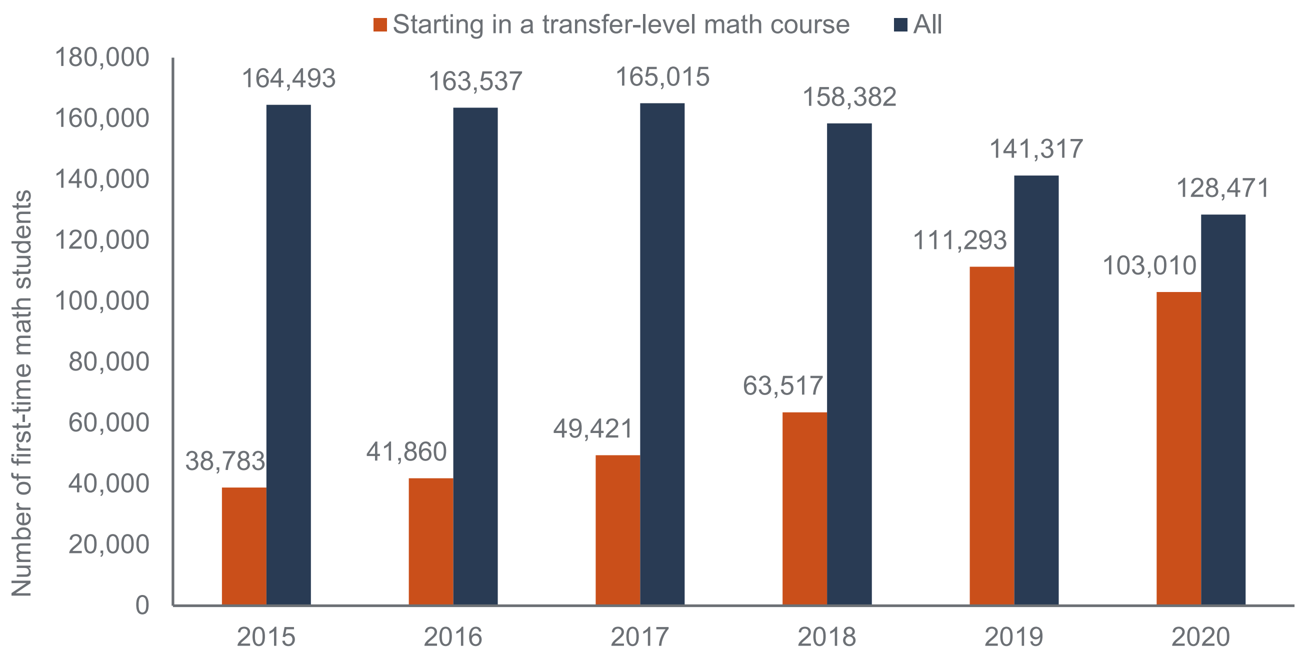
NOTE: Sample includes all first-time math students among 2019 fall cohort.

## Caveats and Limitations of this Study

1. The accuracy of our results relies on the accuracy with which colleges report their information to the Chancellor's Office. While we used various approaches to identify colleges with inconsistent data, it is possible that we missed colleges where the data discrepancies were not stark.
2. The MIS database does not include data on placement, so we are unable to identify students who were referred to developmental education or to transfer-level courses, with or without co-requisite support. We similarly do not have information on students' high school performance measures (i.e. course taking history, course grades, or GPA). As a result, our analysis focuses exclusively on course-taking behavior once students reach community college.
3. Our ITS analysis, discussed more thoroughly in Appendix D, is limited to only one student cohort post-AB 705. Unfortunately, cohorts entering after spring 2020 were impacted by the COVID-19 pandemic and thus, any results after that term cannot be interpreted as causal.
4. A critical question we attempt to answer is whether students who start in transfer-level courses with co-requisite support have better outcomes than those who start in traditional developmental sequences. Since we do not have high school records, or assessment and placement information, we cannot directly assess whether prior academic preparedness drives our results. We further discuss this limitation in our analysis of corequisite courses in Appendix E.
5. Our focus in Appendix E is strictly on corequisite models because we are not yet able to consistently identify and measure participation in other forms of concurrent support (e.g., writing labs, tutoring centers, supplemental instruction).
6. The analysis of persistence and success in subsequent courses for the 2019 cohort is impacted by the pandemic and therefore its results should be interpreted with caution.

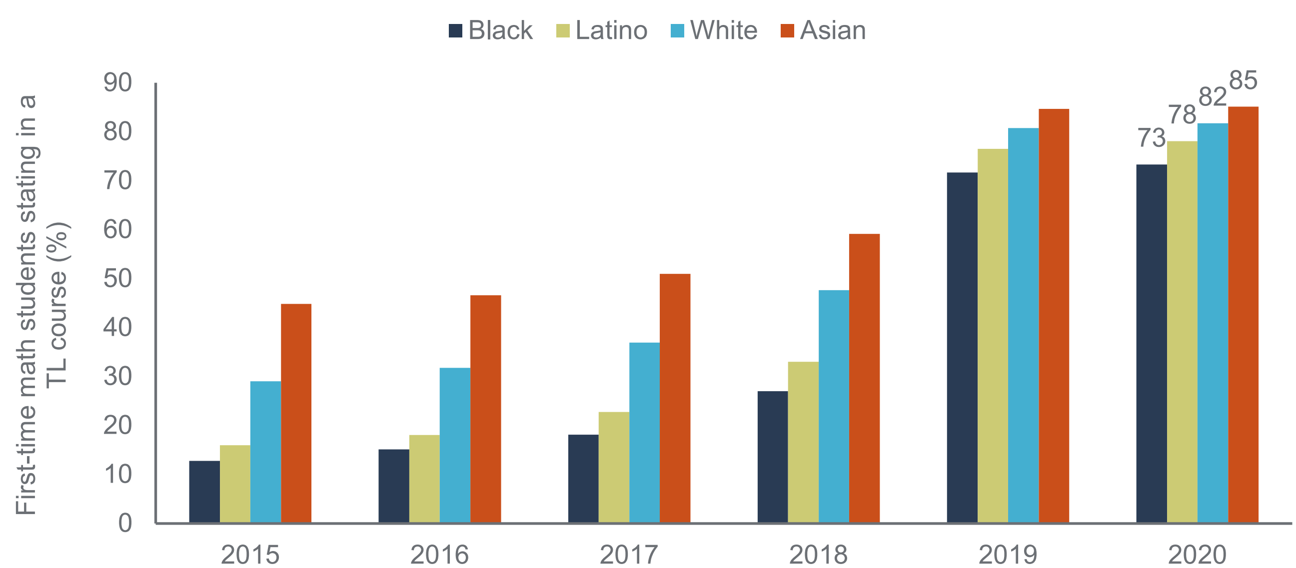
# Appendix B. Figures and Tables

**FIGURE B1**
Number of first-time math students starting in a transfer-level course over time




SOURCE: Authors' calculations using MIS data.
NOTE: Fall of each year.

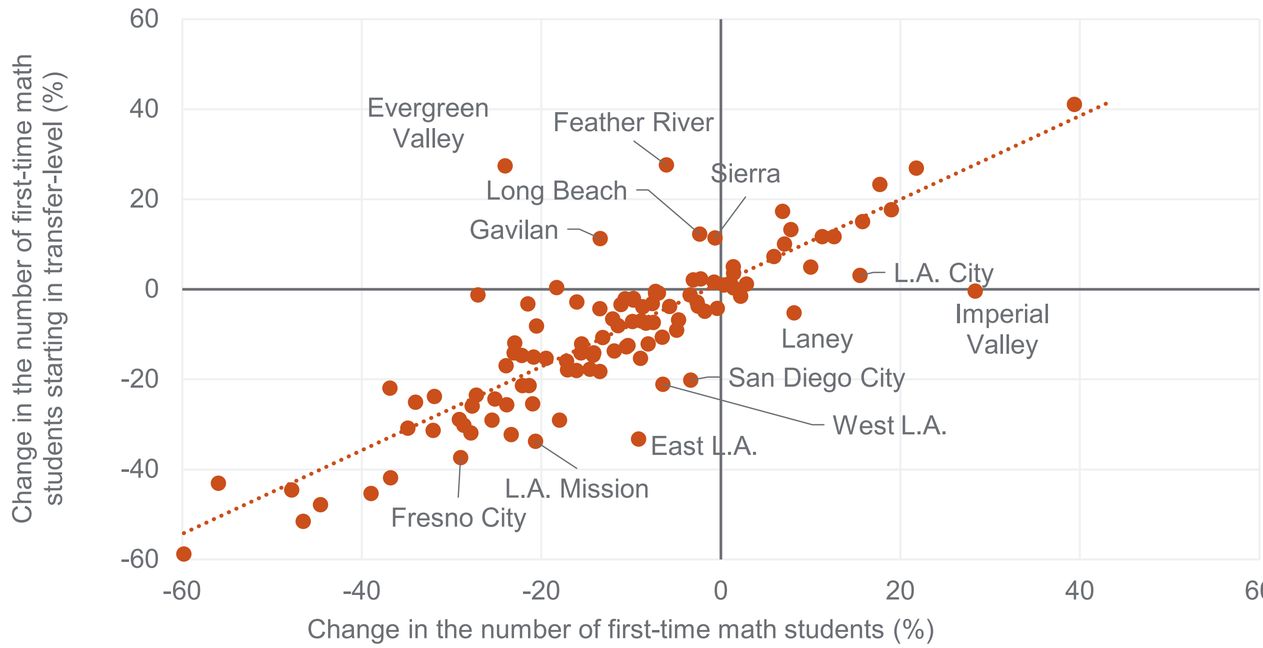
**FIGURE B2**
Distribution of first-time math students starting in a transfer-level course by race/ethnicity




SOURCE: Authors' calculations using MIS data.
NOTE: Fall of each year. In the fall 2020 cohort (128,471 students), there were 16,457 Asian, 5,716 Black, 63,997 Latino, and 29,257 white first-time math students.

**FIGURE B3**

Identifying colleges with increases in the number of students starting in a transfer-level course




SOURCE: Authors' calculations using MIS data.

NOTES: Annual change between fall 2019 and fall 2020. In the colleges in the upper-left quadrant, the number of students going into transfer-level math increased despite there being fewer first-time math takers.

**TABLE B1**

Number of first-time math students starting in a below transfer-level course by college (sorted by percent change 2019-20)

| | 2018 (pre-AB 705) | 2019 (post AB705) | 2020 (pandemic) | Percent change 2019-20 | Absolute change 2019-20 | Percent change 2018-19 |
|---|---|---|---|---|---|---|
| IMPERIAL VALLEY | 983 | 109 | 284 | 161 | 175 | -89 |
| L.A. CITY | 1,063 | 131 | 277 | 111 | 146 | -88 |
| CANYONS | 1,242 | 180 | 292 | 62 | 112 | -86 |
| GOLDEN WEST | 748 | 76 | 121 | 59 | 45 | -90 |
| WEST L.A. | 667 | 116 | 173 | 49 | 57 | -83 |
| LANEY | 309 | 108 | 160 | 48 | 52 | -65 |
| ORANGE COAST | 1,388 | 160 | 223 | 39 | 63 | -88 |
| SANTA BARBARA CITY | 772 | 99 | 132 | 33 | 33 | -87 |
| FRESNO CITY | 1,767 | 234 | 308 | 32 | 74 | -87 |
| SAN DIEGO CITY | 1,136 | 378 | 496 | 31 | 118 | -67 |
| L.A. MISSION | 740 | 144 | 188 | 31 | 44 | -81 |
| BAKERSFIELD | 1,469 | 369 | 457 | 24 | 88 | -75 |
| EAST L.A. | 1,979 | 994 | 1,220 | 23 | 226 | -50 |
| BERKELEY CITY | 307 | 35 | 42 | 20 | 7 | -89 |
| PALO VERDE | 134 | 10 | 12 | 20 | 2 | -93 |
| MOORPARK | 1,047 | 389 | 460 | 18 | 71 | -63 |
| CERRO COSO | 285 | 51 | 60 | 18 | 9 | -82 |

| | 2018 (pre-AB 705) | 2019 (post AB705) | 2020 (pandemic) | Percent change 2019-20 | Absolute change 2019-20 | Percent change 2018-19 |
|---|---|---|---|---|---|---|
| SANTA ROSA | 1,132 | 284 | 327 | 15 | 43 | -75 |
| MT. SAN JACINTO | 1,315 | 238 | 270 | 13 | 32 | -82 |
| GROSSMONT | 1,134 | 316 | 357 | 13 | 41 | -72 |
| LASSEN | 183 | 39 | 44 | 13 | 5 | -79 |
| NAPA VALLEY | 416 | 143 | 159 | 11 | 16 | -66 |
| SOUTHWESTERN | 1,408 | 554 | 612 | 10 | 58 | -61 |
| LOS MEDANOS | 399 | 243 | 268 | 10 | 25 | -39 |
| CERRITOS | 1,667 | 734 | 808 | 10 | 74 | -56 |
| CITRUS | 754 | 110 | 121 | 10 | 11 | -85 |
| RIVERSIDE | 1,339 | 151 | 161 | 7 | 10 | -89 |
| SISKIYOUS | 49 | 21 | 22 | 5 | 1 | -57 |
| SAN JOAQUIN DELTA | 1,746 | 552 | 575 | 4 | 23 | -68 |
| COALINGA | 291 | 31 | 32 | 3 | 1 | -89 |
| NORCO | 580 | 157 | 162 | 3 | 5 | -73 |
| SOLANO | 515 | 192 | 197 | 3 | 5 | -63 |
| CYPRESS | 1,209 | 335 | 343 | 2 | 8 | -72 |
| DIABLO VALLEY | 972 | 117 | 119 | 2 | 2 | -88 |
| FOLSOM LAKE | 622 | 146 | 145 | -1 | -1 | -77 |
| L.A. PIERCE | 1,330 | 414 | 409 | -1 | -5 | -69 |
| WOODLAND | 327 | 75 | 74 | -1 | -1 | -77 |
| CLOVIS | 663 | 171 | 168 | -2 | -3 | -74 |
| DESERT | 724 | 268 | 262 | -2 | -6 | -63 |
| MODESTO | 781 | 198 | 193 | -3 | -5 | -75 |
| COSUMNES RIVER | 1,136 | 505 | 492 | -3 | -13 | -56 |
| DE ANZA | 531 | 249 | 238 | -4 | -11 | -53 |
| AMERICAN RIVER | 1,492 | 670 | 637 | -5 | -33 | -55 |
| SANTA ANA | 1,335 | 174 | 163 | -6 | -11 | -87 |
| FOOTHILL | 139 | 119 | 109 | -8 | -10 | -14 |
| L.A. TRADE-TECH | 861 | 309 | 282 | -9 | -27 | -64 |
| SHASTA | 519 | 271 | 245 | -10 | -26 | -48 |
| MENDOCINO | 325 | 83 | 75 | -10 | -8 | -74 |
| SANTIAGO CANYON | 623 | 159 | 141 | -11 | -18 | -74 |
| MISSION | 458 | 100 | 87 | -13 | -13 | -78 |
| SADDLEBACK | 1,070 | 248 | 214 | -14 | -34 | -77 |
| SAN DIEGO MESA | 840 | 424 | 363 | -14 | -61 | -50 |
| MT. SAN ANTONIO | 1,648 | 820 | 701 | -15 | -119 | -50 |
| MERCED | 1,026 | 617 | 524 | -15 | -93 | -40 |
| WEST VALLEY | 686 | 137 | 116 | -15 | -21 | -80 |
| BUTTE | 793 | 212 | 178 | -16 | -34 | -73 |
| CUESTA | 506 | 236 | 196 | -17 | -40 | -53 |
| VENTURA | 779 | 112 | 93 | -17 | -19 | -86 |
| YUBA | 585 | 207 | 171 | -17 | -36 | -65 |

| | 2018 (pre-AB 705) | 2019 (post AB705) | 2020 (pandemic) | Percent change 2019-20 | Absolute change 2019-20 | Percent change 2018-19 |
|---|---|---|---|---|---|---|
| HARTNELL | 708 | 304 | 250 | -18 | -54 | -57 |
| SANTA MONICA | 2,404 | 928 | 754 | -19 | -174 | -61 |
| TAFT | 275 | 175 | 142 | -19 | -33 | -36 |
| PALOMAR | 1,629 | 1,010 | 816 | -19 | -194 | -38 |
| SACRAMENTO CITY | 1,292 | 521 | 418 | -20 | -103 | -60 |
| GLENDALE | 786 | 742 | 595 | -20 | -147 | -6 |
| L.A. VALLEY | 1,370 | 331 | 262 | -21 | -69 | -76 |
| LONG BEACH CITY | 1,972 | 1,309 | 1,036 | -21 | -273 | -34 |
| MORENO VALLEY | 628 | 146 | 115 | -21 | -31 | -77 |
| CRAFTON HILLS | 322 | 147 | 114 | -22 | -33 | -54 |
| LEMOORE | 407 | 115 | 88 | -23 | -27 | -72 |
| OHLONE | 796 | 185 | 141 | -24 | -44 | -77 |
| MONTEREY | 492 | 142 | 107 | -25 | -35 | -71 |
| SAN JOSE CITY | 511 | 112 | 84 | -25 | -28 | -78 |
| COASTLINE | 435 | 207 | 153 | -26 | -54 | -52 |
| MIRA COSTA | 536 | 163 | 116 | -29 | -47 | -70 |
| CONTRA COSTA | 441 | 252 | 174 | -31 | -78 | -43 |
| SAN MATEO | 429 | 106 | 73 | -31 | -33 | -75 |
| SOUTHWEST L.A. | 594 | 110 | 75 | -32 | -35 | -81 |
| REDWOODS | 235 | 27 | 18 | -33 | -9 | -89 |
| SAN FRANCISCO CITY | 1,125 | 527 | 351 | -33 | -176 | -53 |
| SAN DIEGO MIRAMAR | 490 | 337 | 220 | -35 | -117 | -31 |
| EL CAMINO | 2,396 | 367 | 236 | -36 | -131 | -85 |
| ALLAN HANCOCK | 895 | 507 | 322 | -36 | -185 | -43 |
| ANTELOPE VALLEY | 1,515 | 656 | 414 | -37 | -242 | -57 |
| BARSTOW | 290 | 45 | 28 | -38 | -17 | -84 |
| FULLERTON | 1,551 | 609 | 377 | -38 | -232 | -61 |
| IRVINE VALLEY | 799 | 140 | 81 | -42 | -59 | -82 |
| CHABOT | 759 | 182 | 102 | -44 | -80 | -76 |
| RIO HONDO | 1,384 | 348 | 188 | -46 | -160 | -75 |
| COLUMBIA | 136 | 62 | 33 | -47 | -29 | -54 |
| CUYAMACA | 163 | 111 | 58 | -48 | -53 | -32 |
| CANADA | 291 | 133 | 68 | -49 | -65 | -54 |
| LAKE TAHOE | 115 | 92 | 47 | -49 | -45 | -20 |
| L.A. HARBOR | 792 | 222 | 111 | -50 | -111 | -72 |
| SKYLINE | 289 | 194 | 91 | -53 | -103 | -33 |
| LAS POSITAS | 524 | 160 | 74 | -54 | -86 | -69 |
| MERRITT | 246 | 26 | 12 | -54 | -14 | -89 |
| FEATHER RIVER | 119 | 61 | 28 | -54 | -33 | -49 |
| GAVILAN | 315 | 229 | 104 | -55 | -125 | -27 |
| SAN BERNARDINO | 1,568 | 884 | 377 | -57 | -507 | -44 |
| SIERRA | 884 | 368 | 154 | -58 | -214 | -58 |

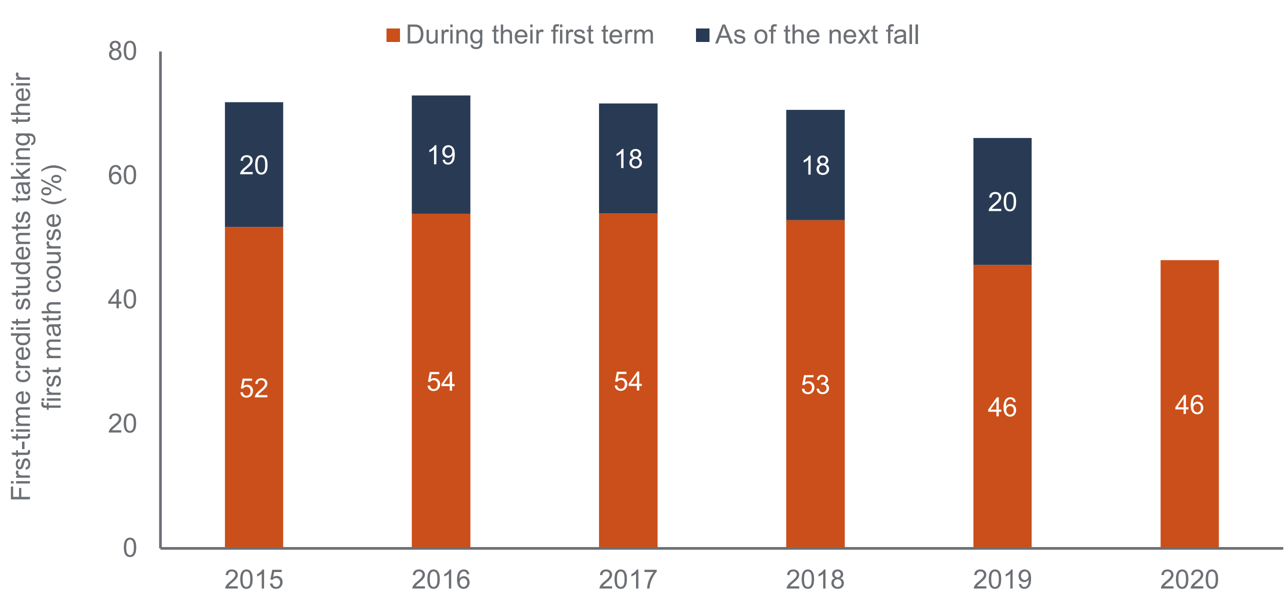
|  | 2018 (pre-AB 705) | 2019 (post AB705) | 2020 (pandemic) | Percent change 2019-20 | Absolute change 2019-20 | Percent change 2018-19 |
|---|---|---|---|---|---|---|
| COMPTON | 521 | 226 | 78 | -65 | -148 | -57 |
| MARIN | 381 | 58 | 19 | -67 | -39 | -85 |
| CHAFFEY | 2,046 | 563 | 132 | -77 | -431 | -72 |
| CABRILLO | 769 | 253 | 56 | -78 | -197 | -67 |
| EVERGREEN VALLEY | 876 | 568 | 88 | -85 | -480 | -35 |
| ALAMEDA | 163 | 42 | 5 | -88 | -37 | -74 |
| REEDLEY | 936 | 30 | 0 | -100 | -30 | -97 |
| SEQUOIAS | 1,571 | 34 | 0 | -100 | -34 | -98 |
| VICTOR VALLEY | 1,375 | 145 | 0 | -100 | -145 | -89 |
| PASADENA CITY | 1,219 | 0 | 0 | N/A | N/A | N/A |
| PORTERVILLE | 387 | 0 | 0 | N/A | N/A | N/A |
| OXNARD | 580 | N/A | 249 | N/A | N/A | N/A |
| COPPER MOUNTAIN | 189 | 89 | N/A | N/A | N/A | -53 |
| MADERA | N/A | N/A | 69 | N/A | N/A | N/A |
| **Total** | **94,865** | **30,024** | **25,461** | **-15** | **-4,563** | **-68** |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall of each year. Data for Copper Mountain College for the fall 2020 term and for Oxnard College for the fall 2019 term was not available in the MIS. Madera is the newest community college in the system that is why 2018 and 2019 data are missing. This table is sorted in descending order of the percent change between fall 2019 and fall 2020 in the number of first-time students starting in a BTL course. N/A is not applicable or not available.

**FIGURE B4**

Share of first-time credit students who take a math course on their first term and as of the next fall

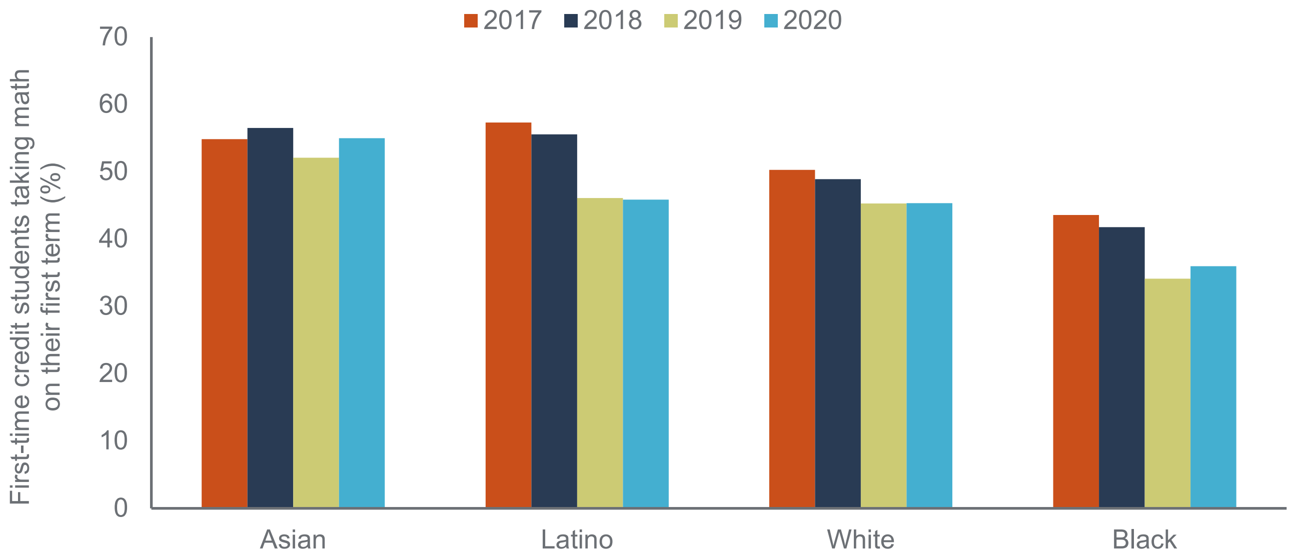



SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to transfer-intending students. First-time credit students are students who took their first credit course in the CCC system in the fall of each year. For example, there were 118,316 first-time transfer intending credit students in fall 2020. Of those students, 46% (or 54,879 students) took a math course during their first term in a community college.

**FIGURE B5**

Share of first-time credit students who take a math course on their first term by race/ethnicity




SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to transfer-intending students. First-time credit students are students who took their first credit course in the CCC system in the fall of each year.

**TABLE B2**

First-time math students starting in corequisite models by race/ethnicity, fall 2020

| | Starting in corequisite models | All first-time math students | Distribution in corequisite models (%) | Distribution all first-time students (%) | Proportionality Index | Share students in corequisite models (%) |
|---|---|---|---|---|---|---|
| Asian | 2,194 | 16,457 | 11 | 13 | 0.84 | 13 |
| Black | 1,024 | 5,716 | 5 | 4 | 1.13 | 18 |
| Latino | 11,221 | 63,997 | 55 | 50 | 1.11 | 18 |
| White | 3,609 | 29,257 | 18 | 23 | 0.78 | 12 |
| **Total** | **20,373** | **128,471** | **100** | **100** | **1.00** | **16** |

First-time math students starting in corequisite models by race/ethnicity, fall 2019

| | Starting in corequisite models | All first-time math students | Distribution in corequisite models (%) | Distribution all first-time students (%) | Proportionality Index | Share students in corequisite modles (%) |
|---|---|---|---|---|---|---|
| Asian | 2,436 | 18,692 | 10 | 13 | 0.79 | 13 |
| Black | 1,203 | 6,524 | 5 | 5 | 1.12 | 18 |
| Latino | 13,193 | 72,825 | 57 | 52 | 1.10 | 18 |
| White | 3,830 | 28,621 | 16 | 20 | 0.81 | 13 |
| **Total** | **23,231** | **141,317** | **100** | **100** | **1.00** | **16** |

SOURCE: Authors' calculations using MIS data.

NOTES: The Proportionality Index compares a group's representation with respect to an educational outcome relative to its representation in the entire cohort of analysis. A PI equal to 1 means that the group is equally represented, a PI greater than 1 means that the group is overrepresented, a PI between 0.86 and 0.99 means near equity; and PI of 0.85 means the group is underrepresented.

**TABLE B3**

First-time math students starting in corequisite models by college, fall 2020

| | Students Starting in corequisite models | Students starting in a TL course | All first-time students | Share in corequisite models of those started in TL course (%) | Share in corequisite models of all students in the cohort (%) |
|---|---|---|---|---|---|
| VICTOR VALLEY | 561 | 926 | 926 | 61 | 61 |
| MERRITT | 92 | 143 | 155 | 64 | 59 |
| CITRUS | 650 | 1,208 | 1,329 | 54 | 49 |
| ALAMEDA | 95 | 191 | 196 | 50 | 48 |
| SEQUOIAS | 633 | 1,359 | 1,359 | 47 | 47 |
| LASSEN | 70 | 107 | 151 | 65 | 46 |
| EL CAMINO | 946 | 1,934 | 2,170 | 49 | 44 |
| MARIN | 90 | 194 | 213 | 46 | 42 |
| COALINGA | 60 | 112 | 144 | 54 | 42 |
| MODESTO | 415 | 847 | 1,040 | 49 | 40 |
| L.A. HARBOR | 222 | 576 | 687 | 39 | 32 |
| PORTERVILLE | 126 | 390 | 390 | 32 | 32 |
| CYPRESS | 519 | 1,341 | 1,684 | 39 | 31 |
| BERKELEY CITY | 137 | 409 | 451 | 33 | 30 |
| CABRILLO | 262 | 811 | 867 | 32 | 30 |
| SANTA MONICA | 887 | 2,260 | 3,014 | 39 | 29 |
| SAN JOSE CITY | 126 | 367 | 451 | 34 | 28 |
| DIABLO VALLEY | 609 | 2,076 | 2,195 | 29 | 28 |
| NORCO | 242 | 716 | 878 | 34 | 28 |
| EAST L.A. | 571 | 879 | 2,099 | 65 | 27 |
| LOS MEDANOS | 334 | 983 | 1,251 | 34 | 27 |
| IRVINE VALLEY | 415 | 1,484 | 1,565 | 28 | 27 |
| CANADA | 103 | 333 | 401 | 31 | 26 |
| CONTRA COSTA | 131 | 343 | 517 | 38 | 25 |
| LANEY | 117 | 305 | 465 | 38 | 25 |
| CUYAMACA | 153 | 563 | 621 | 27 | 25 |
| ORANGE COAST | 547 | 2,027 | 2,250 | 27 | 24 |
| LEMOORE | 86 | 266 | 354 | 32 | 24 |
| PASADENA CITY | 740 | 3,071 | 3,071 | 24 | 24 |
| RIVERSIDE | 487 | 1,892 | 2,053 | 26 | 24 |
| FRESNO CITY | 321 | 1,053 | 1,361 | 30 | 24 |
| FOLSOM LAKE | 220 | 806 | 951 | 27 | 23 |
| SAN MATEO | 154 | 593 | 666 | 26 | 23 |
| MORENO VALLEY | 103 | 354 | 469 | 29 | 22 |

| | Students Starting in corequisite models | Students starting in a TL course | All first-time students | Share in corequisite models of those started in TL course (%) | Share in corequisite models of all students in the cohort (%) |
|---|---|---|---|---|---|
| SOLANO | 242 | 905 | 1,102 | 27 | 22 |
| RIO HONDO | 241 | 911 | 1,099 | 26 | 22 |
| SANTA ANA | 292 | 1,264 | 1,427 | 23 | 20 |
| CANYONS | 448 | 1,925 | 2,217 | 23 | 20 |
| MT. SAN ANTONIO | 595 | 2,271 | 2,972 | 26 | 20 |
| VENTURA | 216 | 1,057 | 1,150 | 20 | 19 |
| SKYLINE | 102 | 466 | 557 | 22 | 18 |
| MT. SAN JACINTO | 395 | 1,891 | 2,161 | 21 | 18 |
| MERCED | 235 | 785 | 1,309 | 30 | 18 |
| YUBA | 90 | 350 | 521 | 26 | 17 |
| REDWOODS | 66 | 371 | 389 | 18 | 17 |
| IMPERIAL VALLEY | 131 | 500 | 784 | 26 | 17 |
| L.A. MISSION | 92 | 373 | 561 | 25 | 16 |
| SACRAMENTO CITY | 233 | 1,008 | 1,426 | 23 | 16 |
| SADDLEBACK | 316 | 1,722 | 1,936 | 18 | 16 |
| OXNARD | 115 | 459 | 708 | 25 | 16 |
| EVERGREEN VALLEY | 151 | 851 | 939 | 18 | 16 |
| AMERICAN RIVER | 287 | 1,239 | 1,876 | 23 | 15 |
| HARTNELL | 173 | 882 | 1,132 | 20 | 15 |
| SAN BERNARDINO | 197 | 951 | 1,328 | 21 | 15 |
| FULLERTON | 368 | 2,211 | 2,588 | 17 | 14 |
| MONTEREY | 84 | 511 | 618 | 16 | 14 |
| COLUMBIA | 28 | 174 | 207 | 16 | 14 |
| WEST VALLEY | 117 | 758 | 874 | 15 | 13 |
| BAKERSFIELD | 276 | 1,617 | 2,074 | 17 | 13 |
| NAPA VALLEY | 86 | 499 | 658 | 17 | 13 |
| SAN FRANCISCO CITY | 188 | 1,100 | 1,451 | 17 | 13 |
| GAVILAN | 65 | 424 | 528 | 15 | 12 |
| GROSSMONT | 220 | 1,457 | 1,814 | 15 | 12 |
| CERRITOS | 328 | 1,910 | 2,718 | 17 | 12 |
| SAN DIEGO MIRAMAR | 105 | 682 | 902 | 15 | 12 |
| LONG BEACH CITY | 325 | 1,857 | 2,893 | 18 | 11 |
| SOUTHWESTERN | 220 | 1,414 | 2,026 | 16 | 11 |
| SAN DIEGO CITY | 116 | 621 | 1,117 | 19 | 10 |
| COASTLINE | 43 | 281 | 434 | 15 | 10 |
| L.A. TRADE-TECH | 46 | 183 | 465 | 25 | 10 |

| | Students Starting in corequisite models | Students starting in a TL course | All first-time students | Share in corequisite models of those started in TL course (%) | Share in corequisite models of all students in the cohort (%) |
|---|---|---|---|---|---|
| SANTA ROSA | 127 | 973 | 1,300 | 13 | 10 |
| CRAFTON HILLS | 68 | 618 | 732 | 11 | 9 |
| REEDLEY | 44 | 476 | 476 | 9 | 9 |
| MISSION | 44 | 421 | 508 | 10 | 9 |
| ALLAN HANCOCK | 79 | 598 | 920 | 13 | 9 |
| GLENDALE | 117 | 803 | 1,398 | 15 | 8 |
| SANTIAGO CANYON | 96 | 1,069 | 1,210 | 9 | 8 |
| FOOTHILL | 69 | 787 | 896 | 9 | 8 |
| SAN DIEGO MESA | 119 | 1,203 | 1,566 | 10 | 8 |
| WOODLAND | 22 | 220 | 294 | 10 | 7 |
| MENDOCINO | 17 | 155 | 230 | 11 | 7 |
| SHASTA | 54 | 502 | 747 | 11 | 7 |
| OHLONE | 74 | 883 | 1,024 | 8 | 7 |
| SAN JOAQUIN DELTA | 136 | 1,353 | 1,928 | 10 | 7 |
| PALOMAR | 174 | 1,766 | 2,582 | 10 | 7 |
| WEST L.A. | 32 | 348 | 521 | 9 | 6 |
| DE ANZA | 133 | 2,074 | 2,312 | 6 | 6 |
| MIRA COSTA | 77 | 1,238 | 1,354 | 6 | 6 |
| SANTA BARBARA CITY | 110 | 1,819 | 1,951 | 6 | 6 |
| MOORPARK | 108 | 1,475 | 1,935 | 7 | 6 |
| GOLDEN WEST | 66 | 1,082 | 1,203 | 6 | 5 |
| LAS POSITAS | 39 | 790 | 864 | 5 | 5 |
| CHABOT | 22 | 991 | 1,093 | 2 | 2 |
| CUESTA | 20 | 955 | 1,151 | 2 | 2 |
| CHAFFEY | 26 | 1,645 | 1,777 | 2 | 1 |
| COSUMNES RIVER | 20 | 996 | 1,488 | 2 | 1 |
| SIERRA | 24 | 1,959 | 2,113 | 1 | 1 |
| ANTELOPE VALLEY | 0 | 1,002 | 1,416 | 0 | 0 |
| BARSTOW | 0 | 254 | 282 | 0 | 0 |
| BUTTE | 0 | 1,089 | 1,267 | 0 | 0 |
| CERRO COSO | 0 | 306 | 366 | 0 | 0 |
| CLOVIS | 0 | 751 | 919 | 0 | 0 |
| COMPTON | 0 | 95 | 173 | 0 | 0 |
| DESERT | 0 | 1,069 | 1,331 | 0 | 0 |
| FEATHER RIVER | 0 | 111 | 139 | 0 | 0 |
| L.A. CITY | 0 | 1,043 | 1,320 | 0 | 0 |

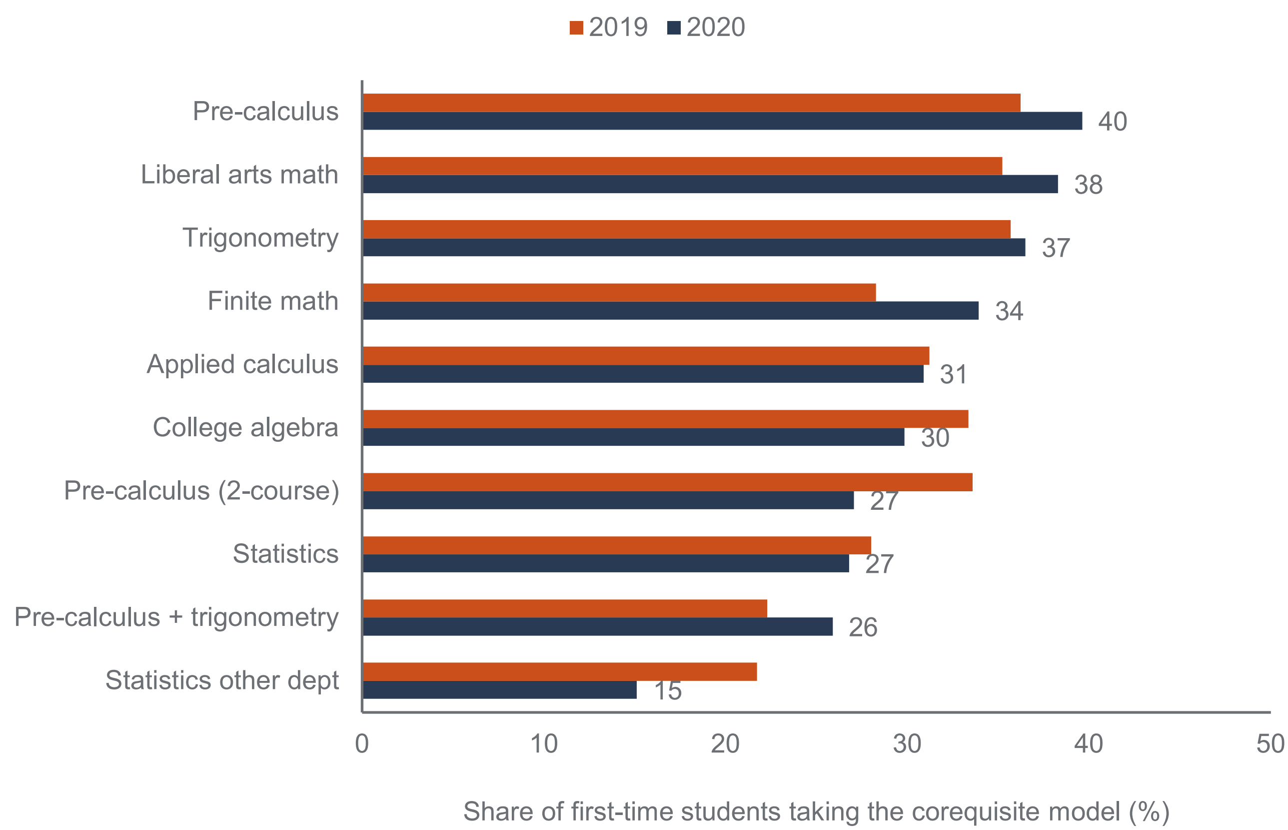
| | Students Starting in corequisite models | Students starting in a TL course | All first-time students | Share in corequisite models of those started in TL course (%) | Share in corequisite models of all students in the cohort (%) |
|---|---|---|---|---|---|
| L.A. PIERCE | 0 | 1,548 | 1,957 | 0 | 0 |
| L.A. VALLEY | 0 | 826 | 1,088 | 0 | 0 |
| LAKE TAHOE | 0 | 77 | 124 | 0 | 0 |
| MADERA | 0 | 122 | 191 | 0 | 0 |
| PALO VERDE | 0 | 165 | 177 | 0 | 0 |
| SISKIYOUS | 0 | 100 | 122 | 0 | 0 |
| SOUTHWEST L.A. | 0 | 222 | 297 | 0 | 0 |
| TAFT | 0 | 232 | 374 | 0 | 0 |
| **Total** | **20,373** | **103,010** | **128,471** | **20** | **16** |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall 2020. Data for Copper Mountain College for the fall 2020 term was not available in the MIS. Table sorted by the share of students starting in a corequisite model among first-time students who started in a transfer-level course. This table is sorted in descending order of the share of students in corequisite models among those who started in a transfer-level course.

**FIGURE B6**

Share of first-time math students who started in a transfer-level course with corequisite support by subject




SOURCE: Authors' calculations using MIS data.

NOTE: Fall of each year. Only colleges that offered corequisite remediation in the given subject are included in this calculation.

**TABLE B4**

Corequisite remediation by math subject, comparison between 2019 and 2020 cohorts

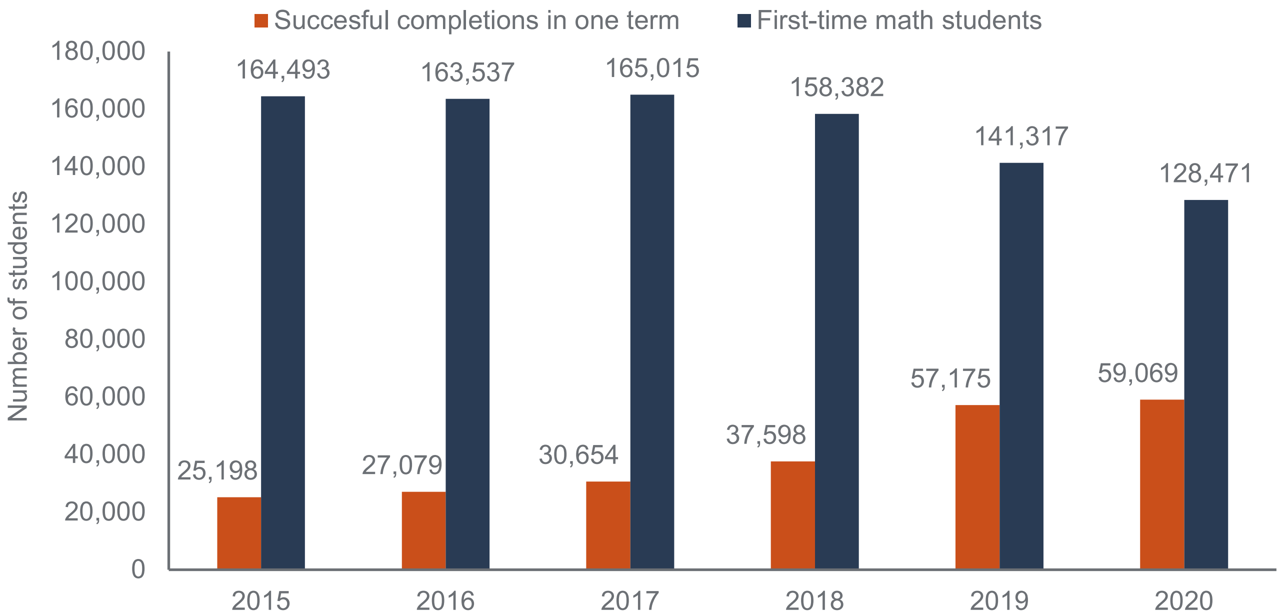
| | TL with corequisite support | | | TL standalone (Colleges with corequisites) | | | TL standalone (Colleges without corequisites) | | | All TL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 | 2020 | Annual change (%) | 2019 | 2020 | Annual change (%) | 2019 | 2020 | Annual change (%) | 2019 | 2020 | Annual change (%) |
| **Number of first-time math students** | | | | | | | | | | | | |
| Applied calculus | 384 | 341 | -11 | 846 | 763 | -10 | 1,028 | 883 | -14 | 2,258 | 1,987 | -12 |
| Finite math | 235 | 246 | 5 | 596 | 479 | -20 | 356 | 296 | -17 | 1,187 | 1,021 | -14 |
| Pre-calculus + trigonometry | 208 | 211 | 1 | 725 | 604 | -17 | 725 | 656 | -10 | 1,658 | 1,471 | -11 |
| Pre-calculus | 1,216 | 1,165 | -4 | 2,140 | 1,775 | -17 | 2,650 | 2,323 | -12 | 6,006 | 5,263 | -12 |
| Pre-calculus (2-course) | 479 | 269 | -44 | 947 | 725 | -23 | 257 | 295 | 15 | 1,683 | 1,289 | -23 |
| Trigonometry | 1,848 | 1,675 | -9 | 3,330 | 2,914 | -12 | 2,538 | 2,260 | -11 | 7,716 | 6,849 | -11 |
| College algebra | 4,226 | 3,314 | -22 | 8,445 | 7,789 | -8 | 1,902 | 1,610 | -15 | 14,573 | 12,713 | -13 |
| Statistics | 13,393 | 11,869 | -11 | 34,424 | 32,423 | -6 | 5,495 | 4,949 | -10 | 53,312 | 49,241 | -8 |
| Liberal arts math | 860 | 895 | 4 | 1,582 | 1,443 | -9 | 4,177 | 4,324 | 4 | 6,619 | 6,662 | 1 |
| **Number of students who successfully completed in one term** | | | | | | | | | | | | |
| Applied calculus | 158 | 167 | 6 | 454 | 494 | 9 | 634 | 603 | -5 | 1,246 | 1,264 | 1 |
| Finite math | 78 | 81 | 4 | 342 | 303 | -11 | 176 | 153 | -13 | 596 | 537 | -10 |
| Pre-calculus + trigonometry | 87 | 105 | 21 | 306 | 377 | 23 | 391 | 390 | 0 | 784 | 872 | 11 |
| Pre-calculus | 479 | 618 | 29 | 1,095 | 1,093 | 0 | 1,307 | 1,423 | 9 | 2,881 | 3,134 | 9 |
| Pre-calculus (2-course) | 261 | 170 | -35 | 613 | 517 | -16 | 109 | 139 | 28 | 983 | 826 | -16 |
| Trigonometry | 722 | 881 | 22 | 1,570 | 1,635 | 4 | 1,037 | 1,150 | 11 | 3,329 | 3,666 | 10 |
| College algebra | 1,549 | 1,581 | 2 | 3,553 | 4,107 | 16 | 693 | 778 | 12 | 5,795 | 6,466 | 12 |
| Statistics | 6,484 | 6,117 | -6 | 18,601 | 18,364 | -1 | 2,811 | 2,900 | 3 | 27,896 | 27,381 | -2 |
| Liberal arts math | 500 | 491 | -2 | 871 | 890 | 2 | 2,357 | 2,544 | 8 | 3,728 | 3,925 | 5 |
| **Success rate (%)** | | | change (pp) | | | change (pp) | | | change (pp) | | | change (pp) |
| Applied calculus | 41 | 49 | 8 | 54 | 65 | 11 | 62 | 68 | 7 | 55 | 64 | 8 |
| Finite math | 33 | 33 | 0 | 57 | 63 | 6 | 49 | 52 | 2 | 50 | 53 | 2 |
| Pre-calculus + trigonometry | 42 | 50 | 8 | 42 | 62 | 20 | 54 | 59 | 6 | 47 | 59 | 12 |
| Pre-calculus | 39 | 53 | 14 | 51 | 62 | 10 | 49 | 61 | 12 | 48 | 60 | 12 |
| Pre-calculus (2-course) | 54 | 63 | 9 | 65 | 71 | 7 | 42 | 47 | 5 | 58 | 64 | 6 |
| Trigonometry | 39 | 53 | 14 | 47 | 56 | 9 | 41 | 51 | 10 | 43 | 54 | 10 |
| College algebra | 37 | 48 | 11 | 42 | 53 | 11 | 36 | 48 | 12 | 40 | 51 | 11 |
| Statistics | 48 | 52 | 3 | 54 | 57 | 3 | 51 | 59 | 7 | 52 | 56 | 3 |
| Liberal arts math | 58 | 55 | -3 | 55 | 62 | 7 | 56 | 59 | 2 | 56 | 59 | 3 |

SOURCE: Authors' calculations using MIS data.

NOTES: First-time math students in each fall cohort.

**FIGURE B7**

Number of first-time math students successfully completing transfer math in one-term over time




SOURCE: Authors' calculations using MIS data.

NOTE: Fall of each year.

**TABLE B5**

Share of students who started in a transfer-level course and successfully complete it in their first attempt (%)

| | 2019 | 2020 | PP change | % change in successful completions | % change in cohort size | PP change in TL access rate |
|---|---|---|---|---|---|---|
| SOUTHWEST L.A. | 33 | 55 | 22 | -13 | -48 | -5 |
| BARSTOW | 56 | 78 | 21 | -6 | -31 | 1 |
| SAN MATEO | 56 | 76 | 21 | 4 | -24 | 1 |
| PALO VERDE | 38 | 57 | 19 | 109 | 41 | 1 |
| L.A. PIERCE | 48 | 66 | 17 | 19 | -12 | -2 |
| COMPTON | 40 | 56 | 16 | -20 | -43 | 12 |
| EAST L.A. | 41 | 56 | 15 | -9 | -33 | -15 |
| MODESTO | 46 | 60 | 14 | 13 | -14 | -2 |
| CRAFTON HILLS | 50 | 64 | 14 | 10 | -14 | 1 |
| LANEY | 53 | 67 | 14 | 19 | -5 | -9 |
| SANTIAGO CANYON | 40 | 54 | 14 | 14 | -15 | 0 |
| CHABOT | 45 | 59 | 13 | 21 | -7 | 5 |
| IRVINE VALLEY | 61 | 73 | 12 | 7 | -11 | 3 |
| SKYLINE | 66 | 78 | 12 | 4 | -12 | 10 |
| WEST VALLEY | 57 | 69 | 12 | 19 | -1 | 2 |
| SAN DIEGO CITY | 46 | 58 | 12 | 1 | -20 | -12 |
| L.A. VALLEY | 44 | 55 | 11 | 6 | -16 | 1 |
| GOLDEN WEST | 55 | 67 | 11 | 7 | -11 | -4 |
| FOOTHILL | 64 | 74 | 11 | 8 | -7 | 0 |

| | 2019 | 2020 | PP change | % change in successful completions | % change in cohort size | PP change in TL access rate |
|---|---|---|---|---|---|---|
| WEST L.A. | 41 | 51 | 10 | -1 | -21 | -12 |
| EL CAMINO | 41 | 51 | 10 | 10 | -12 | 3 |
| VICTOR VALLEY | 41 | 51 | 10 | -5 | -24 | 11 |
| L.A. CITY | 32 | 42 | 10 | 36 | 3 | -10 |
| L.A. TRADE-TECH | 38 | 48 | 10 | -10 | -29 | -6 |
| PASADENA CITY | 47 | 57 | 10 | 4 | -14 | 0 |
| EVERGREEN VALLEY | 56 | 65 | 10 | 50 | 27 | 37 |
| MOORPARK | 53 | 62 | 10 | 36 | 15 | 0 |
| MT. SAN JACINTO | 52 | 62 | 10 | 10 | -7 | -2 |
| CANADA | 60 | 70 | 9 | -1 | -14 | 9 |
| GLENDALE | 53 | 62 | 9 | 14 | -3 | 5 |
| IMPERIAL VALLEY | 53 | 63 | 9 | 17 | 0 | -18 |
| RIVERSIDE | 39 | 48 | 9 | 37 | 12 | 0 |
| MARIN | 50 | 59 | 9 | -35 | -45 | 5 |
| ORANGE COAST | 54 | 63 | 9 | 11 | -5 | -3 |
| DE ANZA | 68 | 77 | 9 | 21 | 7 | 1 |
| CANYONS | 61 | 69 | 8 | 19 | 5 | -4 |
| SANTA ANA | 34 | 43 | 8 | -8 | -26 | -2 |
| SAN FRANCISCO CITY | 60 | 68 | 8 | 9 | -4 | 7 |
| FEATHER RIVER | 46 | 54 | 8 | 50 | 28 | 21 |
| CHAFFEY | 37 | 45 | 8 | 17 | -3 | 17 |
| SANTA MONICA | 41 | 50 | 8 | 15 | -3 | 3 |
| SAN DIEGO MESA | 60 | 68 | 8 | -7 | -18 | -1 |
| L.A. MISSION | 35 | 43 | 8 | -19 | -34 | -13 |
| FULLERTON | 46 | 53 | 7 | 14 | -2 | 7 |
| MT. SAN ANTONIO | 43 | 51 | 7 | 20 | 2 | 3 |
| SAN JOSE CITY | 51 | 58 | 7 | -10 | -21 | 1 |
| MORENO VALLEY | 29 | 36 | 7 | -40 | -52 | -8 |
| BERKELEY CITY | 60 | 67 | 7 | -3 | -13 | -2 |
| CABRILLO | 44 | 50 | 7 | 16 | 0 | 17 |
| CERRITOS | 37 | 43 | 7 | 13 | -4 | -3 |
| COASTLINE | 58 | 65 | 7 | -6 | -15 | 3 |
| GROSSMONT | 52 | 58 | 6 | -1 | -12 | -4 |
| SANTA ROSA | 52 | 58 | 6 | 11 | -2 | -3 |
| SOUTHWESTERN | 50 | 56 | 6 | -5 | -15 | -5 |
| DESERT | 49 | 55 | 6 | 80 | 61 | 9 |
| OHLONE | 68 | 74 | 6 | 0 | -7 | 3 |
| CITRUS | 57 | 63 | 6 | -10 | -18 | -2 |
| COLUMBIA | 69 | 75 | 6 | -8 | -15 | 7 |
| MERRITT | 57 | 62 | 6 | -16 | -24 | 4 |
| SAN JOAQUIN DELTA | 62 | 67 | 5 | 9 | 0 | -1 |
| LONG BEACH CITY | 38 | 43 | 5 | 27 | 12 | 8 |

| | 2019 | 2020 | PP change | % change in successful completions | % change in cohort size | PP change in TL access rate |
|---|---|---|---|---|---|---|
| SAN DIEGO MIRAMAR | 64 | 69 | 5 | -9 | -15 | 5 |
| PALOMAR | 48 | 53 | 5 | 9 | -1 | 5 |
| AMERICAN RIVER | 60 | 64 | 4 | 9 | 2 | 1 |
| LAS POSITAS | 55 | 59 | 4 | 5 | -2 | 8 |
| COSUMNES RIVER | 49 | 53 | 4 | 12 | 4 | 1 |
| CYPRESS | 48 | 52 | 4 | 4 | -4 | -1 |
| FRESNO CITY | 45 | 49 | 4 | -32 | -37 | -10 |
| SOLANO | 51 | 55 | 4 | 37 | 27 | 3 |
| MISSION | 61 | 64 | 4 | 12 | 5 | 3 |
| REEDLEY | 51 | 55 | 4 | -56 | -59 | 3 |
| NAPA VALLEY | 49 | 53 | 3 | -3 | -9 | -3 |
| SACRAMENTO CITY | 51 | 54 | 3 | 5 | -1 | 5 |
| BAKERSFIELD | 47 | 49 | 3 | 25 | 18 | -1 |
| GAVILAN | 50 | 53 | 2 | 17 | 11 | 18 |
| SAN BERNARDINO | 39 | 41 | 2 | -17 | -22 | 14 |
| DIABLO VALLEY | 65 | 67 | 2 | 0 | -3 | 0 |
| SADDLEBACK | 54 | 57 | 2 | 28 | 23 | 4 |
| OXNARD | 62 | 64 | 2 | -16 | -19 | N/A |
| MONTEREY | 49 | 51 | 2 | -5 | -8 | 3 |
| VENTURA | 63 | 64 | 2 | -5 | -8 | 1 |
| CONTRA COSTA | 65 | 67 | 2 | -24 | -26 | 2 |
| CUYAMACA | 67 | 69 | 1 | 0 | -2 | 7 |
| ANTELOPE VALLEY | 57 | 58 | 1 | -1 | -3 | 10 |
| MIRA COSTA | 64 | 65 | 1 | 15 | 13 | 4 |
| ALAMEDA | 64 | 65 | 1 | -24 | -25 | 12 |
| ALLAN HANCOCK | 57 | 58 | 1 | -7 | -8 | 9 |
| REDWOODS | 56 | 56 | 0 | -29 | -29 | 0 |
| SEQUOIAS | 51 | 51 | 0 | 10 | 10 | 3 |
| MERCED | 52 | 51 | 0 | -5 | -4 | 3 |
| FOLSOM LAKE | 61 | 60 | 0 | 1 | 1 | 0 |
| CERRO COSO | 54 | 53 | -1 | 10 | 12 | -1 |
| SANTA BARBARA CITY | 58 | 57 | -1 | 0 | 1 | -2 |
| SISKIYOUS | 72 | 71 | -1 | -43 | -42 | -7 |
| RIO HONDO | 43 | 42 | -1 | -19 | -17 | 7 |
| CLOVIS | 62 | 61 | -1 | -33 | -32 | -5 |
| YUBA | 45 | 43 | -1 | -4 | -1 | 4 |
| LOS MEDANOS | 64 | 62 | -1 | -20 | -18 | -5 |
| BUTTE | 55 | 53 | -2 | -7 | -4 | 2 |
| L.A. HARBOR | 47 | 45 | -2 | -34 | -31 | 5 |
| NORCO | 58 | 55 | -3 | -23 | -18 | -3 |
| LAKE TAHOE | 64 | 60 | -4 | -8 | -1 | 16 |
| SIERRA | 60 | 56 | -5 | 3 | 11 | 10 |

| | 2019 | 2020 | PP change | % change in successful completions | % change in cohort size | PP change in TL access rate |
|---|---|---|---|---|---|---|
| PORTERVILLE | 60 | 54 | -6 | -29 | -21 | 0 |
| HARTNELL | 59 | 53 | -6 | -9 | 2 | 4 |
| CUESTA | 59 | 52 | -7 | -17 | -7 | 2 |
| LEMOORE | 58 | 50 | -8 | -39 | -30 | -2 |
| WOODLAND | 57 | 49 | -8 | -14 | 1 | 0 |
| COALINGA | 64 | 54 | -9 | -53 | -45 | -9 |
| MENDOCINO | 70 | 59 | -11 | -37 | -25 | -4 |
| SHASTA | 58 | 46 | -12 | -7 | 17 | 6 |
| TAFT | 55 | 41 | -13 | -46 | -29 | -3 |
| LASSEN | 59 | 36 | -24 | -60 | -32 | -9 |
| **Total** | **51** | **57** | **6** | **3** | **-7** | **1** |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall of each year. Restricted to students who started in a transfer-level course. This table is sorted in descending order of the 2019-2020 percentage point difference in one term throughput rate.

**TABLE B6**

First-time math students who successfully completed in one term by race/ethnicity

| | 2019 | | | 2020 | | | Change 2019-20 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Successful completions | First-time math takers | One-term throughput rate (%) | Successful completions | First-time math takers | One-term throughput rate (%) | Successful completions (%) | First-time math takers (%) | One-term throughput rate (pp) |
| Asian | 10,755 | 18,692 | 58 | 10,510 | 16,457 | 64 | -2 | -12 | 6 |
| Black | 1,751 | 6,524 | 27 | 1,775 | 5,716 | 31 | 1 | -12 | 4 |
| Latino | 24,098 | 72,825 | 33 | 24,708 | 63,997 | 39 | 3 | -12 | 6 |
| White | 14,208 | 28,621 | 50 | 15,599 | 29,257 | 53 | 10 | 2 | 4 |
| Total | 57,175 | 141,317 | 40 | 59,069 | 128,471 | 46 | 3 | -9 | 6 |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall of each year.

**TABLE B7**

Share of first-time math students starting in a below transfer-level course (%)

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Category |
|---|---|---|---|---|---|---|---|
| COPPER MOUNTAIN | 84 | 80 | 83 | 76 | 43 | N/A | |
| L.A. TRADE-TECH | 98 | 96 | 94 | 81 | 54 | 61 | Low access into TL |
| EAST L.A. | 86 | 88 | 90 | 73 | 43 | 58 | Low access into TL |
| COMPTON | 94 | 95 | 92 | 91 | 58 | 45 | Low access into TL |
| SAN DIEGO CITY | 79 | 79 | 81 | 75 | 33 | 44 | Low access into TL |
| GLENDALE | 72 | 69 | 64 | 51 | 47 | 43 | Low access into TL |
| MERCED | 80 | 77 | 77 | 67 | 43 | 40 | Low access into TL |
| TAFT | 80 | 80 | 78 | 57 | 35 | 38 | Low access into TL |
| LAKE TAHOE | 86 | 92 | 80 | 68 | 54 | 38 | Low access into TL |

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Category |
|---|---|---|---|---|---|---|---|
| IMPERIAL VALLEY | 92 | 87 | 89 | 87 | 18 | 36 | Low access into TL |
| MADERA | N/A | N/A | N/A | N/A | N/A | 36 | Low access into TL |
| LONG BEACH CITY | 82 | 79 | 79 | 68 | 44 | 36 | Low access into TL |
| COASTLINE | 71 | 75 | 73 | 58 | 38 | 35 | Low access into TL |
| OXNARD | 80 | 78 | 71 | 61 | N/A | 35 | Low access into TL |
| ALLAN HANCOCK | 82 | 78 | 72 | 65 | 44 | 35 | Low access into TL |
| LANEY | 71 | 70 | 64 | 62 | 25 | 34 | Low access into TL |
| AMERICAN RIVER | 84 | 82 | 90 | 68 | 35 | 34 | Low access into TL |
| CONTRA COSTA | 66 | 67 | 56 | 55 | 35 | 34 | Low access into TL |
| L.A. MISSION | 88 | 86 | 67 | 64 | 20 | 34 | Low access into TL |
| WEST L.A. | 85 | 85 | 86 | 85 | 21 | 33 | Low access into TL |
| COSUMNES RIVER | 78 | 80 | 86 | 72 | 34 | 33 | Low access into TL |
| YUBA | 95 | 94 | 93 | 77 | 37 | 33 | Low access into TL |
| SHASTA | 68 | 67 | 56 | 59 | 39 | 33 | Low access into TL |
| MENDOCINO | 82 | 82 | 86 | 82 | 29 | 33 | Low access into TL |
| PALOMAR | 79 | 79 | 59 | 53 | 36 | 32 | Medium access into TL |
| SOUTHWESTERN | 91 | 87 | 82 | 64 | 25 | 30 | Medium access into TL |
| SAN JOAQUIN DELTA | 86 | 87 | 77 | 78 | 29 | 30 | Medium access into TL |
| CERRITOS | 86 | 84 | 82 | 69 | 27 | 30 | Medium access into TL |
| SACRAMENTO CITY | 91 | 91 | 92 | 68 | 34 | 29 | Medium access into TL |
| ANTELOPE VALLEY | 87 | 85 | 85 | 83 | 39 | 29 | Medium access into TL |
| LASSEN | 94 | 85 | 77 | 79 | 20 | 29 | Medium access into TL |
| SAN BERNARDINO | 93 | 94 | 92 | 94 | 42 | 28 | Medium access into TL |
| SOUTHWEST L.A. | 92 | 93 | 89 | 93 | 21 | 25 | Medium access into TL |
| WOODLAND | 88 | 93 | 87 | 75 | 26 | 25 | Medium access into TL |
| SANTA ROSA | 69 | 71 | 68 | 70 | 22 | 25 | Medium access into TL |
| SANTA MONICA | 67 | 61 | 67 | 69 | 28 | 25 | Medium access into TL |
| LEMOORE | 79 | 86 | 82 | 67 | 23 | 25 | Medium access into TL |
| MORENO VALLEY | 95 | 91 | 60 | 54 | 17 | 25 | Medium access into TL |
| SAN DIEGO MIRAMAR | 58 | 53 | 49 | 45 | 30 | 24 | Medium access into TL |
| SAN FRANCISCO CITY | 68 | 66 | 64 | 59 | 31 | 24 | Medium access into TL |
| NAPA VALLEY | 73 | 68 | 68 | 60 | 21 | 24 | Medium access into TL |
| L.A. VALLEY | 91 | 79 | 72 | 72 | 25 | 24 | Medium access into TL |
| MOORPARK | 61 | 60 | 61 | 52 | 23 | 24 | Medium access into TL |
| MT. SAN ANTONIO | 74 | 72 | 75 | 54 | 27 | 24 | Medium access into TL |
| SAN DIEGO MESA | 56 | 55 | 53 | 40 | 22 | 23 | Medium access into TL |
| FRESNO CITY | 75 | 71 | 64 | 63 | 12 | 23 | Medium access into TL |
| COALINGA | 86 | 80 | 76 | 67 | 13 | 22 | Medium access into TL |
| HARTNELL | 89 | 85 | 85 | 58 | 26 | 22 | Medium access into TL |
| BAKERSFIELD | 83 | 81 | 75 | 61 | 21 | 22 | Medium access into TL |
| LOS MEDANOS | 66 | 45 | 37 | 29 | 17 | 21 | Medium access into TL |
| L.A. CITY | 89 | 89 | 89 | 83 | 11 | 21 | Medium access into TL |
| L.A. PIERCE | 78 | 79 | 63 | 64 | 19 | 21 | Medium access into TL |
| CYPRESS | 74 | 71 | 69 | 66 | 19 | 20 | Medium access into TL |

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Category |
|---|---|---|---|---|---|---|---|
| FEATHER RIVER | 68 | 68 | 71 | 58 | 41 | 20 | Medium access into TL |
| GAVILAN | 86 | 80 | 79 | 64 | 38 | 20 | Medium access into TL |
| DESERT | 80 | 81 | 81 | 65 | 29 | 20 | Medium access into TL |
| GROSSMONT | 74 | 68 | 66 | 50 | 16 | 20 | Medium access into TL |
| SAN JOSE CITY | 80 | 79 | 71 | 70 | 19 | 19 | Medium access into TL |
| MODESTO | 93 | 91 | 90 | 70 | 17 | 19 | Medium access into TL |
| NORCO | 91 | 88 | 60 | 47 | 15 | 18 | Medium access into TL |
| CLOVIS | 57 | 55 | 54 | 48 | 13 | 18 | Medium access into TL |
| SISKIYOUS | 86 | 35 | 34 | 20 | 11 | 18 | Medium access into TL |
| SOLANO | 65 | 62 | 63 | 51 | 21 | 18 | Medium access into TL |
| MONTEREY | 83 | 84 | 81 | 70 | 20 | 17 | Medium access into TL |
| MISSION | 72 | 71 | 56 | 72 | 20 | 17 | Medium access into TL |
| RIO HONDO | 93 | 83 | 76 | 72 | 24 | 17 | Medium access into TL |
| CUESTA | 70 | 71 | 66 | 43 | 19 | 17 | Medium access into TL |
| CANADA | 63 | 60 | 55 | 55 | 26 | 17 | Medium access into TL |
| CERRO COSO | 87 | 78 | 81 | 82 | 16 | 16 | Medium access into TL |
| SKYLINE | 79 | 65 | 49 | 42 | 27 | 16 | Medium access into TL |
| L.A. HARBOR | 84 | 86 | 80 | 70 | 21 | 16 | Medium access into TL |
| COLUMBIA | 81 | 81 | 79 | 48 | 23 | 16 | Medium access into TL |
| CRAFTON HILLS | 81 | 74 | 59 | 38 | 17 | 16 | Medium access into TL |
| FOLSOM LAKE | 75 | 77 | 77 | 56 | 16 | 15 | Medium access into TL |
| FULLERTON | 60 | 58 | 58 | 54 | 21 | 15 | Medium access into TL |
| BUTTE | 76 | 78 | 68 | 57 | 16 | 14 | Medium access into TL |
| OHLONE | 84 | 81 | 76 | 64 | 16 | 14 | Medium access into TL |
| WEST VALLEY | 79 | 78 | 73 | 73 | 15 | 13 | Medium access into TL |
| CANYONS | 82 | 63 | 59 | 55 | 9 | 13 | Medium access into TL |
| MT. SAN JACINTO | 85 | 82 | 82 | 56 | 10 | 12 | Medium access into TL |
| FOOTHILL | 41 | 46 | 45 | 14 | 12 | 12 | Medium access into TL |
| SANTIAGO CANYON | 63 | 62 | 56 | 44 | 11 | 12 | Medium access into TL |
| SANTA ANA | 69 | 63 | 61 | 57 | 9 | 11 | Medium access into TL |
| SADDLEBACK | 68 | 75 | 73 | 58 | 15 | 11 | Medium access into TL |
| SAN MATEO | 64 | 55 | 52 | 47 | 12 | 11 | Medium access into TL |
| EL CAMINO | 85 | 85 | 81 | 73 | 14 | 11 | Medium access into TL |
| DE ANZA | 69 | 70 | 66 | 26 | 11 | 10 | Medium access into TL |
| GOLDEN WEST | 63 | 64 | 55 | 53 | 6 | 10 | Medium access into TL |
| BARSTOW | 85 | 88 | 85 | 72 | 11 | 10 | Medium access into TL |
| ORANGE COAST | 60 | 63 | 62 | 54 | 7 | 10 | Medium access into TL |
| EVERGREEN VALLEY | 81 | 80 | 71 | 60 | 46 | 9 | High access into TL |
| CUYAMACA | 75 | 44 | 37 | 23 | 16 | 9 | High access into TL |
| CHABOT | 72 | 74 | 69 | 61 | 15 | 9 | High access into TL |
| BERKELEY CITY | 63 | 58 | 58 | 52 | 7 | 9 | High access into TL |
| CITRUS | 82 | 82 | 78 | 44 | 7 | 9 | High access into TL |
| MARIN | 79 | 79 | 79 | 78 | 14 | 9 | High access into TL |
| MIRA COSTA | 60 | 57 | 48 | 37 | 13 | 9 | High access into TL |

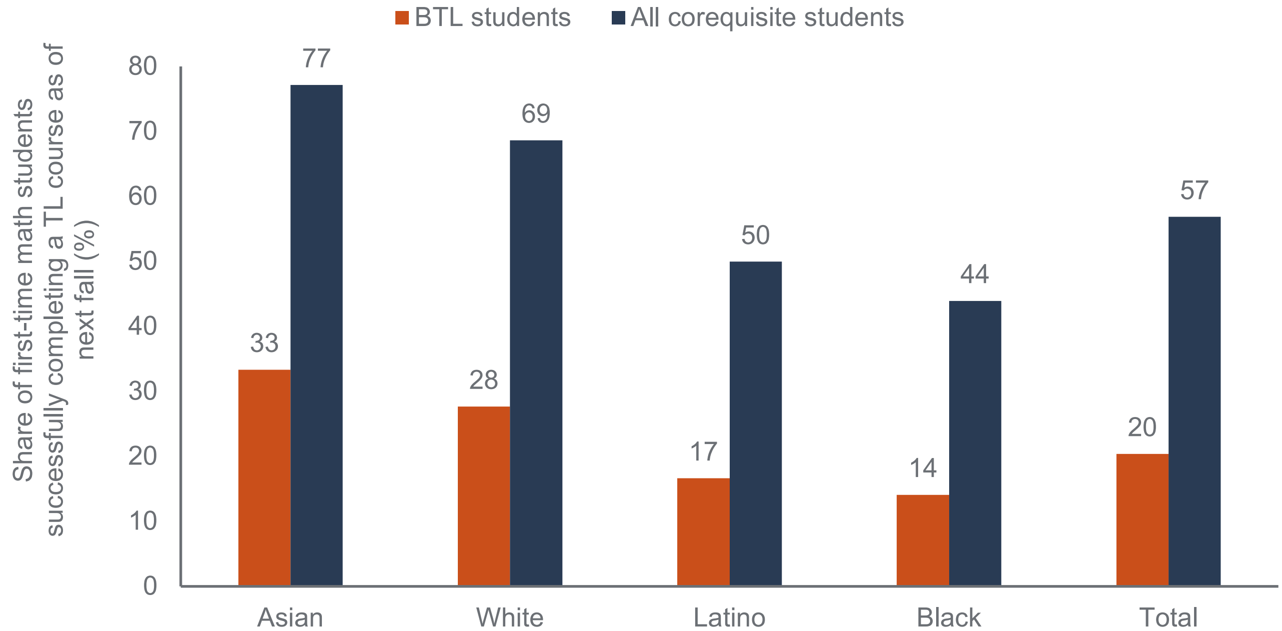
| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Category |
|---|---|---|---|---|---|---|---|
| LAS POSITAS | 70 | 68 | 64 | 48 | 17 | 9 | High access into TL |
| VENTURA | 67 | 64 | 60 | 52 | 9 | 8 | High access into TL |
| RIVERSIDE | 91 | 90 | 59 | 49 | 8 | 8 | High access into TL |
| MERRITT | 83 | 81 | 82 | 76 | 12 | 8 | High access into TL |
| CHAFFEY | 85 | 87 | 87 | 86 | 25 | 7 | High access into TL |
| SIERRA | 64 | 53 | 46 | 39 | 17 | 7 | High access into TL |
| PALO VERDE | 95 | 93 | 92 | 83 | 8 | 7 | High access into TL |
| SANTA BARBARA CITY | 59 | 47 | 46 | 49 | 5 | 7 | High access into TL |
| CABRILLO | 77 | 80 | 78 | 56 | 24 | 6 | High access into TL |
| DIABLO VALLEY | 46 | 44 | 41 | 38 | 5 | 5 | High access into TL |
| IRVINE VALLEY | 54 | 55 | 44 | 42 | 8 | 5 | High access into TL |
| REDWOODS | 70 | 71 | 73 | 44 | 5 | 5 | High access into TL |
| ALAMEDA | 73 | 66 | 69 | 44 | 14 | 3 | High access into TL |
| PASADENA CITY | 79 | 77 | 64 | 41 | 0 | 0 | High access into TL |
| PORTERVILLE | 78 | 71 | 67 | 61 | 0 | 0 | High access into TL |
| REEDLEY | 82 | 83 | 70 | 64 | 3 | 0 | High access into TL |
| SEQUOIAS | 85 | 85 | 84 | 81 | 3 | 0 | High access into TL |
| VICTOR VALLEY | 95 | 94 | 90 | 79 | 11 | 0 | High access into TL |
| **Total** | **76** | **74** | **70** | **60** | **21** | **20** | |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall of each year. BTL is below transfer-level. "Higher access" are colleges where the share of first-time math students starting directly in a transfer-level course is one standard deviation above the system-wide share (i.e., 91% or higher) while "lower access" are colleges where the share of first-time math students starting directly in a transfer-level course is one standard deviation below (i.e., 68% or lower). "Medium access" are colleges where the share of first-time math students starting directly in a transfer-level course is between 68% and 91%. Fall 2020 data for Copper Mountain was not available in the MIS. This table is sorted in descending order of the share of first-time math students starting in a BTL course. N/A is not applicable or not available.

**FIGURE B8**

Share of first-time math students successfully completing a TL course as of next fall by race/ethnicity, students who started in a below transfer-level course versus students who started in a corequisite model

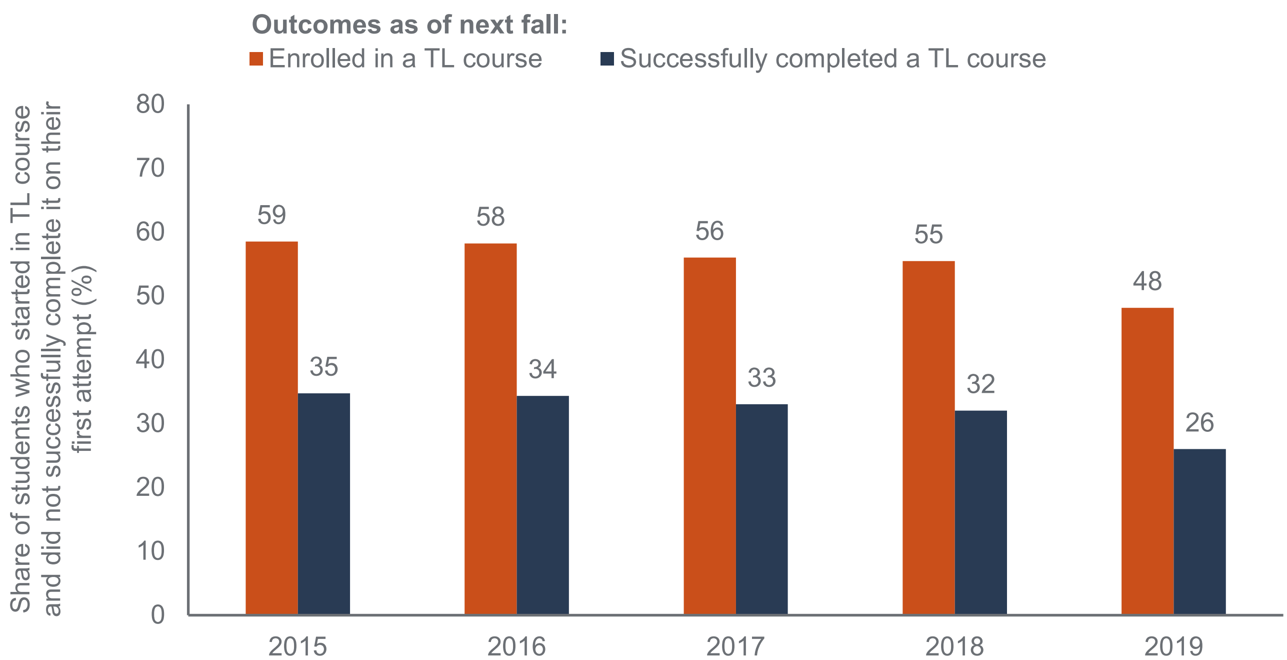



SOURCE: Authors' calculations using MIS data.

NOTE: Fall 2019 cohort. Restricted to students with a transfer goal. For reference, there were 16,700 corequisite students and 18,700 students who started in a below transfer-level course.

**FIGURE B9**

Outcomes of students who started in TL course and did not complete it on their first attempt as of the following fall

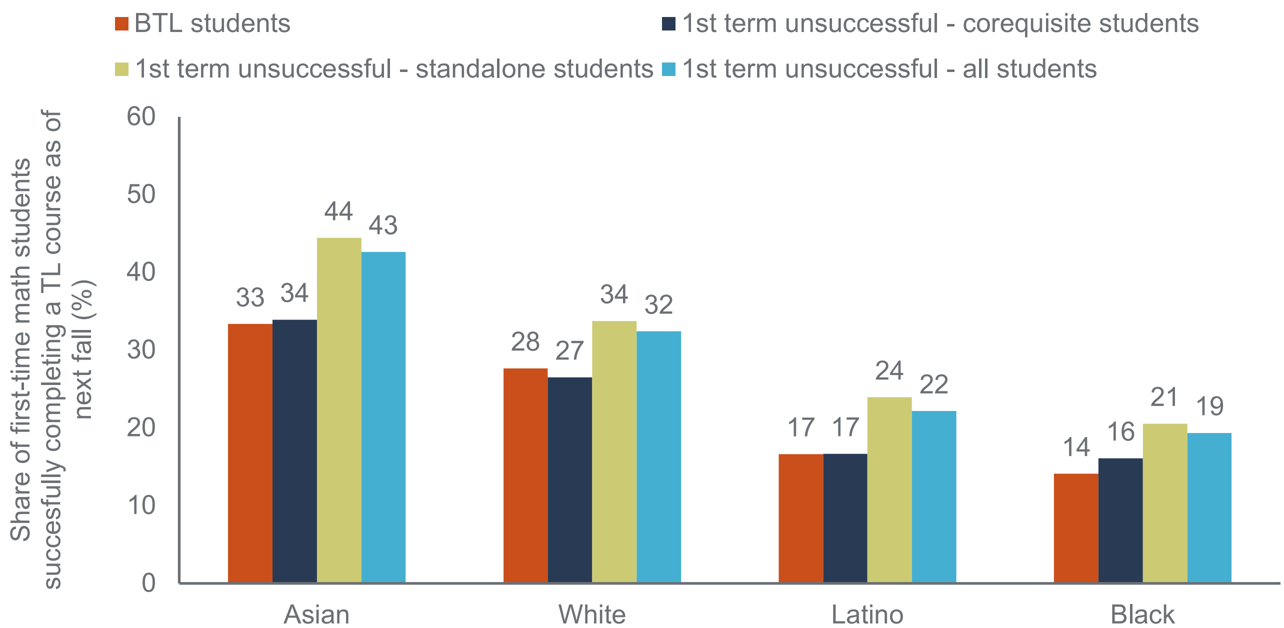



SOURCE: Authors' calculations using MIS data.

NOTE: Fall of each year. Restricted to students with a transfer goal. For reference, there were 19,800 students in the 2018 cohort who started in a transfer-level course and did not complete it and 39,700 students in the 2019 cohort.

## FIGURE B10

Fall-to-fall throughput rates by race/ethnicity, BTL versus students who started in transfer-level course and did not successfully complete it on their first attempt (no controls)




SOURCE: Authors' calculations using MIS data.

NOTE: Fall 2019 cohort. Restricted to students with a transfer goal. For reference, of all 1st term unsuccessful students, 8,900 took their transfer-level course with corequisite support the first time around and 30,700 without it.

## TABLE B8

Students' characteristics and outcomes: One-term completers, students who started in a TL course but did not successfully complete in their first attempt, and BTL students

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **One-term completers** | | | **Students who started in a TL course but did not successfully complete in their first attempt** | | | | | **Non regression-adjusted differences** | |
| | **All** | **Standalone** | **Corequisite** | **All** | **Standalone** | **Corequisite** | **BTL students** | **Total transfer-intending cohort** | **(7)-(4)** | **(7)-(6)** |
| **Number of transfer-intending students - - Fall 2019** | **43,220** | **35,465** | **7,755** | **39,669** | **30,748** | **8,921** | **18,751** | **101,640** | | |
| One-year throughput rate | 100 | 100 | 100 | 18 | 20 | 13 | 15 | 52 | -3 | 2 |
| Fall-to-fall throughput rate | 100 | 100 | 100 | 26 | 28 | 19 | 20 | 56 | -6 | 1 |
| Latino | 42 | 41 | 49 | 59 | 57 | 64 | 59 | 54 | 0 | -5 |
| White | 25 | 26 | 21 | 17 | 17 | 14 | 17 | 19 | 1 | 4 |
| Asian | 20 | 20 | 17 | 10 | 11 | 8 | 9 | 13 | -1 | 2 |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | One-term completers | | | Students who started in a TL course but did not successfully complete in their first attempt | | | | | Non regression-adjusted differences | |
| | All | Standalone | Corequisite | All | Standalone | Corequisite | BTL students | Total transfer-intending cohort | (7)-(4) | (7)-(6) |
| Black | 3 | 3 | 4 | 5 | 5 | 7 | 6 | 5 | 1 | 0 |
| Other | 11 | 11 | 10 | 9 | 10 | 9 | 9 | 10 | -1 | 0 |
| Native American | 0 | 0 | 5 | 0 | 0 | 4 | 0 | 1 | 0 | -3 |
| Pacific Islander | 0 | 0 | 5 | 1 | 1 | 4 | 0 | 1 | 0 | -3 |
| Two or more races | 5 | 5 | 1 | 4 | 4 | 1 | 4 | 4 | -1 | 3 |
| Unknown | 5 | 5 | 0 | 4 | 4 | 0 | 4 | 4 | 0 | 4 |
| Female | 53 | 53 | 54 | 49 | 49 | 50 | 51 | 51 | 2 | 1 |
| Male | 45 | 46 | 45 | 49 | 49 | 49 | 47 | 47 | -2 | -1 |
| Unknown gender | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| U.S. citizen | 87 | 86 | 88 | 91 | 91 | 91 | 88 | 88 | -3 | -3 |
| Non traditional student | 7 | 7 | 8 | 5 | 5 | 4 | 15 | 7 | 10 | 11 |
| DSPS students | 3 | 3 | 5 | 4 | 4 | 6 | 7 | 4 | 3 | 1 |
| EOP&S students | 8 | 8 | 10 | 9 | 8 | 11 | 10 | 9 | 1 | -2 |
| LEP students | 2 | 2 | 2 | 1 | 1 | 1 | 4 | 2 | 3 | 3 |
| Special program participation | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 0 | -1 |
| Prior dual enrollment | 15 | 15 | 12 | 12 | 12 | 10 | 8 | 12 | -3 | -2 |
| First generation students | 34 | 33 | 37 | 41 | 41 | 41 | 44 | 38 | 2 | 3 |
| First generation missing | 27 | 26 | 30 | 31 | 29 | 37 | 34 | 30 | 4 | -2 |
| Edu: Not a HS graduate | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Edu: Adult education student | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Edu: HS diploma | 88 | 88 | 89 | 93 | 93 | 94 | 86 | 90 | -7 | -7 |
| Edu: GED | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 2 | 2 | 2 |
| Edu: California High School Proficiency Cert | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Edu: Foreign HS degree | 4 | 4 | 3 | 1 | 1 | 1 | 4 | 3 | 3 | 3 |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | One-term completers | | | Students who started in a TL course but did not successfully complete in their first attempt | | | | | Non regression-adjusted differences | |
| | All | Standalone | Corequisite | All | Standalone | Corequisite | BTL students | Total transfer-intending cohort | (7)-(4) | (7)-(6) |
| Edu: AA | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Edu: BA | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Edu: Unknown | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 0 |
| First-time credit students | 63 | 63 | 65 | 68 | 67 | 71 | 58 | 64 | -10 | -13 |
| BSTEM Major | 39 | 40 | 35 | 36 | 37 | 34 | 32 | 37 | -4 | -2 |
| Full time | 85 | 85 | 86 | 78 | 77 | 81 | 68 | 79 | -10 | -14 |
| GPA>3.0 no math | 76 | 77 | 70 | 35 | 36 | 31 | 40 | 53 | 5 | 10 |
| GPA>3.0 no math missing | 0 | 0 | 0 | 5 | 4 | 6 | 4 | 3 | 0 | -1 |
| Persisted into spring | 94 | 94 | 94 | 79 | 79 | 77 | 79 | 85 | 0 | 2 |
| Persisted into fall | 79 | 78 | 80 | 61 | 62 | 57 | 60 | 68 | -1 | 3 |
| GPA_3_Spring | 72 | 73 | 66 | 35 | 36 | 30 | 37 | 51 | 2 | 7 |
| GPA_3_Spring_missing | 6 | 6 | 6 | 22 | 21 | 24 | 22 | 15 | 0 | -2 |
| GPA_3_Fall | 57 | 57 | 52 | 27 | 29 | 22 | 29 | 40 | 2 | 7 |
| GPA_3_Fall_missing | 21 | 22 | 20 | 39 | 38 | 43 | 40 | 32 | 1 | -3 |
| **Units earned as a share of units attempted during first term (excluding math courses)** | | | | | | | | | 0 | 0 |
| 25% or less | 2 | 2 | 3 | 23 | 22 | 28 | 21 | 14 | -2 | -7 |
| 25-50% | 4 | 3 | 6 | 13 | 13 | 15 | 10 | 9 | -3 | -5 |
| 50-75% | 8 | 8 | 8 | 14 | 14 | 12 | 9 | 10 | -5 | -3 |
| More than 75% | 84 | 85 | 81 | 47 | 48 | 42 | 52 | 64 | 5 | 10 |
| missing | 2 | 2 | 3 | 3 | 3 | 3 | 8 | 4 | 5 | 5 |
| **Units earned as a share of units attempted during following Spring** | | | | | | | | | 0 | 0 |
| 25% or less | 7 | 7 | 10 | 23 | 22 | 26 | 21 | 16 | -2 | -4 |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | One-term completers | | | Students who started in a TL course but did not successfully complete in their first attempt | | | | | Non regression-adjusted differences | |
| | All | Standalone | Corequisite | All | Standalone | Corequisite | BTL students | Total transfer-intending cohort | (7)-(4) | (7)-(6) |
| 25-50% | 5 | 5 | 7 | 10 | 10 | 11 | 10 | 8 | -1 | -1 |
| 50-75% | 12 | 11 | 14 | 12 | 12 | 12 | 10 | 12 | -2 | -2 |
| More than 75% | 70 | 71 | 64 | 33 | 34 | 28 | 35 | 49 | 3 | 8 |
| missing | 6 | 6 | 6 | 22 | 21 | 24 | 23 | 15 | 2 | 0 |
| **Units earned as a share of units attempted during following Fall** | | | | | | | | | 0 | 0 |
| 25% or less | 7 | 7 | 9 | 16 | 16 | 17 | 14 | 12 | -2 | -3 |
| 25-50% | 4 | 4 | 6 | 7 | 7 | 7 | 6 | 6 | -1 | -1 |
| 50-75% | 9 | 8 | 11 | 8 | 9 | 8 | 7 | 8 | -1 | -1 |
| More than 75% | 58 | 59 | 53 | 29 | 31 | 24 | 31 | 42 | 2 | 7 |
| missing | 22 | 22 | 21 | 39 | 38 | 44 | 42 | 32 | 2 | -2 |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall of 2019 cohort.

## TABLE B9

Difference in the likelihood of successful completion relative to students who started in a BTL course (**Underlying results Figure 10)**

| | Students who started in a TL course and did not successfully complete it in their first attempt | | Students who started in a TL course and did not successfully complete it in their first attempt - Corequisite students | | Students who started in a TL course and did not successfully complete it in their first attempt -- Standalone students | | All corequisite students | |
|---|---|---|---|---|---|---|---|---|
| | one-year throughput | fall-to-fall throughput | one-year throughput | fall-to-fall throughput | one-year throughput | fall-to-fall throughput | one-year throughput | fall-to-fall throughput |
| Coeficient of interest | 0.043 | 0.069 | 0.003 | 0.026 | 0.055 | 0.082 | 0.335 | 0.313 |
| | (0.006)*** | (0.006)*** | (0.007) | (0.009)*** | (0.006)*** | (0.006)*** | (0.012)*** | (0.011)*** |
| Asian | 0.059 | 0.077 | 0.035 | 0.05 | 0.061 | 0.079 | 0.054 | 0.062 |
| | (0.011)*** | (0.013)*** | (0.012)*** | (0.014)*** | (0.012)*** | (0.014)*** | (0.011)*** | (0.013)*** |
| Black | -0.055 | -0.08 | -0.057 | -0.077 | -0.053 | -0.079 | -0.099 | -0.11 |
| | (0.008)*** | (0.009)*** | (0.008)*** | (0.009)*** | (0.009)*** | (0.010)*** | (0.010)*** | (0.010)*** |
| Latino | -0.042 | -0.061 | -0.038 | -0.06 | -0.041 | -0.058 | -0.059 | -0.072 |
| | (0.006)*** | (0.008)*** | (0.007)*** | (0.010)*** | (0.007)*** | (0.009)*** | (0.008)*** | (0.009)*** |
| Native American | -0.045 | -0.074 | -0.008 | -0.045 | -0.041 | -0.065 | -0.048 | -0.078 |

| | Students who started in a TL course and did not successfully complete it in their first attempt | | Students who started in a TL course and did not successfully complete it in their first attempt - Corequisite students | | Students who started in a TL course and did not successfully complete it in their first attempt -- Standalone students | | All corequisite students | |
|---|---|---|---|---|---|---|---|---|
| | (0.020)** | (0.023)*** | (0.025) | (0.029) | (0.024)* | (0.026)** | (0.033) | (0.034)** |
| Pacific Islander | -0.045 | -0.052 | -0.047 | -0.049 | -0.042 | -0.051 | -0.043 | -0.046 |
| | (0.018)** | (0.021)** | (0.022)** | (0.026)* | (0.020)** | (0.023)** | (0.027) | (0.030) |
| Two or more races | -0.025 | -0.044 | -0.022 | -0.04 | -0.023 | -0.041 | -0.025 | -0.039 |
| | (0.009)*** | (0.009)*** | (0.011)* | (0.014)*** | (0.009)** | (0.010)*** | (0.011)** | (0.012)*** |
| Unknown race | -0.01 | -0.022 | -0.008 | -0.021 | -0.01 | -0.019 | -0.008 | -0.017 |
| | (0.007) | (0.008)*** | (0.010) | (0.013)* | (0.007) | (0.009)** | (0.011) | (0.012) |
| Female | 0.01 | 0.024 | 0.009 | 0.022 | 0.011 | 0.025 | 0.013 | 0.022 |
| | (0.003)*** | (0.003)*** | (0.004)** | (0.005)*** | (0.004)*** | (0.004)*** | (0.004)*** | (0.004)*** |
| Unknown gender | 0.024 | 0.01 | 0.029 | 0.033 | 0.029 | 0.008 | 0.042 | 0.044 |
| | (0.015) | (0.016) | (0.019) | (0.022) | (0.017)* | (0.019) | (0.018)** | (0.018)** |
| Non Traditional Age | 0.013 | 0.013 | 0.013 | 0.019 | 0.012 | 0.014 | 0.033 | 0.035 |
| | (0.007)* | (0.008) | (0.008) | (0.009)** | (0.007) | (0.009) | (0.009)*** | (0.009)*** |
| CPG or PELL recipient | -0.014 | -0.018 | -0.01 | -0.013 | -0.011 | -0.018 | -0.021 | -0.022 |
| | (0.004)*** | (0.005)*** | (0.005)* | (0.006)** | (0.005)** | (0.006)*** | (0.007)*** | (0.007)*** |
| EOP&S students | -0.004 | -0.001 | -0.004 | -0.002 | -0.003 | 0.003 | -0.008 | -0.005 |
| | (0.006) | (0.007) | (0.007) | (0.008) | (0.006) | (0.007) | (0.008) | (0.008) |
| DSPS students | -0.01 | -0.005 | -0.015 | -0.011 | -0.004 | -0.001 | -0.035 | -0.028 |
| | (0.007) | (0.008) | (0.008)* | (0.009) | (0.008) | (0.009) | (0.010)*** | (0.010)*** |
| U.S. Citizen | -0.042 | -0.039 | -0.04 | -0.045 | -0.045 | -0.041 | -0.037 | -0.04 |
| | (0.006)*** | (0.006)*** | (0.007)*** | (0.008)*** | (0.006)*** | (0.007)*** | (0.007)*** | (0.008)*** |
| LEP students | -0.03 | -0.031 | -0.036 | -0.045 | -0.032 | -0.034 | -0.041 | -0.047 |
| | (0.012)** | (0.014)** | (0.014)*** | (0.015)*** | (0.013)** | (0.014)** | (0.017)** | (0.017)*** |
| Foster | -0.052 | -0.066 | -0.048 | -0.061 | -0.05 | -0.063 | -0.073 | -0.08 |
| | (0.012)*** | (0.012)*** | (0.016)*** | (0.015)*** | (0.014)*** | (0.014)*** | (0.020)*** | (0.019)*** |
| First time student in the CCC | -0.034 | -0.039 | -0.016 | -0.022 | -0.033 | -0.035 | -0.02 | -0.024 |
| | (0.005)*** | (0.005)*** | (0.005)*** | (0.006)*** | (0.005)*** | (0.006)*** | (0.006)*** | (0.006)*** |
| Full time student in their first term | 0.075 | 0.09 | 0.065 | 0.079 | 0.078 | 0.094 | 0.073 | 0.081 |
| | (0.005)*** | (0.006)*** | (0.006)*** | (0.007)*** | (0.006)*** | (0.007)*** | (0.007)*** | (0.007)*** |
| GPA (no math) >3.0 in their first term | 0.091 | 0.112 | 0.091 | 0.111 | 0.095 | 0.117 | 0.158 | 0.164 |
| | (0.004)*** | (0.005)*** | (0.005)*** | (0.006)*** | (0.005)*** | (0.006)*** | (0.006)*** | (0.006)*** |
| GPA (no math) >3.0 in their first term missing | -0.125 | -0.169 | -0.113 | -0.142 | -0.132 | -0.175 | -0.185 | -0.202 |
| | (0.009)*** | (0.011)*** | (0.010)*** | (0.014)*** | (0.010)*** | (0.012)*** | (0.017)*** | (0.018)*** |
| ShareUnitsEarned_25-50% | 0.06 | 0.063 | 0.06 | 0.051 | 0.058 | 0.064 | 0.083 | 0.074 |

| | Students who started in a TL course and did not successfully complete it in their first attempt | | Students who started in a TL course and did not successfully complete it in their first attempt - Corequisite students | | Students who started in a TL course and did not successfully complete it in their first attempt -- Standalone students | | All corequisite students | |
|---|---|---|---|---|---|---|---|---|
| | (0.008)*** | (0.009)*** | (0.014)*** | (0.013)*** | (0.009)*** | (0.010)*** | (0.012)*** | (0.011)*** |
| ShareUnitsEarned_50-75% | 0.129 | 0.14 | 0.126 | 0.131 | 0.12 | 0.136 | 0.165 | 0.162 |
| | (0.009)*** | (0.009)*** | (0.014)*** | (0.015)*** | (0.010)*** | (0.010)*** | (0.011)*** | (0.011)*** |
| ShareUnitsEarned_more than 75% | 0.204 | 0.259 | 0.176 | 0.223 | 0.208 | 0.264 | 0.297 | 0.321 |
| | (0.007)*** | (0.008)*** | (0.009)*** | (0.010)*** | (0.008)*** | (0.008)*** | (0.014)*** | (0.013)*** |
| ShareUnitsEarned_missing | 0.218 | 0.224 | 0.216 | 0.217 | 0.221 | 0.236 | 0.282 | 0.268 |
| | (0.015)*** | (0.014)*** | (0.018)*** | (0.017)*** | (0.017)*** | (0.015)*** | (0.012)*** | (0.012)*** |
| Special program participation | 0.048 | 0.049 | 0.062 | 0.051 | 0.049 | 0.054 | 0.044 | 0.038 |
| | (0.015)*** | (0.016)*** | (0.019)*** | (0.023)** | (0.016)*** | (0.018)*** | (0.022)** | (0.023) |
| Attending multiple colleges | 0.06 | 0.071 | 0.055 | 0.065 | 0.061 | 0.07 | 0.057 | 0.063 |
| | (0.006)*** | (0.008)*** | (0.010)*** | (0.011)*** | (0.006)*** | (0.008)*** | (0.009)*** | (0.009)*** |
| Prior dual enrollment | 0.025 | 0.032 | 0.015 | 0.021 | 0.027 | 0.033 | 0.029 | 0.031 |
| | (0.007)*** | (0.009)*** | (0.008)* | (0.010)** | (0.008)*** | (0.010)*** | (0.010)*** | (0.011)*** |
| Observations | 58,420 | 58,420 | 27,672 | 27,672 | 49,499 | 49,499 | 35,427 | 35,427 |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall 2019 cohort. Only transfer-intending students included. Each column is a regression. Column headers are the dependent variable. "Coefficient of interest" is the estimate of the difference in the likelihood of successful completion between the group in the column header and BTL students. Average marginal effects from probit regressions. By multiplying coefficients by 100 you get percentage points increases/decreases in the probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Special program participation includes Mesa, Puente and Umoja. Share units earned is units earned as a share of units attempted (25% or less is the reference group). White students are the reference group for race/ethnicity in the regressions.

**TABLE B10**

One-year and fall-to-fall TL successful completions among students who started in a transfer-level course and did not complete in their first attempt and BTL students (sorted by number of students starting in a BTL course)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | TL Access rate 2019 | Students who started in a TL course and did not successfully complete it in their first attempt | BTL students | Students who started in a TL course and did not successfully complete it in their first attempt completion rate within a year (%) | BTL students completion rate within a year (%) | Diff (4)-(5) | Students who started in a TL course and did not successfully complete it in their first attempt completion rate as of next fall (%) | BTL students completion rate as of next fall (%) | Diff (7)-(8) |
| LONG BEACH CITY | 56 | 882 | 1,072 | 13 | 11 | 2 | 19 | 15 | 4 |
| EAST L.A. | 57 | 715 | 881 | 16 | 9 | 8 | 22 | 13 | 10 |
| SANTA MONICA | 72 | 1,253 | 800 | 18 | 12 | 7 | 26 | 16 | 11 |
| SAN BERNARDINO | 58 | 583 | 628 | 11 | 9 | 2 | 18 | 12 | 6 |
| PALOMAR | 64 | 611 | 561 | 15 | 15 | 1 | 24 | 19 | 5 |
| MT. SAN ANTONIO | 73 | 1,050 | 552 | 18 | 7 | 10 | 24 | 11 | 13 |

| | (1) TL Access rate 2019 | (2) Students who started in a TL course and did not successfully complete it in their first attempt | (3) BTL students | (4) Students who started in a TL course and did not successfully complete it in their first attempt completion rate within a year (%) | (5) BTL students completion rate within a year (%) | (6) Diff (4)-(5) | (7) Students who started in a TL course and did not successfully complete it in their first attempt completion rate as of next fall (%) | (8) BTL students completion rate as of next fall (%) | (9) Diff (7)-(8) |
|---|---|---|---|---|---|---|---|---|---|
| CERRITOS | 73 | 1,095 | 497 | 21 | 8 | 13 | 26 | 14 | 12 |
| AMERICAN RIVER | 65 | 408 | 468 | 16 | 13 | 2 | 21 | 19 | 2 |
| GLENDALE | 53 | 261 | 435 | 37 | 18 | 19 | 47 | 24 | 23 |
| EVERGREEN VALLEY | 54 | 254 | 420 | 20 | 14 | 6 | 28 | 23 | 5 |
| COSUMNES RIVER | 66 | 444 | 401 | 23 | 13 | 10 | 33 | 20 | 13 |
| SACRAMENTO CITY | 66 | 442 | 395 | 14 | 18 | -4 | 24 | 22 | 1 |
| FULLERTON | 79 | 840 | 382 | 19 | 15 | 4 | 31 | 21 | 10 |
| L.A. PIERCE | 81 | 844 | 355 | 20 | 25 | -5 | 30 | 32 | -3 |
| SAN FRANCISCO CITY | 69 | 346 | 344 | 21 | 21 | -1 | 32 | 27 | 5 |
| MERCED | 57 | 300 | 342 | 16 | 12 | 4 | 20 | 16 | 4 |
| SAN JOAQUIN DELTA | 71 | 372 | 338 | 14 | 15 | -1 | 24 | 21 | 3 |
| SOUTHWESTERN | 75 | 631 | 331 | 16 | 11 | 5 | 25 | 18 | 7 |
| CHAFFEY | 75 | 798 | 329 | 16 | 15 | 1 | 20 | 19 | 1 |
| MOORPARK | 77 | 523 | 272 | 27 | 22 | 5 | 40 | 32 | 7 |
| L.A. VALLEY | 75 | 458 | 266 | 20 | 24 | -4 | 25 | 30 | -5 |
| ANTELOPE VALLEY | 61 | 234 | 244 | 21 | 21 | 0 | 27 | 28 | -1 |
| SIERRA | 83 | 584 | 239 | 18 | 16 | 2 | 26 | 22 | 4 |
| BAKERSFIELD | 79 | 535 | 236 | 14 | 7 | 7 | 24 | 10 | 13 |
| GROSSMONT | 84 | 635 | 225 | 15 | 11 | 4 | 22 | 16 | 5 |
| RIO HONDO | 76 | 504 | 220 | 13 | 10 | 3 | 19 | 18 | 1 |
| ALLAN HANCOCK | 56 | 154 | 216 | 25 | 7 | 17 | 32 | 12 | 20 |
| L.A. HARBOR | 79 | 368 | 201 | 13 | 16 | -4 | 19 | 20 | -1 |
| L.A. TRADE-TECH | 46 | 134 | 196 | 16 | 11 | 5 | 22 | 13 | 10 |
| SAN DIEGO MIRAMAR | 70 | 217 | 195 | 24 | 21 | 4 | 34 | 26 | 8 |
| DE ANZA | 89 | 557 | 193 | 35 | 35 | 0 | 42 | 39 | 3 |
| HARTNELL | 74 | 303 | 191 | 15 | 20 | -5 | 23 | 24 | -1 |
| SADDLEBACK | 85 | 554 | 184 | 24 | 23 | 1 | 35 | 30 | 5 |
| CYPRESS | 81 | 504 | 180 | 14 | 12 | 2 | 24 | 18 | 6 |
| SAN DIEGO MESA | 78 | 299 | 178 | 24 | 27 | -3 | 30 | 32 | -2 |
| CONTRA COSTA | 65 | 114 | 174 | 15 | 15 | 0 | 18 | 19 | -1 |
| DESERT | 71 | 263 | 167 | 19 | 11 | 8 | 32 | 17 | 15 |
| CABRILLO | 76 | 363 | 157 | 20 | 11 | 9 | 28 | 13 | 15 |
| TAFT | 65 | 140 | 151 | 9 | 9 | 1 | 14 | 15 | -1 |
| MT. SAN JACINTO | 90 | 858 | 150 | 18 | 22 | -4 | 25 | 32 | -7 |
| EL CAMINO | 86 | 443 | 149 | 16 | 15 | 1 | 21 | 21 | 0 |
| YUBA | 63 | 148 | 149 | 13 | 11 | 1 | 21 | 15 | 6 |
| SKYLINE | 73 | 148 | 144 | 21 | 17 | 4 | 33 | 20 | 13 |
| GAVILAN | 62 | 137 | 143 | 22 | 12 | 10 | 29 | 16 | 13 |
| OHLONE | 84 | 231 | 132 | 29 | 31 | -2 | 40 | 38 | 2 |
| CUESTA | 81 | 322 | 127 | 13 | 12 | 1 | 19 | 18 | 1 |
| MODESTO | 83 | 463 | 124 | 16 | 13 | 3 | 26 | 19 | 7 |

| | (1) TL Access rate 2019 | (2) Students who started in a TL course and did not successfully complete it in their first attempt | (3) BTL students | (4) Students who started in a TL course and did not successfully complete it in their first attempt completion rate within a year (%) | (5) BTL students completion rate within a year (%) | (6) Diff (4)-(5) | (7) Students who started in a TL course and did not successfully complete it in their first attempt completion rate as of next fall (%) | (8) BTL students completion rate as of next fall (%) | (9) Diff (7)-(8) |
|---|---|---|---|---|---|---|---|---|---|
| SANTA ROSA | 78 | 298 | 122 | 25 | 16 | 9 | 39 | 27 | 12 |
| FOLSOM LAKE | 84 | 289 | 119 | 18 | 13 | 6 | 27 | 24 | 3 |
| FRESNO CITY | 88 | 684 | 119 | 9 | 16 | -7 | 14 | 18 | -4 |
| NORCO | 85 | 311 | 119 | 20 | 17 | 3 | 28 | 22 | 6 |
| CLOVIS | 87 | 329 | 114 | 14 | 16 | -2 | 21 | 23 | -2 |
| L.A. MISSION | 80 | 320 | 112 | 9 | 16 | -7 | 13 | 21 | -8 |
| RIVERSIDE | 92 | 802 | 110 | 17 | 18 | -1 | 24 | 21 | 3 |
| LOS MEDANOS | 83 | 333 | 106 | 17 | 16 | 1 | 25 | 22 | 3 |
| SOLANO | 79 | 267 | 106 | 15 | 9 | 5 | 23 | 12 | 11 |
| BUTTE | 84 | 266 | 104 | 9 | 16 | -7 | 17 | 20 | -3 |
| SAN DIEGO CITY | 67 | 198 | 103 | 14 | 16 | -2 | 22 | 23 | -2 |
| SHASTA | 61 | 96 | 101 | 11 | 12 | 0 | 18 | 17 | 1 |
| MIRA COSTA | 87 | 254 | 98 | 25 | 18 | 6 | 35 | 24 | 11 |
| MONTEREY | 80 | 219 | 95 | 15 | 11 | 4 | 21 | 19 | 3 |
| MORENO VALLEY | 83 | 422 | 95 | 13 | 17 | -4 | 18 | 21 | -3 |
| CRAFTON HILLS | 83 | 278 | 94 | 14 | 23 | -9 | 21 | 28 | -7 |
| IRVINE VALLEY | 92 | 539 | 92 | 30 | 26 | 4 | 40 | 37 | 3 |
| CHABOT | 85 | 421 | 90 | 17 | 16 | 1 | 27 | 26 | 2 |
| L.A. CITY | 89 | 597 | 89 | 15 | 30 | -16 | 19 | 38 | -19 |
| NAPA VALLEY | 79 | 201 | 89 | 15 | 21 | -6 | 24 | 30 | -6 |
| SOUTHWEST L.A. | 79 | 251 | 87 | 13 | 10 | 2 | 18 | 15 | 3 |
| WEST VALLEY | 85 | 213 | 87 | 23 | 29 | -5 | 32 | 36 | -4 |
| LAS POSITAS | 83 | 272 | 86 | 25 | 16 | 9 | 29 | 23 | 6 |
| CANADA | 74 | 141 | 81 | 13 | 22 | -9 | 18 | 26 | -7 |
| LEMOORE | 77 | 111 | 77 | 14 | 17 | -2 | 25 | 21 | 4 |
| WEST L.A. | 79 | 219 | 75 | 15 | 16 | -1 | 21 | 23 | -2 |
| ORANGE COAST | 93 | 574 | 72 | 22 | 13 | 9 | 30 | 22 | 8 |
| VENTURA | 91 | 349 | 70 | 20 | 13 | 7 | 27 | 20 | 7 |
| CANYONS | 91 | 362 | 69 | 27 | 19 | 8 | 32 | 29 | 3 |
| SAN MATEO | 88 | 303 | 69 | 24 | 14 | 10 | 35 | 20 | 14 |
| VICTOR VALLEY | 89 | 453 | 69 | 12 | 16 | -4 | 18 | 19 | -1 |
| SAN JOSE CITY | 81 | 170 | 67 | 15 | 16 | -1 | 22 | 24 | -2 |
| DIABLO VALLEY | 95 | 577 | 65 | 23 | 34 | -10 | 32 | 37 | -5 |
| FOOTHILL | 88 | 234 | 64 | 29 | 47 | -18 | 33 | 47 | -14 |
| SANTA BARBARA CITY | 95 | 653 | 64 | 26 | 20 | 6 | 38 | 28 | 10 |
| CITRUS | 93 | 380 | 61 | 13 | 20 | -6 | 22 | 26 | -4 |
| CUYAMACA | 84 | 155 | 61 | 15 | 25 | -10 | 22 | 36 | -14 |
| SANTIAGO CANYON | 89 | 378 | 61 | 24 | 25 | -1 | 36 | 33 | 3 |
| MENDOCINO | 71 | 40 | 50 | 5 | 16 | -11 | 10 | 16 | -6 |
| WOODLAND | 74 | 83 | 50 | 18 | 14 | 4 | 27 | 18 | 9 |
| MISSION | 80 | 96 | 42 | 16 | 24 | -8 | 26 | 31 | -5 |
| LANEY | 75 | 100 | 41 | 24 | 12 | 12 | 31 | 22 | 9 |
| MARIN | 86 | 143 | 41 | 13 | 10 | 4 | 23 | 10 | 13 |

| | (1) TL Access rate 2019 | (2) Students who started in a TL course and did not successfully complete it in their first attempt | (3) BTL students | (4) Students who started in a TL course and did not successfully complete it in their first attempt completion rate within a year (%) | (5) BTL students completion rate within a year (%) | (6) Diff (4)-(5) | (7) Students who started in a TL course and did not successfully complete it in their first attempt completion rate as of next fall (%) | (8) BTL students completion rate as of next fall (%) | (9) Diff (7)-(8) |
|---|---|---|---|---|---|---|---|---|---|
| LAKE TAHOE | 46 | 20 | 38 | 25 | 32 | -7 | 35 | 32 | 3 |
| COPPER MOUNTAIN | 57 | 29 | 37 | 0 | 11 | -11 | 0 | 11 | -11 |
| FEATHER RIVER | 59 | 32 | 37 | 28 | 30 | -2 | 34 | 32 | 2 |
| SANTA ANA | 91 | 447 | 33 | 18 | 21 | -3 | 23 | 27 | -4 |
| GOLDEN WEST | 94 | 337 | 32 | 17 | 16 | 1 | 26 | 22 | 4 |
| COLUMBIA | 77 | 45 | 30 | 2 | 10 | -8 | 9 | 10 | -1 |
| CERRO COSO | 84 | 86 | 27 | 16 | 15 | 1 | 20 | 15 | 5 |
| BERKELEY CITY | 93 | 135 | 23 | 27 | 43 | -16 | 38 | 48 | -10 |
| COASTLINE | 62 | 45 | 23 | 13 | 39 | -26 | 16 | 43 | -28 |
| ALAMEDA | 86 | 56 | 20 | 13 | 20 | -8 | 14 | 20 | -6 |
| COMPTON | 42 | 6 | 20 | 0 | 25 | -25 | 0 | 25 | -25 |
| BARSTOW | 89 | 76 | 18 | 13 | 22 | -9 | 20 | 33 | -14 |
| IMPERIAL VALLEY | 82 | 65 | 17 | 25 | 18 | 7 | 32 | 18 | 15 |
| COALINGA | 87 | 56 | 16 | 14 | 6 | 8 | 23 | 6 | 17 |
| MERRITT | 88 | 50 | 15 | 14 | 27 | -13 | 20 | 33 | -13 |
| REEDLEY | 97 | 393 | 14 | 10 | 7 | 3 | 14 | 7 | 7 |
| REDWOODS | 95 | 154 | 12 | 10 | 17 | -7 | 18 | 25 | -7 |
| SISKIYOUS | 89 | 31 | 9 | 23 | 11 | 11 | 26 | 33 | -8 |
| PALO VERDE | 92 | 41 | 7 | 0 | 0 | 0 | 2 | 0 | 2 |
| LASSEN | 80 | 30 | 3 | 27 | 33 | -7 | 37 | 33 | 3 |
| PASADENA CITY | 100 | 1,532 | N/A | 26 | N/A | N/A | 33 | N/A | N/A |
| PORTERVILLE | 100 | 131 | N/A | 8 | N/A | N/A | 11 | N/A | N/A |
| SEQUOIAS | 97 | 7 | N/A | 0 | N/A | N/A | 0 | N/A | N/A |
| OXNARD | 100 | 162 | N/A | 12 | N/A | N/A | 19 | N/A | N/A |
| **Total** | **79** | **39,669** | **18,751** | **18** | **15** | **3** | **26** | **20** | **6** |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall of each year. N/A is not applicable or not available.

## TABLE B11

Probability of starting in a BTL course by access tier -- average marginal effects (**Underlying results Figure 14**)

| | Lower access TL | Medium access TL | Higher access TL | | Lower access TL | Medium access TL | Higher access TL |
|---|---|---|---|---|---|---|---|
| Asian | -0.045 | -0.036 | -0.020 | LEP student | 0.268 | 0.198 | 0.106 |
| | (0.014)*** | (0.009)*** | (0.006)*** | | (0.030)*** | (0.028)*** | (0.019)*** |
| Black | 0.066 | 0.024 | -0.004 | Foster student | 0.039 | 0.043 | 0.019 |
| | (0.024)*** | (0.014)* | (0.011) | | (0.023)* | (0.016)*** | (0.025) |
| Latino | 0.072 | 0.032 | -0.007 | First time student in the CCC | -0.027 | -0.031 | -0.016 |
| | (0.015)*** | (0.007)*** | (0.005) | | (0.011)** | (0.009)*** | (0.006)*** |
| Native American | 0.132 | 0.063 | 0.003 | Full time student in their first term | -0.062 | -0.061 | -0.034 |

| | Lower access TL | Medium access TL | Higher access TL | | Lower access TL | Medium access TL | Higher access TL |
|---|---|---|---|---|---|---|---|
| | (0.059)** | (0.030)** | (0.022) | | (0.019)*** | (0.008)*** | (0.009)*** |
| Pacific Islander | 0.001 | -0.015 | -0.023 | GPA (no math) >3.0 in their first term | -0.077 | -0.046 | -0.013 |
| | (0.053) | (0.016) | (0.014) | | (0.007)*** | (0.005)*** | (0.003)*** |
| Two or more races | -0.013 | -0.004 | -0.012 | GPA (no math) >3.0 in their first term missing | -0.010 | 0.009 | -0.003 |
| | (0.017) | (0.008) | (0.005)** | | (0.021) | (0.010) | (0.007) |
| Unknown race | 0.040 | -0.027 | -0.006 | ShareUnitsEarned_25-50% | -0.032 | -0.004 | -0.006 |
| | (0.019)** | (0.027) | (0.004) | | (0.018)* | (0.006) | (0.003)** |
| Female | -0.015 | -0.001 | -0.009 | ShareUnitsEarned_50-75% | -0.106 | -0.043 | -0.014 |
| | (0.008)* | (0.004) | (0.004)** | | (0.014)*** | (0.007)*** | (0.004)*** |
| Unknown gender | 0.009 | -0.008 | -0.006 | ShareUnitsEarned_more than 75% | -0.115 | -0.053 | -0.023 |
| | (0.026) | (0.012) | (0.008) | | (0.014)*** | (0.007)*** | (0.006)*** |
| Non traditional age | 0.144 | 0.125 | 0.045 | ShareUnitsEarned_missing | -0.007 | -0.003 | -0.011 |
| | (0.015)*** | (0.010)*** | (0.015)*** | | (0.027) | (0.014) | (0.006)* |
| CPG or PELL recipient | 0.059 | 0.028 | 0.013 | Special program participation | -0.104 | -0.062 | -0.029 |
| | (0.008)*** | (0.007)*** | (0.005)*** | | (0.043)** | (0.017)*** | (0.012)** |
| EOP&S students | 0.040 | 0.000 | -0.009 | Attending multiple colleges | -0.093 | -0.050 | -0.002 |
| | (0.015)*** | (0.011) | (0.007) | | (0.011)*** | (0.009)*** | (0.008) |
| DSPS student | 0.181 | 0.141 | 0.043 | Prior dual enrollment | -0.080 | -0.051 | -0.009 |
| | (0.025)*** | (0.016)*** | (0.009)*** | | (0.025)*** | (0.009)*** | (0.008) |
| U.S. Citizen | -0.018 | -0.020 | -0.003 | Transfer Goal | -0.087 | -0.076 | -0.015 |
| | (0.013) | (0.009)** | (0.005) | | (0.012)*** | (0.011)*** | (0.007)** |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall 2019 cohort. Average marginal effects from probit regressions. Number of observations: Lower access (27,493), medium access (84,669) and higher access (24,102). By multiplying the coefficients by 100 you get percentage points increases/decreases in the probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Special program participation includes Mesa, Puente and Umoja. Share units earned is units earned as a share of units attempted (25% or less is the reference group). White students are the reference group for race/ethnicity in the regressions.

### TABLE B12

Probability of successfully completing a transfer-level course in one term among students who started in a transfer-level course

| | Average marginal effects | | Average marginal effects |
|---|---|---|---|
| Asian | 0.048 | LEP student | 0.04 |
| | (0.009)*** | | (0.013)*** |
| Black | -0.126 | Foster student | -0.067 |
| | (0.010)*** | | (0.015)*** |
| Latino | -0.086 | First time student in the CCC | -0.019 |
| | (0.008)*** | | (0.006)*** |
| Native American | -0.076 | Full time student in their first term | 0.03 |
| | (0.027)*** | | (0.005)*** |
| Pacific Islander | -0.082 | GPA (no math) >3.0 in their first term | 0.249 |

| | Average marginal effects | | Average marginal effects |
|---|---|---|---|
| | (0.019)*** | | (0.004)*** |
| Two or more races | -0.028 | GPA (no math) >3.0 in their first term missing | -0.133 |
| | (0.008)*** | | (0.012)*** |
| Unknown race | -0.038 | ShareUnitsEarned_25-50% | 0.097 |
| | (0.019)** | | (0.007)*** |
| Female | 0.021 | ShareUnitsEarned_50-75% | 0.196 |
| | (0.004)*** | | (0.007)*** |
| Unknown gender | -0.002 | ShareUnitsEarned_more than 75% | 0.417 |
| | (0.013) | | (0.008)*** |
| Non traditional age | 0.088 | ShareUnitsEarned_missing | 0.343 |
| | (0.007)*** | | (0.006)*** |
| CPG or PELL recipient | -0.026 | Special program participation | 0 |
| | (0.006)*** | | (0.016) |
| EOP&S students | -0.014 | Attending multiple colleges | 0.024 |
| | (0.009) | | (0.008)*** |
| DSPS student | -0.056 | Prior dual enrollment | 0.034 |
| | (0.008)*** | | (0.009)*** |
| U.S. Citizen | -0.033 | Transfer Goal | -0.007 |
| | (0.006)*** | | (0.006) |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall 2019 cohort. Average marginal effects from probit regressions. N equal to 107,295. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. By multiplying the coefficients by 100 you get percentage points increases/decreases in the probability. Special program participation includes Mesa, Puente and Umoja. Share units earned is units earned as a share of units attempted (25% or less is the reference group). White students are the reference group for race/ethnicity in the regressions.

**TABLE B13**

BTL enrollment and outcomes

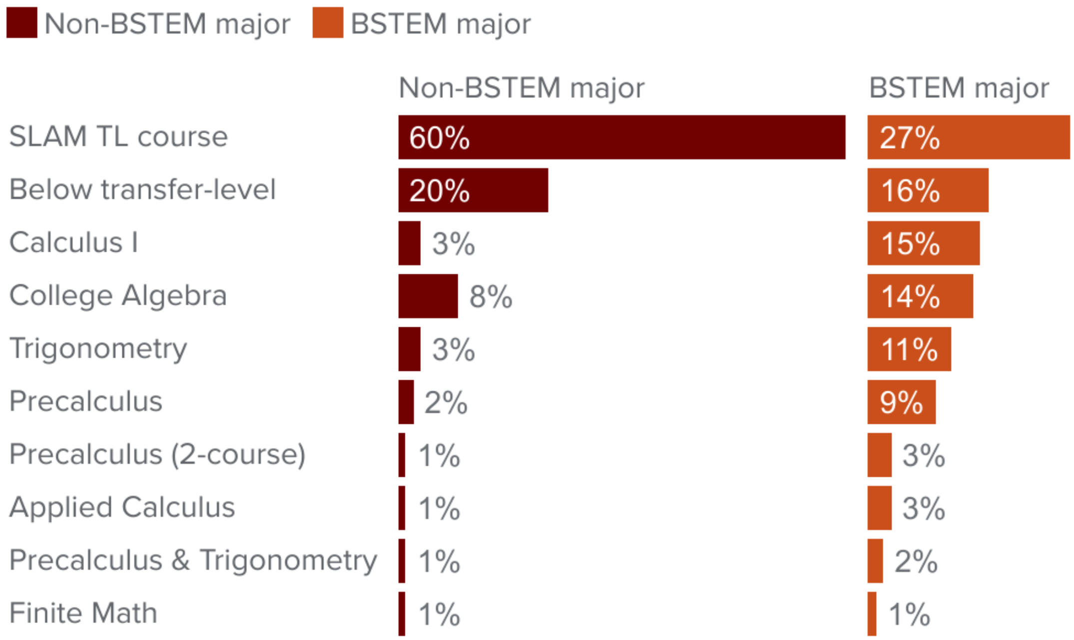
| Fall cohort | Student Group | All students | | | | Students with a transfer goal | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Students enrolled in a BTL course | Distribution (%) | Annual growth (%) | Completed a TL course as next fall (%) | Students enrolled in a BTL course | Distribution (%) | Annual growth (%) | Completed a TL course as next fall (%) | Transfer-intending students staring in a BTL (%) |
| 2017 | All | 237,643 | 100 | | 17 | 160,931 | 100 | | 19 | 68 |
| 2018 | All | 196,440 | 100 | -17 | 20 | 130,248 | 100 | -19 | 22 | 66 |
| 2019 | All | 71,415 | 100 | -64 | 19 | 45,477 | 100 | -65 | 23 | 64 |
| 2020 | All | 50,279 | 100 | -30 | N/A | 30,538 | 100 | -33 | N/A | 61 |
| 2017 | Continuing | 122,049 | 51 | | 18 | 82,426 | 51 | | 20 | 68 |
| 2018 | Continuing | 101,575 | 52 | -17 | 21 | 67,784 | 52 | -18 | 24 | 67 |
| 2019 | Continuing | 41,391 | 58 | -59 | 21 | 26,726 | 59 | -61 | 24 | 65 |
| 2020 | Continuing | 25,461 | 51 | -38 | N/A | 15,344 | 50 | -43 | N/A | 60 |
| 2017 | New | 115,594 | 49 | | 15 | 78,505 | 49 | | 18 | 68 |
| 2018 | New | 94,865 | 48 | -18 | 18 | 62,464 | 48 | -20 | 20 | 66 |
| 2019 | New | 30,024 | 42 | -68 | 17 | 18,751 | 41 | -70 | 20 | 62 |
| 2020 | New | 24,818 | 49 | -17 | N/A | 15,194 | 50 | -19 | N/A | 62 |

SOURCE: Authors' calculations using MIS data.

NOTES: Fall of each year. N/A is not applicable or not available.

FIGURE B11

## 43 percent of students pursuing BSTEM majors do not start in an algebra-based transfer-level course




SOURCE: Authors' calculations using MIS data.

NOTE: Percent distribution of first-time math, transfer-intending, students by starting course. Fall 2019 cohort. SLAM includes statistics offered in any department, liberal arts math, and math for teachers and quantitative reasoning. BSTEM (algebra-based courses) includes Calculus I, finite math, college algebra, pre-calculus, trigonometry, and applied calculus (i.e., calculus for business, social sciences, behavioral sciences, management, life sciences, and economics). See Appendix A for details about which majors where coded as BSTEM.

# Appendix C. Qualitative Interview Analysis

## C1. Description of Qualitative Analysis

### Interview Protocol

To help elucidate our quantitative findings, we conducted 41 semi-structured interviews with community college faculty, staff, and administrators at 22 colleges. We purposefully selected colleges to be inclusive of different scales of implementation and rates of early enrollment and success post-AB 705. Specifically, in order to obtain a diverse pool of interviewees, we selected colleges based on several criteria including the level of (and change in) access to transfer-level courses, the proportion of students in corequisite support courses, the level of (and change in) one-term and one-year throughput rates, student success and persistence rates, and proportionality indexes across student outcomes.

Interviews were conducted over Zoom over the course of three months (April 2021 to June 2021) and were about one hour each. We asked each interviewee a variety of questions related to the implementation of AB 705, including but not limited to math/English placement policies and sequence offerings, changes to classroom experiences, pedagogy, and policies, the structure and characteristics of corequisite courses, holistic supports, math and English outcomes, racial equity, and professional development. Importantly, because our interviews took place during the Spring 2021 semester, when the shift to distance education as a result of COVID-19 had been in place for a year, we also asked about how the pandemic affected the implementation of AB 705, especially as it related to the online transition of courses and student services. We audio recorded and kept notes during each interview to accurately capture the observations and thoughts of each interviewee, as well as to synthesize themes, observations, and insights to investigate further and inform other interviews.

### Interview Sample

In summary, our 41 interviews can be broken down into the following categories:

- 15 interviews with English instructors, department chairs, and AB 705 coordinators that focused on corequisites, classroom experiences, and assessment and placement practices
- 18 interviews with Mathematics instructors, department chairs, and AB 705 coordinators that focused on corequisites, classroom experiences and assessment and placement practices
- 5 interviews with student services staff and counselors that focused on holistic supports, and math and English assessment and placement practices
- 3 interviews with district-level administrators that focused on AB 705 implementation, resources needed, and alignment across reform efforts

In this report, we highlight findings from our interviews with math faculty. We provide some insights from student services staff, counselors, and district-level administrators when they are relevant to changes made to math placement policies or to the math student experience. Though we do not share findings from our interviews with English faculty, it is worth noting that in many cases, their thoughts, experiences, and concerns were similar to those shared by their math colleagues. At the same time, there are many insights that are math- or English-specific. In our companion report focused on English outcomes, planned to be released in spring 2022, we will share findings from our English faculty interviews and explore similarities and differences we uncover across the disciplines.

Additionally, some of the interview insights shared in this report derive from, or are further supported by, interviews initially conducted for some of our previous reports, most notably for our November 2020 report that examined early outcomes post-AB 705 (see Cuellar Mejia, et al. 2020). The implementation, structure, and analysis of these interviews were identical, with the shared goal of obtaining a more nuanced understanding of how and why enrollment and success in transfer-level courses has varied across colleges due to changes to placement policies, course sequences, and academic supports.

Among our 18 math interviews (conducted with faculty at 14 different colleges), we find that the colleges represented in our sample are similar to the state average in various aspects, including the share of students with direct access to transfer-level math, corequisite enrollment and success rates, one-term throughput rates, and racial/ethnic demographics among first-time math students (Table C1). One key difference, however, is evident when examining average first-time math cohort sizes for the Fall 2019 term. Among the colleges represented in our interview sample, the average cohort size was 1,873 students, while the average cohort size for the state was 1,240 students. Nevertheless, while our interviews with math faculty may more accurately reflect experiences at larger colleges, our sample includes four colleges with below average first-time math cohort sizes, ensuring some representation among relatively smaller schools.

**TABLE C1**

Fall 2019 descriptive statistics for math interview sample compared to statewide average

| | Statewide | Math Interviewees |
|---|---|---|
| Number of Colleges | 114 | 14 |
| Average first-time math fall 2019 cohort | 1,240 | 1,873 |
| Share of first-time math students starting directly in transfer-level (%) | 79 | 75 |
| Share of first-time math students in corequisite models (%) | 16 | 17 |
| Success rate among first-time corequisite students | 46 | 48 |
| Overall one-term throughput rate (%) | 40 | 39 |
| Share of Asian American students among first-time math students (%) | 13 | 15 |
| Share of Black students among first-time math students (%) | 5 | 6 |
| Share of Latino students among first-time math students (%) | 52 | 53 |
| Share of white students among first-time math students (%) | 21 | 18 |

SOURCE: Authors' calculations using MIS data.

NOTE: See the glossary of terms in the main report for definitions.

## Analytical Methods

In this study, we employ an explanatory sequential mixed methods design. This approach involves collecting and analyzing quantitative data and then explaining the quantitative results with in-depth qualitative data (Creswell and Plano Clark 2011; Ivankova, Creswell and Stick 2006). As part of the explanatory sequential mixed methods design, we used the research and findings from our current and prior research on AB 705 (see Cuellar Mejia et al. 2020) to construct controls for the regression models and to assist with site selection. Additionally, the qualitative research is used to help explain the how and why of implementation decisions at a group of colleges.

The qualitative analysis in this report is grounded by a social constructivist framework in which themes and main ideas are uncovered by interpreting the meaning derived by interviewees and relying on their points of view as experts, key stakeholders, and contributors to the situation of interest, in this case a post-AB 705 community college landscape (Creswell and Poth 2017). More specifically, we incorporate an inductive analytical method, developing ideas through a generalization of unique perspectives and insights into broader themes. Considering the role researcher interpretation and individual interviewee experiences play in such a framework, it is important to note that the qualitative insights discussed below are co-constructed among several actors and reflect multiple realities that may be simultaneously true due to a wide diversity in environments and experiences.

Our qualitative analytical methods broadly followed a multi-step process that began once all interviews were completed. First, initial notes for each interview were updated and revised, and direct quotes were verified, using interview transcripts and Zoom recordings. Since at least one interviewer and one designated note-taker attended each interview, multiple researchers documented specific insights. Subsequent discussions among the research team provided opportunities to review and validate such insights. Once all notes were completed, common insights among interviewees were categorized into general themes, while one-off viewpoints or perspectives were documented as unique examples. The last step of the analytical process involved developing a narrative that accurately represented our interview findings, while also answering broad questions of interest and contextualizing the findings from our quantitative analysis. In the following sections, we present insights from our interviews with math faculty.

## C2. Insights on the impact of the pandemic on AB 705 implementation

In the main report, we highlight how the pandemic affected math enrollment and success while colleges continued to implement placement and curricular changes in light of AB 705. Below, we use our qualitative findings to contextualize these impacts.

### The decrease in first-time math enrollment

Our interviews with college math faculty, staff, and administrators shed light on some of the reasons why students were less likely to take math in fall 2020. We also identify how other key factors had already been contributing to this trend pre-pandemic, and how they were likely exacerbated as colleges moved instruction and supports online.

**Disruptions and discouragement heightened by the pandemic.** The disruptions brought on by the pandemic have likely heightened declines in first-term math enrollment. According to several faculty members, many students postponed taking math during the fall, instead choosing to wait until classes resumed face-to-face. Limited access to technology, basic resources, and in-person academic supports, among others all contributed to students' enrollment decisions. Additionally, students with math anxiety or concerns over potential workloads and stress management may have felt further discouraged from taking a transfer-level math course in an online setting. Though such circumstances undoubtedly intensified recent declines, more work is needed to understand the longer-term effects of the pandemic on first-time math enrollment, and the inequities it may have widened.

**Concerns over large unit loads.** Of primary importance are the possible unintended consequences of higher unit loads associated with taking corequisite courses—which can add as many as 3 more units to the transfer-level course. Specifically, students placed in corequisite courses may not be able to take on as many units in their first semester due to scheduling constraints or conflicts. These issues are exacerbated if students are placed in both math and English corequisites and when both of these courses are taught online. We found that when such cases come up, counselors and advisors may be encouraging students to start with English in order to lessen workloads and ease the college transition.[2]

**Shorter math course sequences.** The pre-AB705 "math pipeline of doom," as described by one math faculty member, has been transformed dramatically with the reduction of below transfer-level (BTL) course offerings.

[2] It is important to note that these concerns are not new and were also raised in our last study which examined fall 2019, the first-term of AB 705 implementation (Cuellar Mejia, et al. 2020).

Broadened access to statistics and liberal arts math (SLAM) courses, many of which only require a single course to fulfill the math requirement for non-BSTEM majors, ensure that students in SLAM pathways are no longer lingering in lengthy math sequences—lowering overall math enrollment. Additionally, shorter and more accessible math sequences may incentivize students to delay taking transfer-level math courses in their first term. Such reforms may have had the unintended consequence of further decreasing first-time math enrollment during the pandemic as many decided to delay math-taking in favor of waiting for classes to resume face-to-face, expecting that their academic trajectories would not be greatly altered.

**Uncertainty about major and appropriate math pathway.** Students' educational goals and majors also influence math course taking. Some faculty shared concerns that new placement policies and course recommendations lack clarity, especially with the abundance and variety of major and math pathway options available to students. As a result, some students, without clear and consistent advising, may be left uncertain about their optimal path, and thus delay their math enrollment until they are confident about their major and the course sequence most closely aligned with their intended program of study. The transition to online student services may have further exacerbated this issue, especially among students with uneven access to technology.

## The rise in successful completions in transfer-level math

Our interviews with math faculty provide some additional insight into why one-term throughputs were higher during the pandemic than the previous year.

**Instructors transformed policies and practices to accommodate students' needs.** Prominently, given the constraints and disruptions caused by the pandemic, more than half (56%) of the math faculty we interviewed shared that they embraced a more flexible and student-centered class structure in the spring and fall 2020 terms. Faculty indicated that such changes to course policies and expectations were made with the goal of reducing workloads and stress among students, many of which were left in difficult positions to effectively continue their education. Inspired by increasing conversations around equity—some of which have occurred as a result of AB705—5 of 18 faculty also noted that they more deliberately incorporated the affective domain[3] into their class and worked to elevate student voices by providing more avenues for feedback and discussion. Furthermore, mandatory distance education training instituted at the college-level provided math faculty with a broader set of teaching tools and a clearer understanding of how to conduct an online class.

Perhaps most importantly, many faculty members shared that they dramatically altered their grading policies in order to provide students' with more opportunities to succeed. Such changes included adding flexibility to due dates, accepting late assignments, and providing opportunities for make-up work. In line with recent conversations around grading for equity, faculty also embraced new ways of assessing their students. While some faculty changed grading systems to rely less on tests and more on group projects and presentations, others altered their assessments to emphasize critical thinking, problem solving, and active participation. One faculty member embraced open-note testing, finding that it took pressure off students to memorize material and helped address math and test anxiety.

**Online setting worked for some students.** At the same time, we learned that many students seemed to thrive in an online setting. Anecdotal evidence shared by 5 faculty members we interviewed highlighted that students benefitted greatly from widened access to online class materials, recorded lectures, and student supports such as tutoring and office hours. Additionally, students' ability to learn at their own pace, attend lectures

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[3] Refers to the use of strategies to help students acquire the skills needed to be a successful college student, help reduce students fear/anxiety, and increase their willingness to engage with their coursework (see Hern and Snell 2013).

asynchronously, and participate in more comfortable ways, seemed to reduce math anxiety and promote confidence among students with initial hesitations about taking transfer-level coursework.

It is important to keep in mind, however, that success in the online setting was limited to students who persisted through the fall semester. As one faculty member explained, students that have succeeded and taken advantage of class flexibility and online learning are those that have the resources, technology, and space to effectively study and work. Thus, how students are supported in a changing educational environment will remain an equity issue until all students are afforded the same opportunities to succeed. Still, the course outcomes we see in the fall 2020 term are promising, indicating that current reforms made to how courses are structured and offered can have positive effects on student learning. Encouragingly, many faculty members shared plans to carry on with classroom reforms inspired by the pandemic and continue to find ways to enhance learning environments for all students once in-person classes resume at their college.

## Additional pandemic impacts on students, instructors, and policies

In addition to AB705-related outcomes, the pandemic impacted students' lives and the community college experience in other ways, likely affecting reforms and developments going forward.

**Student supports.** Given the gravity of the pandemic and its far reaching social, economic and health effects, CCC students faced heightened challenges over the last school year. Through our interviews, we consistently heard concerns from faculty, counselors, and administrators that the pandemic exacerbated inequities between students, especially in access to basic resources such as food, housing, and technology. Students without adequate access to technology, wifi, and study spaces were often unable to effectively complete online courses, forcing them to drop out and wait until face-to-face courses resume.

As 11 of the 18 math faculty members we interviewed noted, such inequities have elevated the importance of a compassionate approach to the classroom, providing the flexibility and resources students need to succeed given their challenging circumstances. Relatedly, the need for better holistic and wraparound supports, including accessible mental health counseling, is as great as ever. Both math and counseling faculty alike shared concerns that students not involved in special programs or learning communities are not effectively connected to resources on campus, and that a lack of coordination at the college have left students to fend for themselves. In some cases, schools were very proactive in increasing access to resources and providing effective outreach through early alert systems. Such initiatives will inevitably affect student outcomes, especially among new students with less experience navigating the community college system.

**Enrollment in, and support for, BTL courses.** More directly related to AB705, as with our last study, we found that multiple faculty members believe that the pandemic has strengthened support for BTL courses among some of their colleagues due to fears of learning loss. Such faculty cite the difficulties of conducting online math courses, especially corequisite courses in which group work, participation, and instructor-student relationships are key. They argue that BTL courses provide adequate time for certain students to catch up and receive the support they need. Through our interviews, we also found that while placement policies did not change much during the pandemic, the need for advising and guidance has increased as placement processes became entirely virtual and counseling more difficult to access. Given the complexities of placement guidelines at some schools, providing additional support in the enrollment process may be necessary in order to reduce self-placement into BTL courses.

**Grading and assessments.** Concerns over cheating have grown, becoming a greater issue during the shift to online learning. Specifically, questions have arisen on the ethics and necessity of proctoring online exams and requiring students to have their cameras on. At one college, a faculty member shared that while their department instituted one-on-one exams to combat online cheating, the shift actually inspired a broader conversation on the alternative ways that students could be effectively assessed. Similarly, another faculty member shared that concerns at their school raised questions on why students were cheating and whether traditional assessments were inherently valuable to them. Accordingly, while the pandemic might have heightened initial fears of an online learning environment, it also sparked new discussions and ideas on how equity can be embedded into grading and assessment practices.

**Professional development.** Overall, conversations around equity have intensified since the implementation of AB705, and have increased more recently due to the need for broader online training. Most colleges instituted mandatory training in distance education over the summer of 2020 in order to effectively prepare their staff to be fully online in fall 2020. Through these trainings, which were generally provided by the college and/or individual departments, faculty gained experience using online tools, learned how to implement discussion boards and collaborative online workspaces, and received training on how to provide lectures and class materials online. In some cases, equity was embedded into these trainings, providing opportunities for staff to discuss how to incorporate affective domain modules into class time and provide academic supports for students with different needs. At one college, a faculty-led online webinar series was later redesigned into a wider-reaching "Teaching Success" initiative, furthering discussions and collaboration among faculty members with the goal of improving teaching practices more broadly. The prioritization of effective professional development will remain crucial once in-person classes resume.

## C3. Insights on placement and enrollment: BTL courses and BSTEM

As highlighted in our quantitative analysis, access to, and completion of, transfer-level math coursework has increased dramatically as result of AB 705. Still, disparities remain, both between and within colleges. Below, we use our qualitative findings to explain why this might occur.

### Persistence of BTL course enrollment

Three prominent themes emerged from our interviews with math faculty and student services staff as to why enrollments in BTL courses persist or are increasing at some colleges. It is important to highlight that this occurs despite research suggesting that all students, regardless of demographic group, special population status, and prior academic achievement, are more likely to succeed if given direct access to transfer-level math (Brohawn, Newell and Fagioli 2020; Hayward 2021).

**Placement policies and practices.** Through our interviews and extensive review of math placement policies, we found that some colleges have continued to institute a hard requirement, or strong recommendation, of BTL math for BSTEM math pathways, and even for some SLAM pathways. Such requirements usually target students with the lowest high school GPAs or who have not passed Intermediate Algebra in high school. Relatedly, our previous research found that colleges with lower access to transfer-level math are more likely to use guided self-placement (GSP) (Cuellar Mejia, et al. 2020). Older students, English learners and international students, who may not have access to high school transcripts are more likely to utilize GSP to determine their math placement, possibly leading to higher enrollment in BTL courses. In some cases, colleges actively promote and advise students to take Intermediate Algebra, noting that this course meets math requirements for an associate's degree—this occurs despite the fact that there are transfer-level math courses that would meet this same requirement and open the door to transfer if the student changes their educational goal.

**Faculty support for BTL offerings.** Among the low-access colleges we interviewed, respondents reported that about 1 in 4 math faculty members within their departments support keeping BTL courses to some degree, posing a formidable barrier to reducing or eliminating such courses. Most common is a strong belief among a subset of instructors that such courses are necessary for students who lack the math skills to progress through rigorous higher-level math sequences—and while this sentiment is most notable in BSTEM, it also occurs in SLAM. At one school, the stretch model—where students first take a BTL course and subsequently a transfer-level course the next term—was implemented after seeing data that students in SLAM pathways were dropping off between the BTL and transfer-level courses. Thus, some view the adoption of new BTL courses as student success development. However, it must also be noted that other faculty we interviewed would have interpreted this same data as signaling the need to replace the pre-requisite remedial course with a corequisite, especially given the research suggesting that all student groups were less likely to complete transfer-level math if they begin in a BTL course (Brohawn, et al. 2021; Hayward 2021).

**Messaging on course sequences.** At some colleges, transfer-level courses are heavily promoted, and messaging to students is consistent among faculty and student support staff, with instructors and counselors reinforcing a message that all students can be successful in transfer-level math courses. In other colleges, BTL courses are promoted as a viable option for certain students, especially those in special programs and in certain majors. Stakeholders expressed concern that counselors and faculty who support BTL offerings play a large role in enrolling students in BTL courses despite efforts to improve access to transfer-level classes. While all of the counselors we interviewed expressed a commitment to placement reforms, several admitted finding it difficult to reconcile recommending transfer-level courses to students who voiced concerns about managing workloads and attempting rigorous coursework. Importantly, even counselors at low-access colleges acknowledged the critical importance of consistent advising and constant communication between counseling and the math department as key. These counselors stressed that all of the work put into reforming placement processes and course offerings is undermined if appropriate and consistent messaging is not executed. Without effective coordination, one counselor noted, “somebody is going to be confused, and you hope it is not the student.”

## Overrepresentation of marginalized students in BTL courses

Our report findings on why enrollments in BTL courses persist or are increasing at some colleges also help explain the overrepresentation of marginalized students in such courses. Here we provide further insight, informed by our faculty interviews, into why this happens.

**Inconsistent advising and messaging.** According to over a third (39%) of our interviewees, unclear advising, inconsistent messaging, and a misalignment of expectations between math faculty and counseling largely explain why many students still enroll in BTL courses. Some faculty hypothesized that this lack of college-level coordination affects underrepresented students more since they may not have the adequate institutional knowledge or resources to make up for informational gaps.

At the same time, students may be more frequently advised to take BTL courses if counselors express concerns over unit loads and college readiness. Such cases may be more common among low-income and historically-underrepresented students if they are more likely to be juggling work constraints or come from high schools with less access to college preparatory courses.

**Insufficient academic supports.** Still, even when courses are accessible, insufficient academic supports and encouragement may push students off the transfer-level math pathway. One faculty member cited high drop rates in the first few weeks of their Trigonometry with Support course, a course specifically designed for students with the lowest GPAs and/or math preparation. Anecdotally, this instructor found that students were finding the jump to transfer-level coursework, with minimal math preparation and external support, too difficult to overcome. Such experiences may be causing students from marginalized groups to under-enroll in STEM pathways and over-enroll in BTL courses, exposing a possible unintended consequence of new placement and course sequence reforms. To address issues like this, more than half (56%) of the faculty members we interviewed expressed a need for their departments to work more closely with special programs that are already established on campus, such as PUENTE, MESA, and UMOJA, to better support underrepresented students.

**Coordination among staff and faculty.** As a result of these trends, some colleges have proactively responded by clarifying placement expectations among staff and providing training opportunities for counselors to improve advising to students. Instructors and counselors alike cited constant communication between their two departments as key to effectively broadening enrollment in transfer-level courses. As one counselor explained, at their college, buy in from both sides was necessary to effectively implement AB705 reforms– equalizing access required an alignment of goals among all relevant players in the placement process. Similarly, almost all counselors we interviewed have received some sort of equity-based training (through department based workshops and seminars or though conferences) or have been involved with consistent ongoing discussions and professional development revolved around equity. Most notably, they shared that specific training focused on reducing implicit bias and more equitably placing special populations (e.g., students with disabilities) has been helpful in reducing prerequisite math enrollments and increasing corequisite offerings. At one college, counselors explained that weekly meetings involving student support staff and math faculty have provided effective opportunities for staff to discuss student experiences, collaborate on best approaches to advise and coach, and learn how to encourage and develop growth mindsets among students.

## Changes to, and disparities in, BSTEM pathways and outcomes

Our interviews with math faculty also shed light on how changes related to AB 705 have specifically affected access, enrollment, and success in BSTEM pathways.

**Disparities in enrollment and persistence.** About one in four faculty members we spoke to indicated that after the implementation of AB 705 they experienced increases in enrollments in higher-level math courses. At some schools, the number of calculus sections and above doubled or tripled. Math faculty at these colleges felt especially encouraged by the growth in BSTEM math enrollments because they were also leading to a more diverse student population in higher-level math courses, as well as other core courses, like Physics and Engineering. At the same time, some faculty expressed concerns that new placement policies may discourage enrollment in BSTEM courses among students with less math preparation. Anecdotal accounts of students dropping out of, or delaying enrollment in, transfer-level BSTEM courses signal a need to provide additional academic supports for historically underrepresented students that may be more prone to tracking out. At some colleges, where such trends are being tracked, continual improvement efforts have been made to address equity gaps, including redesigning corequisites, providing additional zero unit or non-credit support courses, incorporating embedded tutors, and emphasizing affective domain[4] and growth mindset[5].

**Wide variation in placement policies and course sequences.** More broadly, college-level disparities in access to BSTEM pathways seem to primarily reflect differences in placement policies. Following the state's placement guidelines, access to standalone BTSEM courses is much more strict than SLAM courses, with wide variation in how students with low GPAs and math preparation are placed. At some schools, such students are required to take a pre-requisite course, most commonly Intermediate Algebra, while at others they may only be required to take the transfer-level course with a linked corequisite. Similarly, the length of BSTEM course sequences varies across colleges. In an effort to reduce the number of course requirements for such majors, and promote enrollment, some

[4] Refers to the use of strategies to help students acquire the skills needed to be a successful college student, help reduce students fear/anxiety, and increase their willingness to engage with their coursework (see Hern and Snell 2013).
[5] Refers to the belief that talents or intelligence can be developed through things like hard work and practice (see Dweck 2016).

colleges have altered course outlines and unit loads, including combining two requirements, such as Trigonometry and Pre-calculus, into one course.

Ultimately, enrollment decisions are dependent on students' majors and are likely influenced by the messaging and advising they receive. At some colleges, all staff heavily promote BSTEM pathways and sufficient academic supports are in place to ensure persistence. In an attempt to minimize enrollment in BTL courses, other colleges emphasize SLAM pathways to students who are undecided on their major or who indicate hesitations over workloads and math sequence lengths.

**Improving BSTEM classroom experiences.** A primary concern expressed by most faculty was that implementing equity-minded changes to course content and policies is inherently difficult in BSTEM. Content-heavy course syllabi and stringent learning outcomes make it more difficult to embed culturally relevant topics in BSTEM than SLAM, where faculty have more freedom to implement project-based assessments and incorporate real-life events into course assignments and readings. Furthermore, as one faculty member explained, emphasis on affective domain and growth mindset may be more important in BSTEM, given the high levels of stereotype threat, math anxiety, and educational trauma present in the classroom.

Unfortunately, incorporating such activities require an investment of time, a resource which is already limited in content-heavy BSTEM courses. Despite these constraints, some colleges have effectively integrated academic supports within their BSTEM classrooms, improving outcomes among students in transfer-level courses. One way successful colleges have done this is by re-thinking the classroom experience in corequisite models, using time and resources deliberately to address the specific needs of students.

**Importance of BSTEM programs.** We also learned that across the state there are special programs helping to support student success in the BSTEM pipeline. Some of these efforts happen at colleges across the state and are funded by the system office, like the Mathematics, Engineering, and Science Achievement (MESA) program. MESA aims to support low-income and historically underrepresented students to pursue math and science majors by providing them with academic enrichment in STEM courses to help them successfully transfer to a four-year college. Other programs are college-based and typically funded by special grants, like Title V federal grants aimed to support STEM initiatives. Such is the case with the Palomar College STEM program, which aims to support STEM pathways through outreach, counseling, academic supports, and guaranteed admissions to CSU San Marcos.

Both the MESA and the Palomar College STEM programs provide good examples of how to support underrepresented populations through a multipronged support system, and in Palomar's case, that also includes intersegmental collaborations to help support the transfer goal. Several colleges shared plans for expanding outreach, including working more collaboratively with high schools, improving summer bridge and first-year experience programs, and creating alternate STEM pathways that do not follow a traditional calculus sequence. Moving forward, given that grant funding is supporting some initiatives, ensuring that programs are sustainable and done at scale will be critical as AB 705 helps to expand and diversify access to the BSTEM pathways.

# Appendix D. Interrupted Time Series Analysis

## D1. Description of Interrupted Time Series Analysis

In an effort to account for the student and college characteristics that may affect our descriptive findings for subsequent math enrollment and completion, we employ a comparative interrupted time series (ITS) design to examine how the implementation of AB 705 affected these outcomes in the spring 2020 and fall 2020 terms controlling for a variety of student and college characteristics.

### Context and Rationale

Considering the strict fall 2019 implementation deadline for AB 705, we believe that ITS is especially fitting. ITS has been used by education research to examine school and system-wide reforms that affect all units when a new policy is implemented for all at a single point in time. A recent study of Florida's Senate Bill 1720 uses this approach. This law transformed developmental education at Florida community colleges by exempting recent high school graduates from placement testing, and effectively made developmental education optional, in addition to mandating that developmental education be accelerated (Park-Gaghan, Mokher, Hu, Spencer & Hu, 2020).

While traditional interrupted time series designs consist of a treatment being introduced at some known point in time, and about 100 observations of an outcome over time, the short interrupted time series can have as little as four observations of a single outcome over time (Somers, Zhu, Jacob & Bloom, 2012). Intuitively, the ITS design produces impact estimates by comparing student outcomes after AB 705 implementation to the outcomes that might have been expected based on pre-implementation trends. Particularly, the ITS approach uses a projection model based on the pattern of the outcomes that has been observed in pre-implementation years to obtain an estimate of the outcomes that would have been expected in the absence of the placement and curricular changes. The difference between the actual and projected outcomes provides an estimate of the causal impact of the reform. Furthermore, Somers, et. al. (2012) found that this methodology can produce results with strong internal validity.

### Key Assumptions

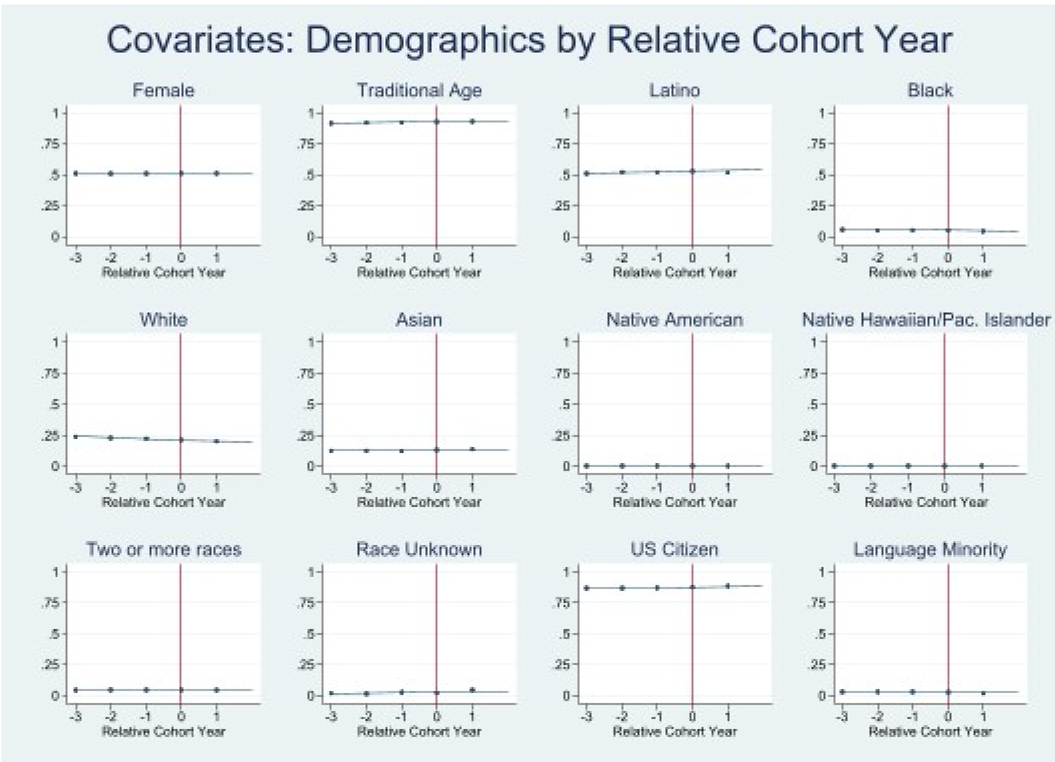
Strong internal validity depends on the correct identification of the functional form of the relationship between time and the outcome (e.g. the projection model). Two key assumptions must also be made: 1) that student characteristics did not significantly change during the time of implementation; and 2) that the developmental education reform was the only significant change taking place that could affect the outcomes. If changes in student characteristics are suspected, controls for these changes can be included in the projection model. Furthermore, if other shocks or statewide initiatives with similar goals coincided with the start of the statewide implementation of AB 705, the observed change in outcomes would be partly or entirely due to these changes.

With respect to the first assumption, Figures D1 and D2 present graphical evidence that the trends in student characteristics remained steady prior to and after the reform period. Importantly, the college GPA covariates, which represent the share of students with a GPA of 3.0 or above, excluding math– the only consistent proxy of student ability over time – experienced no systematic deviations from the trend line during this period. Across all covariates examined, the only exceptions were for first-time college student, which appears to be slightly lower in the post-reform period. The dual enrollment and full-time student in first math term covariates also appear to be slightly higher post-reform. To help adjust for these changes, controls for these variables are included in our model, which we discuss more thoroughly in the following section.

On the second assumption, the key shock that occurred that could have affected our outcomes is the COVID-19 pandemic, which struck just as colleges were in the middle of implementing the second semester of AB 705. As seen in Figure D2, which displays our key outcomes over time, persistence from fall to spring did not change significantly, but persistence from fall to fall does appear to decline. This suggests that we can be more confident that the outcomes measured from fall to spring (e.g. subsequent math enrollment and completion to next spring) are not affected by the pandemic. However, fall to fall outcomes (e.g. subsequent math enrollment in fall) do appear to be affected and, thus, estimates on these outcomes should not be interpreted as causal.

**FIGURE D1**

Covariates over time



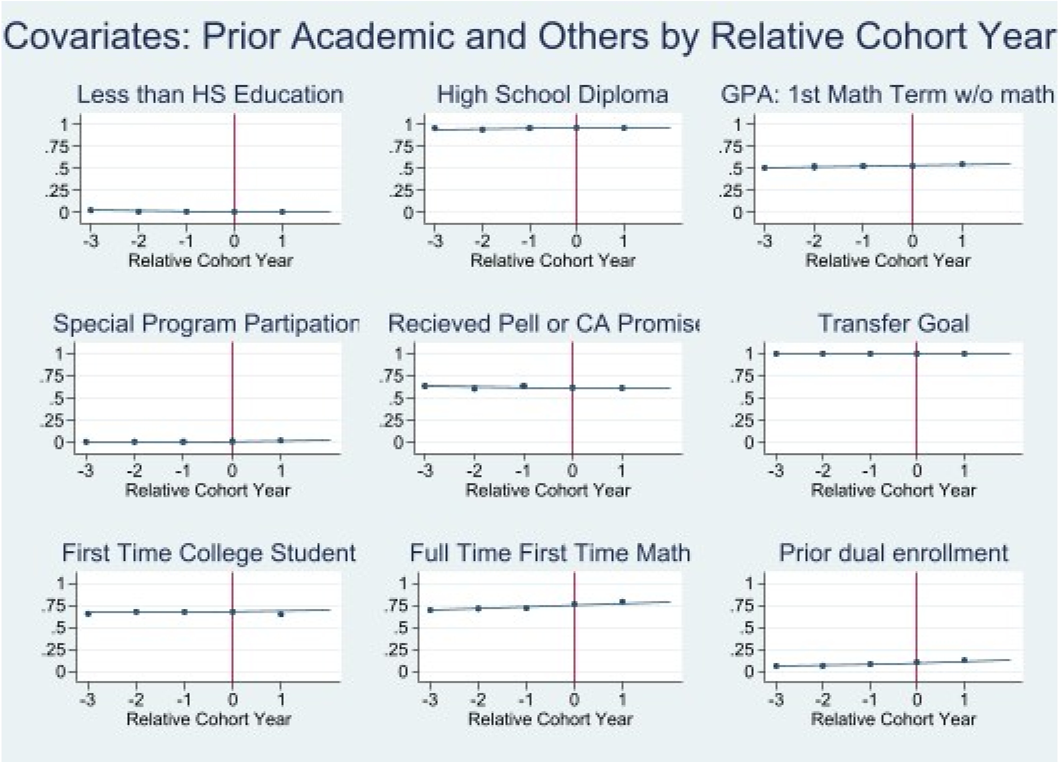
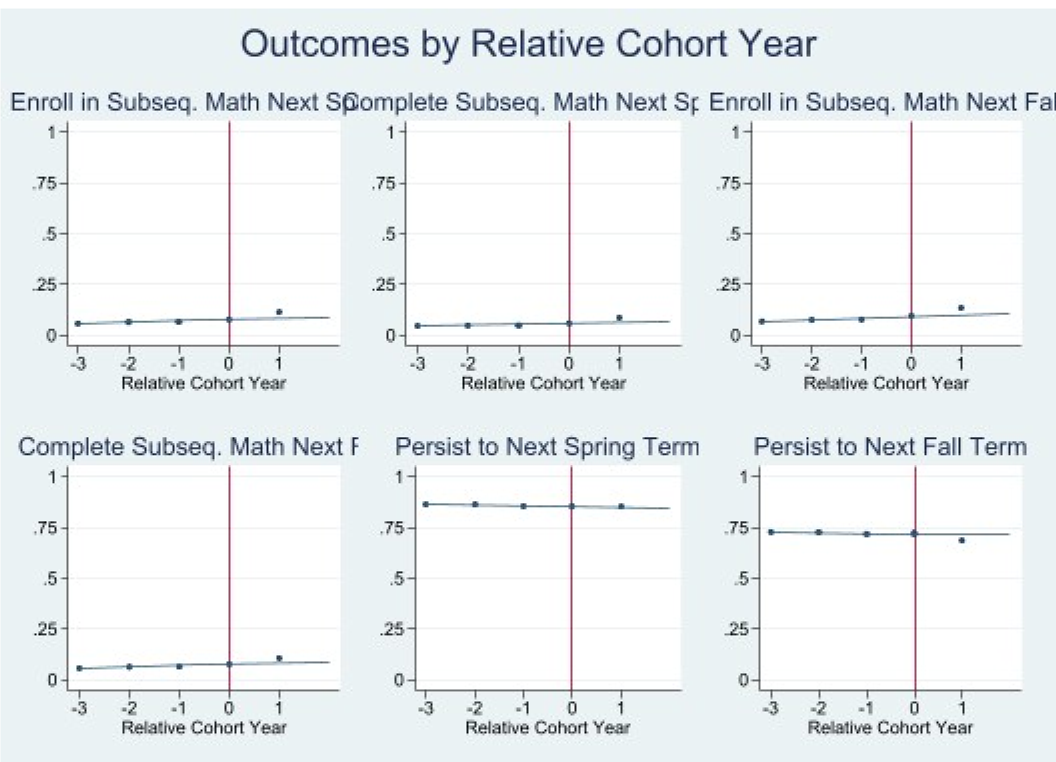



**FIGURE D2**
Outcomes over time



## D2. ITS Model and Results

### Model Specifications

Next, we describe the model specifications used to examine subsequent math course enrollment and completion, as well as persistence into the spring and fall terms. This analysis uses consistent measures of our outcomes of interest over four years (e.g. 2015-2018) prior to fall 2019 to project what outcomes would have been without the reform one year after implementation (e.g. 2019). To account for temporal trends, the analysis also includes a continuous student cohort indicator—this variable helps net out any impacts that may have resulted from early adoption of reforms.

The regression models used to estimate the impacts of AB 705 are specified as follows:

**Model 1:** Baseline mean model

$$Y_i = a + \mathbf{b}\,\mathbf{D_i} + e_i$$

**Model 2:** Regression adjusted linear baseline trend model, no covariates

$$Y_i = a + \mathbf{b}\,\mathbf{D_i} + c\,t_i + d\,D_i * t_i + e_i$$

**Model 3:** Regression adjusted linear baseline trend model, with covariates

$$Y_i = a + \mathbf{b}\,\mathbf{D_i} + c\,t_i + d\,D_i * t_i + \Sigma\, g_i\, X_i + e_i$$

**Model 4:** Regression adjusted linear baseline trend model, with covariates and college fixed effects

$$Y_i = a + \mathbf{b}\,\mathbf{D_i} + c\,t_i + d\,D_i * t_i + \Sigma\, g_i\, X_i + \mathrm{CollegeFE} + e_i$$

Where,

$Y_i$ = outcomes

a = the intercept or starting level of the outcome variable

**b** = impact estimate for the follow-up year, representing the average deviation of the outcome for that cohort from its projected counterfactual

$\mathbf{D_i}$ = equals one if student *i* was a member of the follow-up cohort and zero otherwise

c = estimate for the time trend

$t_i$ = a counter for time that starts at 0 for the first year of study (e.g. 0=2015,…, 2019=5)

$D_i*t_i$ = an interaction between the time trend and reform indicator, measuring the difference between pre-reform and post reform slopes

$g_i$ = estimate for covariates of student *i*

$X_i$ = pre-treatment covariates of student *i*

CollegeFE = college fixed effects that control for unobserved college specific policies and programs

$e_i$ = error term for student *i* clustered at the college level

In these models, *b* is our estimate of interest. It represents the impact estimate as the average deviation of the outcome for that cohort from its projected counterfactual. Additionally, even though ITS specification allows us to measure the difference in pre and post-reform slopes if sufficient post-reform data is available, it must be noted that in our analysis, this interaction ($D_i*t_i$ ) is omitted. Since we only have one post-reform period, we are unable to assess the post-reform slope until more time periods become available.

## Results

In the main report, we only discuss findings for the fully specified model 4, with summarized results provided in Table D1 and Table D2 below. Table D4 presents findings for all model specifications for the full sample that includes all students, while Table D5 presents complete results for the fully specified model by race and ethnicity. Estimates were robust to different specifications of the projection model in persistence outcomes. However, as expected based on our scatter plots, estimates are improved for access and throughput when we control for a time trend and covariates. Results for all outcomes and model specifications are available upon request.

Finally, robustness checks were conducted using a smaller 3 year baseline period (excluding 2018 or 2015); and by running alternative models where the reform period is set as 2017 or 2018. We find that results are robust to including and excluding academic years—but results are somewhat stronger when we exclude fall 2018, as expected given the early implementation of the reform that occurred during that academic year. Indeed, our findings also suggest that when we set 2018 as the reform start period, the early implementation of AB 705 at colleges across the state was also resulting in positive and significant impacts across our outcomes of interest. We opt to keep 2018 in the models given the short pre-reform time period included in our analysis, but acknowledge that the early implementation of AB 705 in 2018 dampens our estimates of AB 705 in fall 2019, when the law was fully implemented across the system.

**TABLE D1**

Persistence outcomes pre- and post-AB 705

| | (1)<br>Full Sample | (2)<br>Asian | (3)<br>Latino | (4)<br>Black | (5)<br>White |
|---|---|---|---|---|---|
| Persist to spring | -0.003 | -0.001 | 0.001 | -0.015 | -0.011 |
| | (0.003) | (0.005) | (0.003) | (0.011) | (0.004)** |
| Persist to fall | -0.034 | -0.023 | -0.042 | -0.038 | -0.026 |
| | (0.005)*** | (0.007)*** | (0.004)*** | (0.014)*** | (0.006)*** |
| | | | | | |
| Observations | 533,586 | 69,761 | 276,832 | 26,587 | 119,358 |

Robust Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to students with a transfer goal and no previous college degree. Estimates presented are for the impact of AB 705 in the fully specified interrupted time series model that includes controls for the reform, time trend, student demographic and academic characteristics, college characteristics and college fixed effects.

**TABLE D2**

BSTEM students, and students of color specifically, see biggest boost in subsequent math course enrollment and success post-AB 705

| Subsequent Math Course | (1) All Students | (2) All BSTEM Majors | (3) Latino BSTEM Majors | (4) Black BSTEM Majors | (5) White BSTEM Majors | (6) Asian BSTEM Majors |
|---|---|---|---|---|---|---|
| Enroll, Next Spring | 0.016 | 0.024 | 0.029 | 0.029 | 0.011 | 0.025 |
| | (0.004)*** | (0.009)*** | (0.010)*** | (0.015)* | (0.011) | (0.018) |
| Complete, Next Spring | 0.012 | 0.019 | 0.024 | 0.024 | 0.010 | 0.020 |
| | (0.003)*** | (0.007)*** | (0.007)*** | (0.014)* | (0.011) | (0.015) |
| Enroll, Next Fall | 0.019 | 0.029 | 0.033 | 0.038 | 0.016 | 0.030 |
| | (0.004)*** | (0.009)*** | (0.010)*** | (0.016)** | (0.012) | (0.018)* |
| Complete, Next Fall | 0.014 | 0.02 | 0.024 | 0.025 | 0.006 | 0.027 |
| | (0.003)*** | (0.007)*** | (0.008)*** | (0.015)* | (0.012) | (0.016)* |
| Observations | 533,586 | 173,268 | 80,107 | 7,489 | 41,152 | 30,408 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to students with a transfer goal and no previous college degree. Estimates presented are for the impact of AB 705 in the fully specified interrupted time series model that includes controls for the reform, time trend, student demographic and academic characteristics, college characteristics and college fixed effects.

**TABLE D3**

Wald chi-squared test across race/ethnic groups, by outcome

| | Persist fall-to-spring | Persist fall-to-fall | Enroll in subsequent math, next spring | Complete subsequent math, next spring | Enroll in subsequent math, next fall | Complete subsequent math, next fall |
|---|---|---|---|---|---|---|
| Asian/Latino | - | 4.21 | - | - | - | |
| | | (0.040)** | | | | |
| Asian/White | - | | - | - | - | |
| Asian/Black | - | - | - | - | - | |
| Latino/White | 4.58 | 3.59 | - | - | - | |
| | (0.032)** | (0.058)* | | | | |
| Latino/Black | - | - | - | - | - | |
| White/Black | - | - | - | - | - | |

*** p<0.01, ** p<0.05, * p<0.1

SOURCE: Authors' calculations using MIS data.

NOTES: SUEST stata command that runs the Wald chi-schared test for significance across groups. Each column represents an outcome, each row header indicates the racial/ethnic group comparison. Only statistically significant results are shown. Full results are available upon request.

## TABLE D4

ITS regression results for different model specifications, by subsequent math course outcome

| | All Students Subsequent Math Enrollment, Spring | | | | All Students Subsequent Math Completion, Spring | | | | BSTEM Students Subsequent Math Enrollment, Spring | | | | BSTEM Students Subsequent Math Completion, Spring | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VARIABLES | Model 1 | Model 2 | Model 3 | Model 4 | Model 1 | Model 2 | Model 3 | Model 4 | Model 1 | Model 2 | Model 3 | Model 4 | Model 1 | Model 2 | Model 3 | Model 4 |
| AB705 | 0.047 | 0.031 | 0.029 | 0.016 | 0.036 | 0.025 | 0.022 | 0.012 | 0.074 | 0.056 | 0.052 | 0.024 | 0.056 | 0.043 | 0.040 | 0.019 |
| | (0.003)*** | (0.003)*** | (0.003)*** | (0.004)*** | (0.003)*** | (0.003)*** | (0.003)*** | (0.003)*** | (0.006)*** | (0.007)*** | (0.006)*** | (0.009)*** | (0.005)*** | (0.006)*** | (0.005)*** | (0.007)*** |
| Time | | 0.006 | 0.005 | 0.004 | | 0.005 | 0.004 | 0.003 | | 0.007 | 0.006 | 0.005 | | 0.005 | 0.004 | 0.003 |
| | | (0.001)*** | (0.001)*** | (0.001)*** | | (0.001)*** | (0.001)*** | (0.001)*** | | (0.002)*** | (0.002)*** | (0.002)*** | | (0.001)*** | (0.001)*** | (0.001)*** |
| Black | | | -0.097 | -0.085 | | | -0.082 | -0.071 | | | -0.111 | -0.093 | | | -0.099 | -0.083 |
| | | | (0.006)*** | (0.004)*** | | | (0.006)*** | (0.004)*** | | | (0.009)*** | (0.006)*** | | | (0.008)*** | (0.005)*** |
| Latino | | | -0.085 | -0.076 | | | -0.075 | -0.066 | | | -0.089 | -0.078 | | | -0.082 | -0.071 |
| | | | (0.007)*** | (0.004)*** | | | (0.007)*** | (0.004)*** | | | (0.009)*** | (0.005)*** | | | (0.009)*** | (0.005)*** |
| Native American | | | -0.094 | -0.084 | | | -0.081 | -0.070 | | | -0.116 | -0.101 | | | -0.103 | -0.088 |
| | | | (0.008)*** | (0.005)*** | | | (0.007)*** | (0.005)*** | | | (0.014)*** | (0.012)*** | | | (0.013)*** | (0.010)*** |
| Pacific Islander | | | -0.086 | -0.081 | | | -0.081 | -0.075 | | | -0.104 | -0.094 | | | -0.102 | -0.093 |
| | | | (0.007)*** | (0.006)*** | | | (0.007)*** | (0.006)*** | | | (0.011)*** | (0.010)*** | | | (0.011)*** | (0.009)*** |
| Two or more races | | | -0.060 | -0.058 | | | -0.055 | -0.052 | | | -0.057 | -0.053 | | | -0.054 | -0.049 |
| | | | (0.005)*** | (0.004)*** | | | (0.005)*** | (0.004)*** | | | (0.008)*** | (0.005)*** | | | (0.008)*** | (0.005)*** |
| White | | | -0.056 | -0.054 | | | -0.050 | -0.046 | | | -0.049 | -0.045 | | | -0.047 | -0.041 |
| | | | (0.007)*** | (0.004)*** | | | (0.007)*** | (0.004)*** | | | (0.009)*** | (0.005)*** | | | (0.009)*** | (0.005)*** |
| Race unknown | | | -0.045 | -0.043 | | | -0.036 | -0.033 | | | -0.041 | -0.043 | | | -0.035 | -0.033 |
| | | | (0.011)*** | (0.008)*** | | | (0.012)*** | (0.009)*** | | | (0.011)*** | (0.010)*** | | | (0.012)*** | (0.010)*** |
| Sex: Female | | | -0.027 | -0.027 | | | -0.018 | -0.017 | | | -0.016 | -0.016 | | | -0.007 | -0.007 |
| | | | (0.001)*** | (0.001)*** | | | (0.001)*** | (0.001)*** | | | (0.003)*** | (0.003)*** | | | (0.002)*** | (0.002)*** |
| Sex: Unknown | | | -0.018 | -0.017 | | | -0.013 | -0.012 | | | -0.010 | -0.011 | | | -0.005 | -0.004 |
| | | | (0.004)*** | (0.003)*** | | | (0.003)*** | (0.003)*** | | | (0.008) | (0.007) | | | (0.006) | (0.007) |
| Non-Traditional Age | | | -0.035 | -0.032 | | | -0.029 | -0.027 | | | -0.061 | -0.054 | | | -0.049 | -0.044 |
| | | | (0.003)*** | (0.002)*** | | | (0.002)*** | (0.002)*** | | | (0.005)*** | (0.004)*** | | | (0.004)*** | (0.003)*** |
| Prior Ed: Adult | | | -0.026 | -0.023 | | | -0.024 | -0.021 | | | -0.056 | -0.050 | | | -0.053 | -0.048 |

| | All Students Subsequent Math Enrollment, Spring | | All Students Subsequent Math Completion, Spring | | BSTEM Students Subsequent Math Enrollment, Spring | | BSTEM Students Subsequent Math Completion, Spring | |
|---|---|---|---|---|---|---|---|---|
| education student | | | | | | | | |
| | (0.014)* | (0.011)** | (0.013)* | (0.011)* | (0.017)*** | (0.016)*** | (0.017)*** | (0.016)*** |
| Prior Ed: HS diploma | -0.005 | -0.005 | -0.010 | -0.010 | 0.002 | 0.002 | -0.010 | -0.009 |
| | (0.012) | (0.009) | (0.012) | (0.010) | (0.011) | (0.009) | (0.013) | (0.011) |
| Prior Ed: GED | -0.002 | -0.003 | -0.005 | -0.005 | -0.005 | -0.010 | -0.009 | -0.014 |
| | (0.013) | (0.010) | (0.013) | (0.010) | (0.013) | (0.011) | (0.015) | (0.013) |
| Prior Ed: CA HS Proficiency Cert. | 0.020 | 0.019 | 0.016 | 0.015 | 0.036 | 0.035 | 0.026 | 0.025 |
| | (0.014) | (0.012) | (0.013) | (0.012) | (0.017)** | (0.015)** | (0.017) | (0.016) |
| Prior Ed: Foreign HS degree | 0.032 | 0.029 | 0.032 | 0.029 | 0.031 | 0.025 | 0.031 | 0.023 |
| | (0.016)** | (0.012)** | (0.016)** | (0.012)** | (0.015)** | (0.012)** | (0.017)* | (0.014)* |
| Prior Ed: Unknown | -0.004 | 0.003 | -0.005 | 0.001 | -0.004 | 0.005 | -0.005 | 0.003 |
| | (0.012) | (0.010) | (0.012) | (0.010) | (0.013) | (0.012) | (0.015) | (0.014) |
| CPG or PELL recipient | -0.015 | -0.010 | -0.013 | -0.008 | -0.021 | -0.012 | -0.018 | -0.010 |
| | (0.002)*** | (0.001)*** | (0.002)*** | (0.001)*** | (0.004)*** | (0.002)*** | (0.004)*** | (0.002)*** |
| EOP&S student | -0.003 | -0.000 | -0.003 | -0.000 | -0.003 | 0.002 | -0.002 | 0.002 |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.004) | (0.004) | (0.003) | (0.003) |
| Learning disability | -0.026 | -0.028 | -0.019 | -0.021 | -0.034 | -0.036 | -0.025 | -0.027 |
| | (0.002)*** | (0.002)*** | (0.001)*** | (0.002)*** | (0.004)*** | (0.004)*** | (0.004)*** | (0.004)*** |
| U.S. Citizen | -0.028 | -0.026 | -0.026 | -0.025 | -0.029 | -0.025 | -0.030 | -0.029 |
| | (0.003)*** | (0.003)*** | (0.003)*** | (0.003)*** | (0.003)*** | (0.004)*** | (0.004)*** | (0.004)*** |
| English learner | -0.006 | -0.008 | -0.002 | -0.004 | -0.003 | -0.008 | -0.000 | -0.005 |
| | (0.008) | (0.007) | (0.008) | (0.006) | (0.016) | (0.013) | (0.015) | (0.012) |
| Foster child | -0.013 | -0.015 | -0.009 | -0.011 | -0.032 | -0.034 | -0.021 | -0.024 |
| | (0.003)*** | (0.003)*** | (0.002)*** | (0.002)*** | (0.007)*** | (0.006)*** | (0.006)*** | (0.006)*** |
| Participated in special program | 0.053 | 0.054 | 0.039 | 0.040 | 0.061 | 0.066 | 0.045 | 0.050 |
| | (0.010)*** | (0.010)*** | (0.009)*** | (0.009)*** | (0.012)*** | (0.012)*** | (0.012)*** | (0.012)*** |

| | All Students Subsequent Math Enrollment, Spring | | | | All Students Subsequent Math Completion, Spring | | | | BSTEM Students Subsequent Math Enrollment, Spring | | | | BSTEM Students Subsequent Math Completion, Spring | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| First-time in college student | | | 0.006 | 0.004 | | | 0.002 | 0.001 | | | 0.004 | 0.003 | | | -0.001 | -0.001 |
| | | | (0.002)*** | (0.001)*** | | | (0.002) | (0.001) | | | (0.003) | (0.003) | | | (0.003) | (0.002) |
| Attended full-time first-term | | | 0.032 | 0.028 | | | 0.025 | 0.023 | | | 0.052 | 0.046 | | | 0.042 | 0.037 |
| | | | (0.002)*** | (0.002)*** | | | (0.002)*** | (0.001)*** | | | (0.003)*** | (0.003)*** | | | (0.003)*** | (0.002)*** |
| Attended multiple colleges | | | 0.020 | 0.013 | | | 0.018 | 0.012 | | | 0.015 | 0.011 | | | 0.014 | 0.012 |
| | | | (0.005)*** | (0.002)*** | | | (0.004)*** | (0.002)*** | | | (0.007)** | (0.004)*** | | | (0.005)*** | (0.004)*** |
| Prior dual enrollee | | | 0.022 | 0.021 | | | 0.016 | 0.016 | | | 0.030 | 0.026 | | | 0.022 | 0.020 |
| | | | (0.003)*** | (0.003)*** | | | (0.003)*** | (0.002)*** | | | (0.006)*** | (0.005)*** | | | (0.006)*** | (0.005)*** |
| GPA 3.0 First Term, Excl. Math | | | 0.067 | 0.066 | | | 0.061 | 0.060 | | | 0.116 | 0.115 | | | 0.108 | 0.107 |
| | | | (0.003)*** | (0.003)*** | | | (0.003)*** | (0.003)*** | | | (0.004)*** | (0.004)*** | | | (0.004)*** | (0.004)*** |
| Constant | | | | -0.018 | | | | -0.015 | | | | -0.023 | | | | -0.029 |
| | | | | (0.018) | | | | (0.013) | | | | (0.030) | | | | (0.020) |
| *Model controls for:* | | | | | | | | | | | | | | | | |
| Reform | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Time Trend | | X | X | X | | X | X | X | | X | X | X | | X | X | X |
| Student and academic characteristics | | | X | X | | | X | X | | | X | X | | | X | X |
| College characteristics and fixed effects | | | | X | | | | X | | | | X | | | | X |
| | | | | | | | | | | | | | | | | |
| Observations | 535,258 | 535,258 | 533,760 | 533,586 | 535,258 | 535,258 | 533,760 | 533,586 | 173,810 | 173,810 | 173,310 | 173,268 | 173,810 | 173,810 | 173,310 | 173,268 |
| R-squared | 0.005 | 0.005 | 0.057 | 0.070 | 0.004 | 0.004 | 0.055 | 0.066 | 0.007 | 0.008 | 0.070 | 0.086 | 0.005 | 0.006 | 0.070 | 0.085 |

SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to students with a transfer goal and no previous college degree. Estimates present results for the different model specifications listed in the Interrupted Time Series empirical strategy description in Technical Appendix D (models 1-4). Note that the models control for college characteristics and fixed effects, but these are excluded for length, these results are available upon request.

**TABLE D4, CONTINUED**

ITS regression results for different model specifications, by subsequent math course outcome

| | BSTEM Students Subsequent Math Enrollment, Fall | | | | BSTEM Students Subsequent Math Completion, Fall | | | |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | Model 1 | Model 2 | Model 3 | Model 4 | Model 1 | Model 2 | Model 3 | Model 4 |
| | | | | | | | | |
| AB705 | 0.084 | 0.062 | 0.058 | 0.029 | 0.064 | 0.048 | 0.043 | 0.02 |
| | (0.006)*** | (0.007)*** | (0.006)*** | (0.009)*** | (0.005)*** | (0.006)*** | (0.005)*** | (0.007)*** |
| Time | | 0.009 | 0.007 | 0.006 | | 0.007 | 0.005 | 0.004 |
| | | (0.002)*** | (0.002)*** | (0.002)*** | | (0.002)*** | (0.001)*** | (0.001)*** |
| Black | | | -0.125 | -0.107 | | | -0.117 | -0.1 |
| | | | (0.008)*** | (0.006)*** | | | (0.008)*** | (0.005)*** |
| Latino | | | -0.101 | -0.091 | | | -0.098 | -0.087 |
| | | | (0.009)*** | (0.005)*** | | | (0.009)*** | (0.005)*** |
| Native American | | | -0.130 | -0.117 | | | -0.122 | -0.107 |
| | | | (0.014)*** | (0.012)*** | | | (0.013)*** | (0.011)*** |
| Pacific Islander | | | -0.116 | -0.106 | | | -0.12 | -0.11 |
| | | | (0.012)*** | (0.011)*** | | | (0.011)*** | (0.010)*** |
| Two or more races | | | -0.063 | -0.061 | | | -0.065 | -0.061 |
| | | | (0.008)*** | (0.006)*** | | | (0.008)*** | (0.006)*** |
| White | | | -0.055 | -0.053 | | | -0.054 | -0.05 |
| | | | (0.009)*** | (0.005)*** | | | (0.009)*** | (0.005)*** |
| Race unknown | | | -0.040 | -0.045 | | | -0.036 | -0.037 |
| | | | (0.013)*** | (0.012)*** | | | (0.014)** | (0.013)*** |
| Sex: Female | | | -0.013 | -0.012 | | | -0.006 | -0.006 |
| | | | (0.003)*** | (0.003)*** | | | (0.002)** | (0.002)** |
| Sex: Unknown | | | -0.010 | -0.011 | | | -0.006 | -0.006 |
| | | | (0.008) | (0.008) | | | -0.007 | -0.007 |
| Non-Traditional Age | | | -0.069 | -0.062 | | | -0.06 | -0.054 |
| | | | (0.005)*** | (0.004)*** | | | (0.005)*** | (0.004)*** |
| Prior Ed: Adult education student | | | -0.052 | -0.043 | | | -0.047 | -0.039 |
| | | | (0.021)** | (0.019)** | | | (0.021)** | (0.019)** |
| Prior Ed: HS diploma | | | 0.001 | 0.004 | | | -0.008 | -0.005 |
| | | | (0.014) | (0.011) | | | -0.015 | -0.013 |
| Prior Ed: GED | | | -0.010 | -0.012 | | | -0.01 | -0.012 |
| | | | (0.017) | (0.013) | | | -0.018 | -0.014 |
| Prior Ed: CA HS Proficiency Cert. | | | 0.033 | 0.035 | | | 0.025 | 0.026 |
| | | | (0.019)* | (0.017)** | | | -0.02 | -0.018 |
| Prior Ed: Foreign HS degree | | | 0.030 | 0.029 | | | 0.032 | 0.028 |
| | | | (0.019) | (0.015)* | | | -0.02 | (0.016)* |
| Prior Ed: Unknown | | | -0.007 | 0.005 | | | -0.007 | 0.004 |

| | BSTEM Students Subsequent Math Enrollment, Fall | | | | BSTEM Students Subsequent Math Completion, Fall | | | |
|---|---|---|---|---|---|---|---|---|
| | | | (0.016) | (0.014) | | | -0.017 | -0.015 |
| CPG or PELL recipient | | | -0.024 | -0.015 | | | -0.021 | -0.013 |
| | | | (0.004)*** | (0.002)*** | | | (0.004)*** | (0.002)*** |
| EOP&S student | | | -0.006 | -0.001 | | | -0.004 | 0 |
| | | | (0.005) | (0.004) | | | -0.004 | -0.004 |
| Learning disability | | | -0.041 | -0.043 | | | -0.032 | -0.035 |
| | | | (0.005)*** | (0.005)*** | | | (0.004)*** | (0.004)*** |
| U.S. Citizen | | | -0.034 | -0.029 | | | -0.036 | -0.033 |
| | | | (0.004)*** | (0.004)*** | | | (0.004)*** | (0.004)*** |
| English learner | | | -0.009 | -0.013 | | | -0.006 | -0.01 |
| | | | (0.016) | (0.013) | | | -0.015 | -0.013 |
| Foster child | | | -0.038 | -0.040 | | | -0.029 | -0.031 |
| | | | (0.008)*** | (0.007)*** | | | (0.007)*** | (0.006)*** |
| Participated in special program | | | 0.058 | 0.063 | | | 0.046 | 0.052 |
| | | | (0.012)*** | (0.012)*** | | | (0.013)*** | (0.013)*** |
| First-time in college student | | | 0.005 | 0.005 | | | 0.001 | 0.001 |
| | | | (0.003) | (0.003)* | | | -0.003 | -0.002 |
| Attended full-time first-term | | | 0.058 | 0.051 | | | 0.05 | 0.045 |
| | | | (0.003)*** | (0.003)*** | | | (0.003)*** | (0.003)*** |
| Attended multiple colleges | | | 0.018 | 0.014 | | | 0.018 | 0.014 |
| | | | (0.007)** | (0.004)*** | | | (0.006)*** | (0.004)*** |
| Prior dual enrollee | | | 0.036 | 0.031 | | | 0.029 | 0.026 |
| | | | (0.006)*** | (0.005)*** | | | (0.006)*** | (0.005)*** |
| GPA 3.0 First Term, Excl. Math | | | 0.133 | 0.131 | | | 0.128 | 0.126 |
| | | | (0.004)*** | (0.004)*** | | | (0.004)*** | (0.004)*** |
| Constant | | | | -0.041 | | | | -0.036 |
| | | | | (0.035) | | | | -0.023 |
| *Model controls for:* | | | | | | | | |
| Reform | X | X | X | X | X | X | X | X |
| Time Trend | | X | X | X | | X | X | X |
| Student and academic characteristics | | | X | X | | | X | X |
| College characteristics and fixed effects | | | | X | | | | X |
| Observations | 173,810 | 173,810 | 173,310 | 173,268 | 173,810 | 173,810 | 173,310 | 173,268 |
| R-squared | 0.008 | 0.009 | 0.080 | 0.096 | 0.006 | 0.006 | 0.082 | 0.096 |

SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to students with a transfer goal and no previous college degree. Estimates present results for the different model specifications listed in the Interrupted Time Series empirical strategy description in Technical Appendix D (models 1-4). Note that the models control for college characteristics and fixed effects, but these are excluded for length, these results are available upon request.

**TABLE D5**

ITS regression results for subsequent math course outcome, by race/ethnicity

| | Subsequent Math Enrollment, Spring | | | | Subsequent Math Completion, Spring | | | | Subsequent Math Enrollment, Fall | | | | Subsequent Math Completion, Fall | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VARIABLES | Asian | Latino | Black | White | Asian | Latino | Black | White | Asian | Latino | Black | White | Asian | Latino | Black | White |
| AB705 | 0.025 | 0.029 | 0.029 | 0.011 | 0.020 | 0.024 | 0.024 | 0.010 | 0.030 | 0.033 | 0.038 | 0.016 | 0.027 | 0.024 | 0.025 | 0.006 |
| | (0.011)** | (0.005)*** | (0.014)** | (0.008) | (0.011)* | (0.004)*** | (0.012)** | Note(0.007) | (0.012)** | (0.005)*** | (0.015)*** | (0.009)* | (0.011)** | (0.005)*** | (0.013)* | (0.008) |
| Time | 0.006 | 0.005 | 0.002 | 0.005 | 0.005 | 0.002 | 0.002 | 0.002 | 0.007 | 0.006 | 0.002 | 0.004 | 0.006 | 0.004 | 0.001 | 0.002 |
| | (0.002)** | (0.001)*** | (0.003) | (0.002)** | (0.002)** | (0.001)** | (0.003) | (0.002) | (0.003)*** | (0.001)*** | (0.003) | (0.002)** | (0.002)** | (0.001)*** | (0.003) | (0.002) |
| Sex: Female | -0.008 | -0.022 | -0.004 | -0.015 | -0.001 | -0.011 | 0.001 | -0.008 | -0.001 | -0.020 | -0.003 | -0.013 | 0.006 | -0.012 | -0.003 | -0.006 |
| | (0.005)* | (0.002)*** | (0.006) | (0.004)*** | (0.005) | (0.002)*** | (0.005) | (0.003)** | (0.005) | (0.002)*** | (0.006) | (0.004)*** | (0.005) | (0.002)*** | (0.006) | (0.004)* |
| Sex: Unknown | -0.015 | -0.011 | -0.004 | -0.002 | -0.014 | -0.002 | 0.011 | 0.006 | -0.011 | -0.015 | -0.013 | -0.002 | -0.021 | -0.005 | -0.005 | 0.014 |
| | (0.024) | (0.011) | (0.029) | (0.015) | (0.022) | (0.009) | (0.024) | (0.014) | (0.025) | (0.012) | (0.031) | (0.016) | (0.024) | (0.010) | (0.027) | (0.015) |
| Non-Traditional Age | -0.078 | -0.035 | -0.033 | -0.064 | -0.066 | -0.027 | -0.025 | -0.048 | -0.083 | -0.041 | -0.036 | -0.072 | -0.077 | -0.034 | -0.030 | -0.060 |
| | (0.011)*** | (0.005)*** | (0.009)*** | (0.006)*** | (0.010)*** | (0.004)*** | (0.008)*** | (0.006)*** | (0.011)*** | (0.005)*** | (0.010)*** | (0.007)*** | (0.011)*** | (0.005)*** | (0.009)*** | (0.006)*** |
| Prior Ed: Adult education student | -0.035 | -0.026 | 0.025 | -0.105 | -0.022 | -0.016 | -0.067 | -0.086 | -0.021 | -0.015 | 0.027 | -0.097 | -0.018 | 0.000 | -0.014 | -0.090 |
| | (0.040) | (0.024) | (0.062) | (0.040)*** | (0.038) | (0.021) | (0.052) | (0.036)** | (0.042) | (0.025) | (0.066) | (0.042)** | (0.040) | (0.022) | (0.058) | (0.039)** |
| Prior Ed: HS diploma | 0.007 | 0.016 | 0.007 | 0.011 | 0.004 | 0.012 | 0.000 | 0.002 | 0.027 | 0.018 | 0.016 | 0.009 | 0.018 | 0.016 | 0.012 | 0.002 |
| | (0.019) | (0.011) | (0.027) | (0.017) | (0.018) | (0.009) | (0.023) | (0.016) | (0.020) | (0.011) | (0.029) | (0.018) | (0.019) | (0.010) | (0.025) | (0.017) |
| Prior Ed: GED | 0.017 | 0.000 | 0.000 | -0.007 | 0.019 | 0.007 | -0.004 | -0.016 | 0.031 | -0.001 | 0.015 | -0.019 | 0.036 | 0.011 | 0.009 | -0.022 |
| | (0.023) | (0.013) | (0.032) | (0.020) | (0.022) | (0.012) | (0.027) | (0.018) | (0.024) | (0.014) | (0.034) | (0.021) | (0.023) | (0.013) | (0.030) | (0.020) |
| Prior Ed: CA HS Proficiency Cert. | 0.058 | 0.009 | 0.078 | 0.051 | 0.041 | 0.014 | 0.069 | 0.048 | 0.083 | 0.007 | 0.089 | 0.045 | 0.056 | 0.015 | 0.078 | 0.043 |
| | (0.027)** | (0.016) | (0.038)** | (0.022)** | (0.026) | (0.014) | (0.032)** | (0.020)** | (0.028)*** | (0.017) | (0.040)** | (0.023)** | (0.027)** | (0.015) | (0.035)** | (0.021)** |
| Prior Ed: Foreign HS degree | 0.028 | 0.044 | 0.043 | 0.017 | 0.028 | 0.050 | 0.044 | 0.015 | 0.051 | 0.048 | 0.039 | 0.013 | 0.049 | 0.063 | 0.045 | 0.011 |

| | Subsequent Math Enrollment, Spring | | | | Subsequent Math Completion, Spring | | | | Subsequent Math Enrollment, Fall | | | | Subsequent Math Completion, Fall | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0.020) | (0.016)*** | (0.032) | (0.020) | (0.019) | (0.014)*** | (0.027)* | (0.018) | (0.021)** | (0.017)*** | (0.034) | (0.021) | (0.020)** | (0.015)*** | (0.030) | (0.020) |
| Prior Ed: Unknown | 0.007 | 0.014 | 0.018 | 0.007 | 0.019 | 0.018 | -0.010 | 0.000 | 0.026 | 0.010 | 0.019 | -0.002 | 0.031 | 0.015 | 0.009 | -0.012 |
| | (0.022) | (0.013) | (0.033) | (0.022) | (0.021) | (0.011) | (0.028) | (0.020) | (0.023) | (0.014) | (0.035) | (0.023) | (0.022) | (0.012) | (0.031) | (0.021) |
| CPG or PELL recipient | -0.001 | -0.016 | -0.022 | -0.009 | -0.003 | -0.012 | -0.020 | -0.008 | -0.004 | -0.018 | -0.025 | -0.011 | -0.004 | -0.014 | -0.024 | -0.009 |
| | (0.005) | (0.002)*** | (0.007)*** | (0.004)** | (0.005) | (0.002)*** | (0.006)*** | (0.003)** | (0.005) | (0.003)*** | (0.007)*** | (0.004)*** | (0.005) | (0.002)*** | (0.006)*** | (0.004)** |
| EOP&S student | 0.004 | 0.004 | 0.000 | 0.006 | 0.005 | 0.003 | -0.008 | 0.009 | 0.003 | -0.001 | 0.004 | 0.005 | 0.006 | -0.000 | -0.006 | 0.009 |
| | (0.010) | (0.004) | (0.010) | (0.009) | (0.009) | (0.003) | (0.008) | (0.008) | (0.010) | (0.004) | (0.010) | (0.009) | (0.010) | (0.003) | (0.009) | (0.008) |
| Learning disability | -0.048 | -0.036 | -0.039 | -0.034 | -0.041 | -0.023 | -0.028 | -0.031 | -0.058 | -0.043 | -0.041 | -0.040 | -0.052 | -0.030 | -0.029 | -0.038 |
| | (0.018)*** | (0.006)*** | (0.013)*** | (0.008)*** | (0.017)** | (0.005)*** | (0.011)** | (0.007)*** | (0.019)*** | (0.006)*** | (0.014)*** | (0.009)*** | (0.018)*** | (0.005)*** | (0.012)** | (0.008)*** |
| U.S. Citizen | -0.033 | -0.005 | -0.037 | -0.045 | -0.040 | -0.005 | -0.040 | -0.049 | -0.041 | -0.006 | -0.047 | -0.041 | -0.045 | -0.007 | -0.049 | -0.049 |
| | (0.006)*** | (0.004) | (0.013)*** | (0.008)*** | (0.006)*** | (0.003)* | (0.011)*** | (0.007)*** | (0.006)*** | (0.004) | (0.014)*** | (0.008)*** | (0.006)*** | (0.003)* | (0.012)*** | (0.008)*** |
| English learner | 0.000 | -0.023 | 0.031 | -0.054 | 0.005 | -0.019 | 0.011 | -0.050 | -0.005 | -0.032 | 0.047 | -0.053 | -0.002 | -0.021 | 0.062 | -0.057 |
| | (0.009) | (0.010)** | (0.029) | (0.014)*** | (0.008) | (0.009)** | (0.025) | (0.013)*** | (0.009) | (0.011)*** | (0.031) | (0.015)*** | (0.009) | (0.010)** | (0.027)** | (0.014)*** |
| Foster child | -0.069 | -0.028 | -0.021 | -0.040 | -0.070 | -0.021 | -0.008 | -0.033 | -0.070 | -0.034 | -0.029 | -0.049 | -0.077 | -0.025 | -0.016 | -0.043 |
| | (0.036)* | (0.011)** | (0.016) | (0.019)** | (0.034)** | (0.010)** | (0.014) | (0.017)* | (0.037)* | (0.012)*** | (0.017)* | (0.020)** | (0.036)** | (0.010)** | (0.015) | (0.018)** |
| Participated in special program | 0.025 | 0.083 | 0.036 | 0.119 | 0.032 | 0.066 | 0.017 | 0.085 | 0.034 | 0.075 | 0.043 | 0.115 | 0.047 | 0.063 | 0.030 | 0.093 |
| | (0.024) | (0.008)*** | (0.014)** | (0.023)*** | (0.022) | (0.007)*** | (0.012) | (0.020)*** | (0.025) | (0.008)*** | (0.015)*** | (0.024)*** | (0.024)** | (0.007)*** | (0.013)** | (0.022)*** |
| First-time in college student | 0.008 | 0.001 | 0.018 | 0.001 | 0.003 | -0.004 | 0.009 | -0.000 | 0.010 | 0.001 | 0.017 | 0.003 | 0.004 | -0.003 | 0.009 | 0.004 |
| | (0.005) | (0.002) | (0.006)*** | (0.004) | (0.005) | (0.002)** | (0.005)* | (0.004) | (0.006)* | (0.003) | (0.007)** | (0.004) | (0.005) | (0.002) | (0.006) | (0.004) |
| Attended full-time first-term | 0.060 | 0.041 | 0.020 | 0.053 | 0.052 | 0.032 | 0.011 | 0.041 | 0.063 | 0.046 | 0.021 | 0.059 | 0.061 | 0.039 | 0.017 | 0.050 |
| | (0.007)*** | (0.003)*** | (0.007)*** | (0.004)*** | (0.006)*** | (0.002)*** | (0.006)* | (0.004)*** | (0.007)*** | (0.003)*** | (0.007)*** | (0.005)*** | (0.007)*** | (0.002)*** | (0.006)*** | (0.004)*** |
| Attended multiple colleges | 0.009 | 0.014 | 0.003 | 0.006 | 0.009 | 0.010 | 0.009 | 0.012 | 0.019 | 0.015 | -0.000 | 0.007 | 0.018 | 0.012 | 0.006 | 0.012 |
| | (0.008) | (0.004)*** | (0.009) | (0.006) | (0.008) | (0.004)*** | (0.008) | (0.006)** | (0.008)** | (0.004)*** | (0.010) | (0.006) | (0.008)** | (0.004)*** | (0.009) | (0.006)** |

| | Subsequent Math Enrollment, Spring | | | | Subsequent Math Completion, Spring | | | | Subsequent Math Enrollment, Fall | | | | Subsequent Math Completion, Fall | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prior dual enrollee | 0.027 | 0.022 | 0.044 | 0.028 | 0.022 | 0.018 | 0.034 | 0.019 | 0.027 | 0.027 | 0.065 | 0.035 | 0.023 | 0.024 | 0.043 | 0.027 |
| | (0.009)*** | (0.004)*** | (0.013)*** | (0.006)*** | (0.009)*** | (0.003)*** | (0.011)*** | (0.005)*** | (0.010)*** | (0.004)*** | (0.013)*** | (0.006)*** | (0.009)** | (0.004)*** | (0.012)*** | (0.006)*** |
| GPA 3.0 First Term, Excl. Math | 0.129 | 0.103 | 0.075 | 0.126 | 0.134 | 0.091 | 0.059 | 0.119 | 0.148 | 0.118 | 0.085 | 0.143 | 0.154 | 0.109 | 0.071 | 0.141 |
| | (0.005)*** | (0.002)*** | (0.006)*** | (0.004)*** | (0.005)*** | (0.002)*** | (0.005)*** | (0.003)*** | (0.005)*** | (0.002)*** | (0.006)*** | (0.004)*** | (0.005)*** | (0.002)*** | (0.006)*** | (0.004)*** |
| Constant | -0.059 | -0.149 | -0.089 | -0.177 | -0.036 | -0.083 | -0.062 | -0.129 | -0.079 | -0.158 | -0.091 | -0.206 | -0.053 | -0.104 | -0.054 | -0.171 |
| | (0.075) | (0.018)*** | (0.040)** | (0.026)*** | (0.070) | (0.015)*** | (0.033)* | (0.023)*** | (0.078) | (0.019)*** | (0.042)** | (0.027)*** | (0.074) | (0.017)*** | (0.037) | (0.025)*** |
| *Model controls for:* | | | | | | | | | | | | | | | | |
| Reform | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Time Trend | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Student and academic characteristics | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| College characteristics and fixed effects | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| | | | | | | | | | | | | | | | | |
| Observations | 30,408 | 80,107 | 7,489 | 41,152 | 30,408 | 80,107 | 7,489 | 41,152 | 30,408 | 80,107 | 7,489 | 41,152 | 30,408 | 80,107 | 7,489 | 41,152 |
| R-squared | 0.070 | 0.068 | 0.093 | 0.074 | 0.076 | 0.060 | 0.087 | 0.072 | 0.077 | 0.076 | 0.099 | 0.083 | 0.082 | 0.069 | 0.092 | 0.082 |

SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to students with a transfer goal and no previous college degree. Estimates present results for the fully specified Model 4 Interrupted Time Series model. Note that the models control for college characteristics and fixed effects, but these are excluded for length, these results are available upon request.

# Appendix E. Corequisite Remediation Analysis

## E1. Description of Corequisite Remediation Analysis

### AB 705 and Corequisite Remediation

A critical question in light of AB 705 implementation is how best to provide additional academic support for students who might not be fully prepared for a transfer-level math course. Many – but not all – colleges have opted to provide corequisite courses that are taken at the same time as the transfer-level course. System-wide, the share of first-time transfer math students in a corequisite course increased from 3% in fall 2018 to 21% in fall 2019 (and 20% in fall 2020). Colleges have varied dramatically in their adoption of the corequisite course approach: 17 colleges have no corequisite courses in math, while three colleges (Lassen, Merritt, and East Los Angeles) enroll about two-thirds of their first-time transfer level math students in a corequisite course (in fall 2020). Corequisite courses come in many forms, and placement advice to students about corequisite courses varies across the system (Cuellar Mejia, Rodriguez, and Johnson 2020). By far the most common corequisite course is for students who take statistics in the SLAM pathway.

### Context for Analysis

Here, we seek to determine how much of the increase in throughput rates post AB 705 is due to the effectiveness of corequisite support and how much is because students were given direct access to transfer-level courses. Making that determination is important – given the extent of corequisite courses – but difficult. Our data do not include high school records so we cannot control for that aspect of selection into corequisite courses.[6] Moreover, some colleges still use prerequisite remediation while others use it very sparingly, further complicating the selection into pre-requisite remediation. Because of these complications, our analyses of the effect of corequisite courses on student success cannot be considered causal.

For our analyses, we use statistical models to control for differences in student characteristics (and other factors, as described below). Our earlier findings clearly show that requiring students to take prerequisite developmental math courses is almost always detrimental to eventual completion of a gateway transfer-level math course. However, it is not clear if students are better served by taking the transfer-level course alone or along with a corequisite course (or whether other types of student supports are more effective than corequisite courses).

One study of math students in Tennessee found that those who took a math (including statistics) corequisite course did not complete the gateway transfer-level course at rates higher than their otherwise similar counterparts who took the course without a corequisite, but did have much higher rates of success than those counterparts who started in prerequisite remediation (Ran and Lin, 2019).[7] Their primary finding is that the positive effects of corequisite reform relative to prerequisite remediation "were largely driven by efforts to guide students not interested in a STEM program to take statistics, math for liberal arts, or other types of math that align with their program."

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[6] Although, we do control for students' college GPA in non-math courses. Other data show that high school GPA and college GPA are highly correlated.

[7] Ran and Lin (2019) had better data than we do. Because they had information on academic performance prior to entering college (ACT scores), they were able to use regression discontinuity and difference-in-regression-discontinuity designs. Notably, they did find that students who took a corequisite were more likely to take and pass a subsequent math course. See https://ccrc.tc.columbia.edu/media/k2/attachments/effects-corequisite-remediation-tennessee.pdf .

## E2. Results and Discussion

In general, the results of our statistical models are consistent with Ran and Lin (2019). Descriptively, we know that students in corequisite courses are less likely to succeed than students who take the transfer-level math course without the corequisite course. Among students who start a transfer-level math course in fall 2019 and fall 2020, those taking a corequisite were 8 percentage points less likely to pass the transfer-level course than those who took the transfer-level course without the corequisite. This unsurprising finding is consistent with the selection into corequisite courses. Specifically, students enroll in corequisite courses only if they or the college believes they need additional support to pass the transfer-level course.

### Analytical Approach

In our statistical models, we focus on corequisite courses that accompany transfer-level introductory statistics because they are the most common corequisite courses. We further restrict our analyses to the fall term of each academic year. Limiting the analyses to statistics corequisite courses also allows for a more consistent comparison across colleges. Even so, we know that there are many different approaches to corequisite courses, even within a single discipline. Our data does not allow us to control for those different approaches nor does it allow us to control for a student's high school record.

We use both linear probability models and difference in differences methods to estimate the effect of corequisite enrollment on successful completion of transfer-level statistics (our outcome of interest).

### Results from Linear Probability Models

In our linear probability models, we include the entire sample of first-time math students taking transfer-level statistics. Results are shown in Table E1. Though corequisite courses did not become common until fall 2019, our regressions include an analysis of statistics course outcomes from 2015 to 2020. With no controls other than year, we find that statistics corequisite students were 8 percentage points less likely to pass the transfer-level course than those students who took transfer-level statistics without a corequisite (57% versus 65% in 2020 and 2021, see results from model 1 in Table E1). This is not surprising: students should only be placed in the corequisite course if they are not sufficiently prepared to succeed in the transfer-level course.

Adding a full set of controls, with the exception of grade point average in non-math courses, does not appreciably change the finding. Per model 2 in Table E1, corequisite students are 6 percentage points less likely to complete the transfer-level statistics course. Those controls include gender, race/ethnicity, citizenship, first generation status, English proficiency, age, Pell grant recipient status, student goal (transfer or not), first-time college student, and prior dual enrollment.

Overall, our statistical models show that the gap in successful completion between corequisite students and other transfer-level statistics students remains even after we control for a wide range of characteristics, with one notable exception: grade point average in non-math courses eliminates the gap. When we add a control for students' non-math grade point average in the term they enrolled in the transfer-level statistics course, the difference in course completion rates between corequisite students and those who took the course without corequisites is nearly eliminated (only 1 percentage point, per model 3 in Table E1).[8] Since students who take corequisite courses are more likely to struggle academically than students who take the stand-alone transfer-level statistics course, we also estimated additional models separately for students with low non-math grade point averages. In those models, we find that the probability of successfully completing a transfer-level statistics course is the same for those who

[8] An additional model, not shown, with college fixed effects completely eliminates the difference.

take the corequisite as for those who do not. In other words, corequisites do not appear to improve students' chances at completing a transfer-level statistics course (but they don't seem to hurt either).

**TABLE E1.**

Linear probability model results of the effect of corequisite remediation on passing transfer-level statistics

| | (1) | (2) | (3) |
|---|---|---|---|
| Corequisite Remediation | -.077 | -.060 | -.011 |
| | (0.004)*** | (.004)*** | (0.003)*** |
| | | | |
| Model controls for: | | | |
| Students' First Year in CCC | X | X | X |
| First Year x Corequisite | X | X | X |
| Student Characteristics | | X | X |
| Non-math GPA in Term | | | X |
| | | | |
| Observations | 407,884 | 407,884 | 395,900 |
| R-squared | 0.012 | 0.059 | 0.234 |
| Robust Standard errors in parentheses | | | |
| *** p<0.01, ** p<0.05, * p<0.1 | | | |

SOURCE: Authors' calculations using MIS data.

NOTE: Restricted to first-time math students taking transfer level statistics in the fall. Controls for student characteristics include gender, race/ethnicity, citizenship, first generation status, English proficiency, age, Pell grant recipient status, student goal (transfer or not), first-time college student status, and prior dual enrollment.

Not surprisingly then, we also find that colleges that adopted the corequisite approach to scale did not seem to have better outcomes than those that did not use statistics corequisites at all (Figure E1). Even among colleges that used below transfer-level courses sparingly, those that did not use corequisites had student success rates as high as those that used corequisites extensively. However, there is wide variation across colleges.

**FIGURE E1**

Colleges that used corequisite courses in statistics did not have higher one-term throughput rates


SOURCE: Authors' calculations using MIS data. Note that these are descriptive results with no controls for student characteristics.

NOTE: Includes all first-time math students See the glossary of terms at the end of this report for definitions.

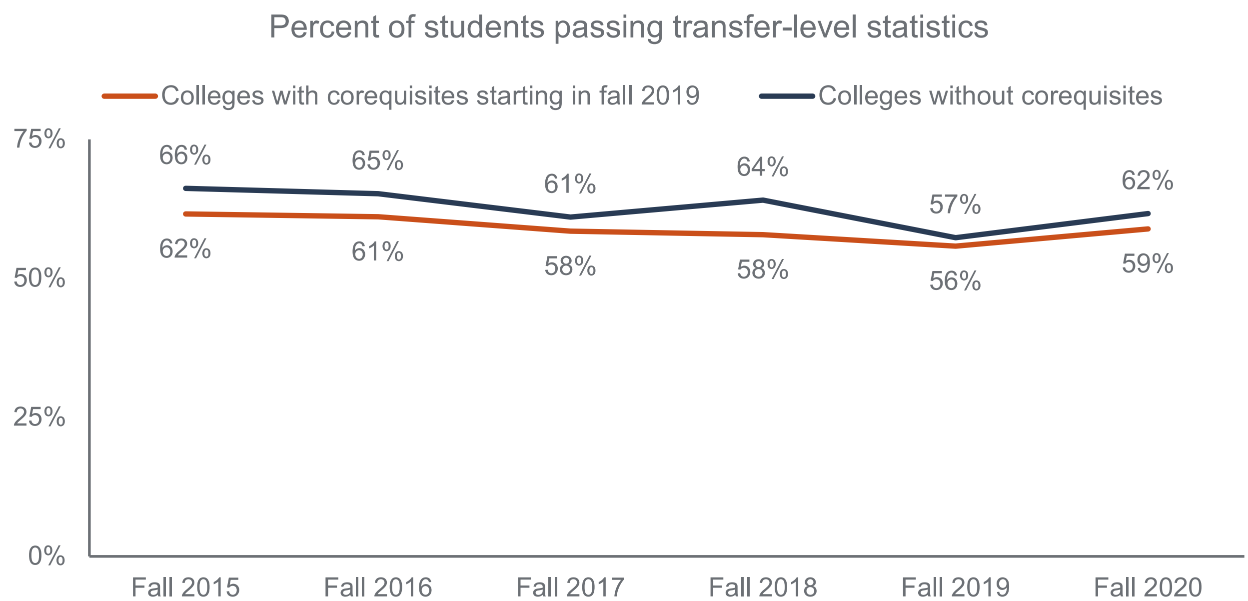
## Results from Difference-in-Difference Models

In our difference-in-difference models, we restrict our analyses to two sets of colleges: our control group consists of colleges that have never used corequisite courses, and our treatment group consists of those that have used them extensively beginning in fall 2019 but did not use them before then. We further limit our sample of colleges to those that had at least 100 students in transfer-level statistics courses in fall 2019 and fall 2020. The goal of these models is to determine whether colleges that began using corequisite courses with AB705 implementation had higher levels of student success relative to colleges that did not use corequisites.

In all, only 42 colleges met our restrictions, 11 in the control group and 31 in the case group (with a total sample of over 80,000 students). Results of the full model, controlling for student characteristics (including non-math GPA), are shown in Figure E2. Both before and after the implementation of AB705 in fall 2019, colleges that did not use corequisites had slightly higher rates of success in statistics courses than in colleges in our treatment group. With the implementation of AB705 in fall 2019 (and the adoption of corequisites in our treatment colleges), the difference in course success rates narrowed from a regression adjusted difference of 4 percentage points in our pre-treatment period to 2 percentage points in the post-treatment period. This difference, while small in magnitude, is statistically significant and suggests that corequisite courses might have had a very slight role in improving student success at this set of colleges. It is worth noting that if we only compare fall 2017, the last term prior to the passage (but not implementation) of AB705, with the most recent data (Fall 2020) we find no change in the difference in success rates between the two sets of colleges.

**FIGURE E2**

Declines in course success rates in fall 2019 were higher in colleges that did not use corequisites




SOURCE: Authors' calculations using MIS data.

NOTE: Includes all first-time math students for two sets of colleges: a control group consisting of colleges that have never used corequisite courses, and a treatment group consisting of colleges that have used them extensively since fall 2019 but did not use them before then. The sample of colleges included is limited to those that had at least 100 students in transfer-level statistics courses in fall 2019 and fall 2020. Results shown are regression-adjusted, see Technical Appendix section E2 for a description of variables used in our corequisite regression analysis. See the glossary of terms at the end of this report for definitions.

Together, our linear probability and difference-in-differences analyses on the effect of corequisite courses in statistics does not convincingly show that students are better off taking corequisite courses than simply taking the transfer-level course without the corequisite. However, we need much more information before we can conclude that all corequisite courses are ineffective. Unfortunately, that information, such as how the corequisite was taught, placement processes, and other student supports, is very hard to come by. We do know student success in corequisite models varies widely across colleges. In future work, we intend to examine this variation; did some colleges consistently outperform others? If so, via interviews and college scans we will seek to contrast successful colleges with those that did not have such strong results to determine how corequisite courses might best be targeted and structured to increase student success.

# Appendix F. What happened to students who started and did not succeed in their first TL math attempt?

The implementation of AB 705 opened the door to transfer-level courses to thousands of additional students. However, about half of students who started in a transfer-level course in fall 2019 did not successfully complete it on their first attempt. By understanding who these students were, their academic record, and how many eventually completed their transfer-level math, colleges may identify ways to support first-time math takers.

Please refer to technical appendix Table B8 for the underlying data in this analysis.

**What are the characteristics of these students?** Relative to transfer-level students who passed in their first attempt, those who did not were more likely to be Latino, Black, male, traditional college-age, US citizens, and Pell grant or California College Promise Grant recipients. Those who were unsuccessful were also more likely to be in their first term at the community college system and less likely to enroll in a full-time course load).

**How did they do in their other courses?** On average, these students earned 63 percent of the transferable units they attempted, with almost a quarter earning 25 percent or less. In comparison, successful transfer-level students earned on average 93 percent of the transferable units they attempted— only 2 percent earned 25 percent or less. This is reflected in average GPAs: 2.5 for unsuccessful students and 3.3 for successful students.

Moreover, while 89 percent of successful transfer-level math students completed college composition in their first term, only 55 percent of the unsuccessful group did so. Regardless of the success in their first attempt, over two-thirds of first-time math students who started in a transfer-level course were also first-time English takers.[9]

**Did they re-enroll in a transfer-level math course?** Thirty-six percent came back for another transfer-level course in the spring; and another 12 percent re-enrolled the next fall. Both percentages are lower than for previous cohorts (41% and 14%). Students who started in a SLAM course were less likely to re-enroll in any transfer-level course than those who started in a BSTEM course (42% versus 56%).

For students in the BSTEM path, these introductory math courses are prerequisite to other courses. But most students in a SLAM course need to complete only that course—so retaking it later does not threaten their progress. The fact that a higher share of first-time math students started in SLAM courses in fall 2019 than in past terms partially explains the relatively lower repeat rates.

Also, given than corequisites continue to be more prevalent in SLAM than in BSTEM courses, students who took the course with corequisite support were less likely to re-enroll as of the next fall than students who took the course without support (41% vs. 50%).

**Did they eventually successfully complete the transfer-level course?** 26 percent of students who started in a transfer-level course in fall 2019 and did not complete it in their first attempt, successfully completed a transfer-level course by the following fall. The success rate conditional on enrollment was 54 percent.

**What about equity gaps?** Racial equity gaps in fall-to-fall throughput rates among transfer-level starters who did not succeed on their first attempt are slightly lower compared to the racial equity gaps in one-term throughput rates. However, both Latino and black students are underrepresented in fall-to-fall completions (with a proportionality index of 0.85 for Latinos and 0.72 for Black).[10]

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[9] Of the students in this group, about one in five students who took a math corequisite also took an English corequisite.

[10] The Proportionality Index measure compares a group's representation with respect to an educational outcome relative to its representation in the entire cohort of analysis. Above equity means a PI of 1 or greater; near equity means that that the PI is between 0.86 and 0.99; and below equity means a PI of 0.85 or lower.

**Did they take the course with corequisite support the second time around?** Among students who re-enrolled as of the next fall, 31 percent did so in a corequisite model. Almost all students who took the corequisite on their first attempt enrolled in a corequisite the second time around. Meanwhile, only 15 percent of those who took the standalone course the first-time enrolled in a corequisite the second time.

**Did they switch from BSTEM to SLAM?** About 9 percent of students who first attempted but did not complete a BSTEM course in fall 2019, completed only a SLAM course by the following fall. Conversely, only 2 percent of those who started in a SLAM course ended up successfully completing a BSTEM course. About 8 percent of all students who successfully completed a transfer-level course by the next fall did so in a different college than the one from their first attempt.

**If they did not attempt another transfer-level math, were they still enrolled in a CCC?** Of the 39,669 students who started in a transfer-level math course and did not successfully complete it, 52 percent *did not* re-enroll in another transfer-level math course by the next fall (20,573 students). However, six in 10 of these students were still enrolled in the community college system in the spring (48% full-time) and 40 percent in the fall (41% full-time).

A key takeaway is that students who were unsuccessful in first attempt at transfer-level math were also less likely to be successful in their other courses, which shows that many of these students may struggle with more than just math content.

Still, about 29,300 students in the fall 2019 cohort, despite starting in a transfer-level course, were unable to complete their math requirement as of fall 2020. For some of these students, the pandemic was a determinant factor. When courses resume face-to-face, it will be important to study whether fewer students start in and successfully complete transfer-level.

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