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# **New Eligibility Rules for the University of California? The Effects of New Science Requirements**

## **Technical Appendices**

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## Appendix A. TES Sample

Our TES sample includes 56,320 high school graduates in the 2017-18 school year. Latino students are over-represented in our TES sample and the A–G complete rate (38%) is lower than the statewide average (47%). Since non A–G completers, regardless of the number of area D taken, are less likely to be affected by the new proposal, in our main analysis we restrict our sample to A–G completers only. Asian American, Latino and female students are over-represented in the A–G sample, and white students are under-represented.

**TABLE 1**

Summary statistics of the TES sample, 2017-18

	TES all graduates	TES A-G graduates	Statewide (CDE Dataquest)
African American	9%	7%	6%
American Indian	0%	0%	1%
Asian American	10%	17%	12%
Latino	66%	57%	53%
White	10%	14%	24%
Female	50%	59%	49%
Met UC requirements	31%	77%	NA
Met CSU requirements	39%	88%	NA
A–G completion	38%	100%	47%
N of graduates	56320	19766	408124

SOURCES: Transcript Evaluation Service, 2017-18; California Department of Education, 2017-18.

NOTES: No high school graduates in our sample met all other subject area requirements but failed the science requirements.

## Appendix B. CPP Sample

The Cal-PASS Plus sample includes 1.6 million high school graduates from 2007–2017, representing about 35 percent of the all high school graduates during the same time period. First generation college students are overrepresented in the CPP sample. The college-going rate (78%) is much higher than the statewide average (64%), which is surprising given the (relatively) small differences in student demographics and family background. The discrepancy may be attributed to blocked directory information records that were not captured by the National Student Clearinghouse (NSC), which provides the underlying data for the CDE’s college-going rate calculation. Analysis conducted by the NSC shows that the average block rate was 11 percent over 2012–13, 2014–15 and 2016–17 (National Student Clearinghouse, 2019).

Close to a third of graduates in the CPP sample did not have any area D course-taking records. This could be due to multiple reasons. First, a substantial number of graduates do not have complete four-year transcripts, making it hard to get an accurate count of area D courses. Second, A–G science courses are under-reported in CPP. Because of these reasons, we restrict our analytical sample to graduates with complete high school transcripts and with at least two years of area D (which matches the TES numbers closely). We rely on this sample to examine the effect of an additional year of science on postsecondary outcomes.

**TABLE 1**  
Summary statistics of the CPP sample, 2007-2017

	Cal PASS Plus Sample		CDE
	All graduates	w/ 4 year transcripts	
Female	51%	52%	49%
Asian American	12%	18%	12%
African American	5%	5%	6%
Latino	51%	46%	53%
White	22%	20%	24%
Free/reduced lunch	37%	42%	65%
Special education	2%	1%	12%
Parent education: high school or below	44%	39%	37%
Parent education: some college	23%	21%	20%
Parent education: college graduates	21%	23%	19%
Parent education: graduate school +	13%	17%	12%
Has 9th grade transcript	56%	100%	
Has 10th grade transcript	65%	100%	
Has 11th grade transcript	65%	100%	
Has 12th grade transcript	40%	100%	
% enrolled in college	78%	76%	64%
N of graduates	1,589,921	200,001	4,539,397

SOURCES: Cal-PASS, 2007-2017.

NOTES: Statewide college going rate is available for the 2017-18 cohort only. Free/reduced price lunch is self-reported data in the CPP and may be lower than the actual number.

## Appendix C. Additional Tables and Figures

**TABLE 1A**

% high school graduates completing ... years of area D, high-need schools only, 2017-18

	Overall	Female	Male	Latino	African American	White	Asian American	UC met	CSU met
3 years or more	43%	49%	37%	40%	37%	50%	70%	83%	77%
2 years	25%	25%	25%	26%	27%	25%	19%	17%	21%
1 year	19%	16%	23%	21%	22%	16%	8%	0%	2%
0 science	12%	9%	16%	13%	14%	9%	4%	0%	0%
N of high school graduates	46484	23527	22957	32950	3662	2947	4032	14415	18167

SOURCES: TES, 2017-18.

NOTES: 88 percent of TES schools are high-need schools. All schools offered at least three years of area D during the 2017-18 school year.

**TABLE 1B**

% high school graduates completing ... years of area D (with an C or better), by gender, high-need schools only, 2017-18

	3 years or more	2 years	1 year	0 years
Latino				
Female	47%	26%	17%	10%
Male	35%	25%	23%	17%
African American				
Female	45%	27%	18%	9%
Male	31%	25%	25%	19%
White				
Female	67%	20%	9%	5%
Male	58%	20%	14%	8%
Asian American				
Female	79%	14%	5%	2%
Male	68%	19%	8%	5%
UC met				
Female	85%	15%	0%	0%
Male	86%	14%	0%	0%
CSU met				
Female	80%	18%	2%	0%
Male	79%	19%	2%	0%

SOURCES: TES, 2017-18.

NOTES: 88 percent of TES schools are high-need schools. All schools offered at least three years of area D during the 2017-18 school year.

**TABLE 2**

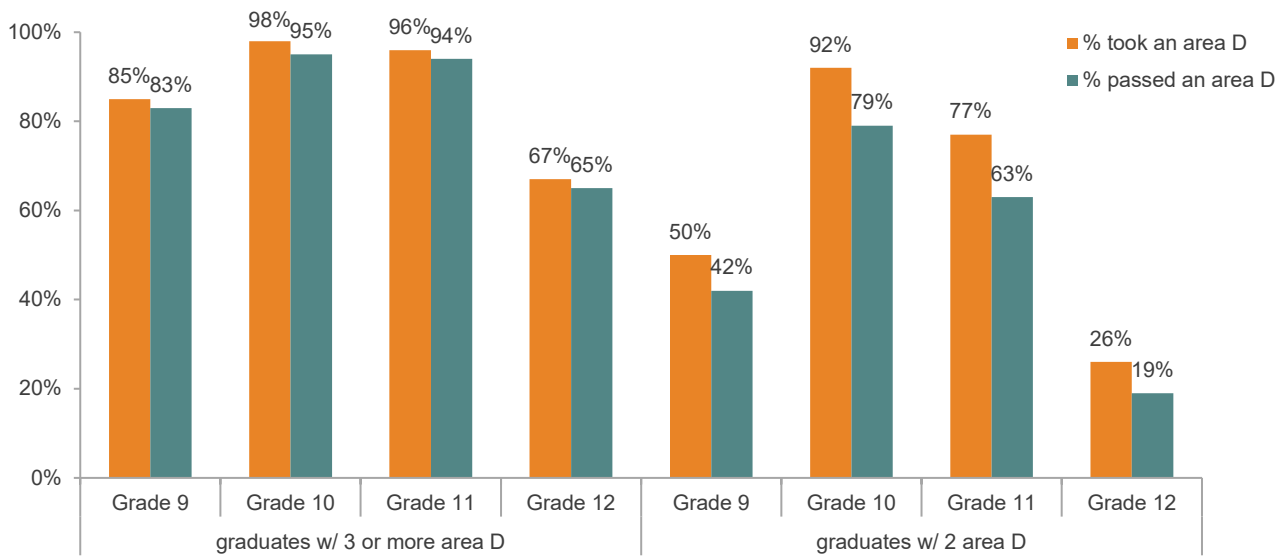
# units earned in A–G subject areas, 2017-18

	Graduates with 3 or more area D	Graduates with 2 area D	A–G graduates with 3 or more area D	A–G graduates with 2 area D
A (History/Social science, minimum: 2)	4	2	4	2
B (English, minimum: 4)	4	4	4	4
C (Math, minimum: 3)	4	3	4	4
E (LOTE, minimum: 2)	2	2	3	3
F (VAPA, minimum: 1)	2	2	2	2
G (Elective, minimum: 1)	2	2	2	3
Total (minimum: 15)	21	17	22	20
N graduates	24068	12560	15919	3782

SOURCES: TES, 2017-18.

**FIGURE 1**

% A-G graduates taking and passing an area D course, by grade



SOURCE: TES, 2017-18.

NOTE: Passing with C or better.

**TABLE 3**

% of A–G completers taking area ... courses, by grade

% A–G graduates taking ...	9th grade		11th grade		12th grade	
	w/ 3 or more	w/ 2, no area D in 9 <sup>th</sup> grade	w/ 3 or more	w/ 2, no area D in 11 <sup>th</sup> grade	w/ 3 or more	w/ 2, no area D in 12 <sup>th</sup> grade
Area A: history/social science	36%	23%	99%	99%	94%	95%
Area B: English	99%	97%	100%	100%	100%	99%
Area C: math	99%	96%	99%	97%	88%	78%
Area D: Science	85%		96%		67%	
Area E: LOTE	74%	57%	71%	73%	29%	33%
Area F: VAPA	43%	39%	53%	63%	52%	64%
Area G:	25%	76%	42%	52%	96%	97%
History/social science	5%	2%	19%	24%	92%	93%
English	4%	1%	3%	5%	4%	6%
Math	1%	1%	4%	4%	5%	5%
Science:	13%	73%	4%	13%	6%	6%
Biological	1%	3%	2%	4%	4%	4%
Integrated	1%	7%	1%	1%	1%	1%
Physical	11%	63%	1%	7%	2%	2%
Interdisciplinary	5%	5%	16%	17%	24%	29%
N of A-G graduates	15917	1906	15919	870	15919	2802

SOURCE: TES, 2017-18.

**TABLE 4**

% public high schools offering &lt;3 years of area D, 2007-2017

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
% schools offering <3 years of area D	9%	10%	12%	13%	13%	14%	14%	13%	12%	10%	9%
% schools offering 2 years of area D	4%	4%	5%	6%	6%	6%	6%	7%	6%	5%	4%
% schools offering 1 year of area D	4%	5%	6%	6%	6%	6%	6%	6%	4%	4%	4%
% schools offering no area D	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%
N Schools	1237	1277	1336	1401	1437	1487	1546	1600	1651	1706	1752

SOURCES: UC A–G course management portal, 2007-2017

NOTES: Sample excludes schools that cannot be matched to the California Department of Education’s public school database (N=652). These schools are mostly private schools and charter schools. Years refer to the fall of the school year.

**TABLE 5**

Effects of school characteristics on the number of area D courses offered, 2017-18

	All	High need	urban	rural	charter
student enrollment	0.0040*** [0.0002]	0.0044*** [0.0002]	0.0039*** [0.0004]	0.0043*** [0.0006]	0.0025*** [0.0007]
# science teachers per 100 students	0.1907*** [0.0598]	0.2671*** [0.0381]	0.3289 [0.3500]	0.0000 [0.1169]	0.2331*** [0.0431]
average science teacher experience	-0.0125 [0.0179]	0.0109 [0.0237]	0.0036 [0.0355]	0.0149 [0.0460]	-0.0154 [0.0440]
% science teachers w/ MS +	0.3845 [0.3949]	0.3184 [0.4257]	0.3851 [0.6155]	-0.1161 [0.6726]	0.7515 [0.7221]
Urban school	0.6318* [0.3325]	1.1001*** [0.3752]			0.1779 [0.6303]
Rural school	-0.0767 [0.3530]	0.3662 [0.4497]			-0.2514 [1.0507]
High-need students share	-0.4967 [0.6611]	-0.2579 [1.2488]	0.9841 [1.0901]	-1.2031 [1.4991]	1.1268 [0.9875]
charter school	-1.3126*** [0.3903]	-0.5092 [0.3784]	-1.5546** [0.7161]	-1.3455 [0.9888]	
Constant	5.4885*** [0.6461]	4.1408*** [1.0611]	4.9349*** [1.3228]	5.6937*** [1.2824]	4.2772*** [1.0917]
Observations	1,524	970	661	147	306
R-squared	0.469	0.483	0.443	0.495	0.186

SOURCES: CMP, 2017-18; CDE, 2017-18.

NOTES: Standard errors are clustered at the district level and included in brackets. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1.

**TABLE 6**

Effects of three years or more area D on postsecondary outcomes, model specifications, 2007-2017

	DV: 75th percentile SAT math (NA for 2 year college)					
	Base	w/ Demo	w/ FRPL	w/ Pared	w/ Course GPA	w/ school FE
Female		-2.3816*** (0.7971)	-1.7808** (0.7660)	-0.4799 (0.9579)	-4.8563*** (0.8837)	-4.6386*** (0.8681)
American Indian		-11.5095 (9.0571)	-7.0664 (9.0420)	0.4793 (10.5250)	-2.9663 (9.8323)	-0.8820 (10.2158)
Asian American		12.6786*** (4.0184)	16.8933*** (3.6914)	20.2757*** (3.6254)	19.5666*** (3.8520)	10.6100*** (2.1022)
African American		-33.4086*** (3.5942)	-25.3812*** (3.2307)	-22.0908*** (3.4015)	-3.0770 (3.3381)	-1.2336 (2.7205)
Latino		-35.1896*** (2.9989)	-24.3790*** (2.5848)	-14.1626*** (2.4307)	-4.8987** (2.3055)	-3.2413** (1.6264)
Pacific Islander		-26.1941*** (6.8844)	-21.0803*** (6.8549)	-18.0587** (7.9579)	-8.0797 (9.6515)	-8.6493 (7.4740)
Multi-race		6.5218** (3.0429)	9.8626*** (2.9312)	6.6411** (3.0939)	6.3133** (2.9229)	4.8885* (2.5440)
FRPL			-21.8417*** (2.8038)	-12.9450*** (2.4431)	-10.1788*** (2.5280)	-0.0396 (1.5277)
Average GPA in area D					47.5012*** (1.3612)	49.2148*** (1.3504)
Parental edu: some college				1.2714 (1.6994)	1.5522 (1.5557)	-0.0863 (1.2349)
Parental edu: college graduates				15.7157*** (2.3549)	11.8062*** (2.3383)	4.7689*** (1.4107)
Parental ed: graduate school				39.5186*** (3.0899)	31.9270*** (3.2312)	18.2469*** (1.7810)
3 or more area D	22.0783*** (3.4604)	16.3711*** (2.4325)	16.0247*** (2.3278)	19.0631*** (2.5745)	-2.2383 (1.9694)	-1.8911 (2.2660)
cohort effects		X	X	X	X	X
high school fixed effects						X
Observations	41,224	41,224	41,224	21,702	21,378	21,378
R-squared	0.010	0.097	0.112	0.153	0.287	0.405

SOURCE: Cal-PASS Plus, 2007-2017

NOTES: Standard errors are in parenthesis and clustered at the high school level. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1.



**TABLE 7**

Effects of taking three (+) years of area D on postsecondary outcomes, 2007-2017

	SAT math	SAT verbal	4 year Col	2 year Col	any Col	Barron's
Female	-4.6386*** (0.8681)	-2.8598*** (0.6544)	0.0476*** (0.0042)	-0.0473*** (0.0042)	0.0192*** (0.0032)	0.1339*** (0.0248)
American Indian	-0.8820 (10.2158)	1.5515 (7.2854)	-0.0023 (0.0318)	0.0040 (0.0318)	-0.0293 (0.0321)	-0.0777 (0.1909)
Asian American	10.6100*** (2.1022)	4.8262*** (1.5934)	0.0445*** (0.0083)	-0.0437*** (0.0084)	0.0685*** (0.0078)	0.2995*** (0.0667)
African American	-1.2336 (2.7205)	-1.1487 (2.2237)	0.0576*** (0.0119)	-0.0577*** (0.0119)	0.0134 (0.0095)	0.1250* (0.0649)
Latino	-3.2413** (1.6264)	-3.1405** (1.2505)	-0.0051 (0.0066)	0.0054 (0.0065)	0.0617*** (0.0058)	-0.1443*** (0.0438)
Pacific Islander	-8.6493 (7.4740)	-6.4972 (5.8394)	-0.0386 (0.0283)	0.0425 (0.0282)	0.0738*** (0.0241)	-0.2678* (0.1503)
Multi-race	4.8885* (2.5440)	1.6159 (1.9863)	0.0112 (0.0139)	-0.0098 (0.0140)	0.0167* (0.0101)	0.0361 (0.0821)
FRPL	-0.0396 (1.5277)	-0.9835 (1.2040)	0.0199*** (0.0054)	-0.0199*** (0.0054)	0.0215*** (0.0041)	0.0594* (0.0327)
Average GPA in area D science	49.2148*** (1.3504)	35.5377*** (1.0322)	0.1728*** (0.0059)	-0.1724*** (0.0059)	-0.0635*** (0.0043)	1.3719*** (0.0391)
Parental education: some college	-0.0863 (1.2349)	1.1855 (0.9280)	0.0022 (0.0053)	-0.0025 (0.0053)	0.0046 (0.0043)	-0.0274 (0.0265)
Parental education: college graduates	4.7689*** (1.4107)	4.6627*** (1.0270)	0.0338*** (0.0070)	-0.0350*** (0.0069)	-0.0092* (0.0052)	0.2188*** (0.0375)
Parental education: graduate school +	18.2469*** (1.7810)	15.4015*** (1.3292)	0.0802*** (0.0095)	-0.0808*** (0.0096)	-0.0382*** (0.0065)	0.8624*** (0.0585)
3 or more area D (comparison: 2 only)	-1.8911 (2.2660)	-1.8877 (1.7031)	0.0705*** (0.0073)	-0.0723*** (0.0073)	0.0049 (0.0055)	0.0440 (0.1808)
cohort effects	X	X	X	X	X	X
high school fixed effects	X	X	X	X	X	X
Observations	21,378	21,378	54,463	54,463	71,327	48,736
R-squared	0.405	0.392	0.289	0.291	0.106	0.343

SOURCE: Cal-PASS Plus, 2007 -2017.

NOTES: standard errors are in parenthesis and clustered at the high school level. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1.

**TABLE 8**

% high schools offering ... years of area D, by school characteristics, 2017-18

% schools offering...	Overall	High need	Large	Small	Urban	Rural	Charter	High standards
<b>Panel A: unweighted</b>								
<3 years of area D	9%	11%	0%	31%	8%	8%	10%	6%
2 years of area D	4%	5%	0%	15%	4%	4%	5%	3%
1 year of area D	4%	4%	0%	12%	3%	3%	3%	2%
no area D	1%	1%	0%	3%	1%	0%	1%	0%
<b>Panel B: weighted by student enrollment</b>								
<3 years of area D	2%	2%			0%	2%	4%	1%
2 years of area D	1%	1%			0%	1%	2%	1%
1 year of area D	1%	1%			0%	1%	1%	1%
no area D	0%	0%			0%	0%	1%	0%
N schools	1752	1133	103	354	724	178	408	610

SOURCES: UC A–G course management portal (CMP), 2017-18; California Department of Education, 2017-18; National Center for Education Statistics, 2014-15; PPIC Next Generation Science Standards Survey, 2018.

NOTES: Schools with high standards require A–G completion for high school graduation. Sample excludes high schools that cannot be matched to the California Department of Education’s public school database file. Most of these schools are private high schools and charter schools. CMP does not include all public high schools in California. In 2017-18, 805 active regular high schools were not included. Most (221) of these schools are charter schools; 72 are traditional public schools. High-need schools are those where at least 55 percent of students are low-income, English Learners, or foster youth. Large schools are those at the 90<sup>th</sup> percentile of the enrollment distribution (>2663 students). Small schools are those at the bottom 10<sup>th</sup> percentile of the enrollment distribution (<198 students). Enrollment size and geographic locations are significant in a multi-variate framework.

**TABLE 9**

% high schools offering specific science courses (weighted by student enrollment), by school characteristics, 2017-18

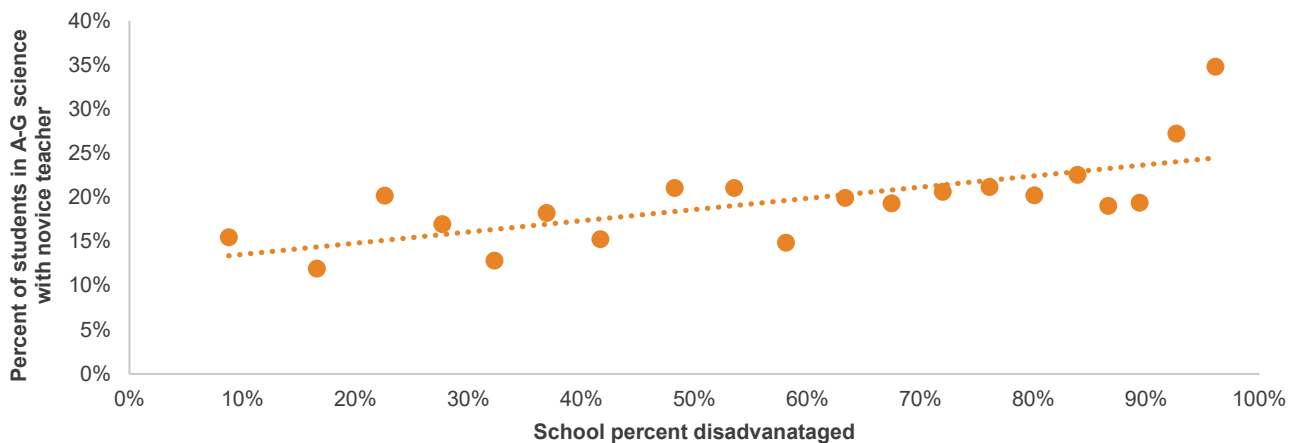
% schools offering...	Overall	High need	Urban	Rural	Charter	High Standards
<b>Area D:</b>						
Biology	100%	100%	100%	99%	99%	100%
Chemistry	98%	98%	98%	99%	96%	99%
Physics	96%	94%	96%	94%	90%	96%
Interdisciplinary science	73%	68%	74%	55%	51%	70%
Integrated science	18%	20%	26%	9%	16%	22%
Earth and space science	17%	19%	16%	23%	24%	10%
<b>Area G:</b>						
Physical science	71%	70%	72%	72%	57%	66%
Biological science	57%	57%	52%	54%	31%	53%
Integrated science	37%	37%	43%	31%	29%	38%
N schools	1752	1133	724	178	408	610

SOURCES: UC A–G course management portal (CMP), 2017-18; California Department of Education, 2017-18; National Center for Education Statistics, 2014-15

NOTES: Sample excludes high schools that cannot be matched to the California Department of Education’s public school database file. Most of these schools are private high schools and charter schools. CMP does not include all public high schools in California. In 2017-18, 805 active regular high schools were not included. Most (221) of these schools are charter schools, while 72 are traditional public schools. High-need schools are those where at least 55 percent of students are low-income, English learners, or foster youth.

**FIGURE 2**

A greater share of students in high-needs schools are taught by novice teachers in A-G science



SOURCE: California Department of Education, 2017-18.

NOTE: The figures are binned scatterplots, which group high-need student shares into equal sized bins, and then compute the average Y and X (high-need students share) values within each bin.

## Appendix D. Qualitative interview questions

A copy of the interview questions was shared with the respondents prior to the interview.

Interviewee position:

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### Background

The University of California (UC) is considering revising the area “D” (laboratory science) requirements to align with the Next Generation Science Standards for K12 schools. The key revisions include:

- 1) Increasing the minimum area D requirements from 2 to 3 years.
  - It continues to require 2 units of coursework in at least two of the core disciplines of biology, chemistry, and physics.
  - One year of approved interdisciplinary or earth and space sciences coursework can meet one year of the requirement (effective 2018-19)
  - Computer science, engineering, applied science courses can be used in area D as an additional laboratory science (effective 2019-20).
- 2) Changing the name of the area D from “Laboratory Science” to “Science”.

### Questions

We are interested in understanding how your school and students might respond to the policy change.

#### Students’ response

Given the policy change, how do you think students may view and respond to the proposal?

How might the proposal change students’ perceptions of the UC? That is, would students continue to see UC as a viable college choice?

What about students completing only two years of science? How would they view and respond to the policy change?

#### Schools’ responses

To your best knowledge, how would your high school respond to the proposal?

What role does teacher staffing play in your high school’s plan to implement the policy?

What challenges do you foresee, if any, in implementing the new policy?



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