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DATE: 5/15/20

TO: Ram Subramaniam, PSME Dean; Evan Gilstrap, Articulation Officer; Chemistry Faculty;  
Curriculum Committee

FROM: Doreen Finkelstein, Research Analyst

RE: Change of Math Prerequisite for Chemistry

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### **Introduction:**

As a prerequisite for taking CHEM 25 or CHEM 1A at Foothill College, students are first asked to demonstrate sufficient background in math. Historically, this prerequisite has been satisfied by either successful completion of intermediate algebra (MATH 105 or MATH 108), or placing into a higher-level math class.

Intermediate algebra is not a transfer-level math class. As of Fall 2018, in compliance with state legislation (AB 705), all students are placed into transfer-level math, thereby automatically satisfying the math prerequisite for chemistry. As a result, Chemistry faculty are exploring changing the math prerequisite from intermediate algebra to precalculus (MATH 48A).

This report provides background analyses pertaining to this discussion. Analyses focus on a review of the historical data (Fall 2015-Spring 2018) as well as a comparison of student experiences before and after Fall 2018, when math placement policies changed.

The analyses fall broadly into questions of (1) access, and (2) performance.

- (1) Access: How would changing the math prerequisite to MATH 48A for CHEM 25 and CHEM 1A affect access to those classes?
- (2) Success: Does successfully completing MATH 48A prior to taking CHEM 25 or CHEM 1A improve the success rate of students in those classes?

### **Results Overview:**

- A prerequisite of MATH 48A would negatively affect access to CHEM 25 and CHEM 1A, with disproportionate impact on groups historically underrepresented in STEM (African-Americans, Latinx, Filipinx, females, and first generation students).
- There is no evidence that passing MATH 48A prior to taking CHEM 25 or CHEM 1A improves the success rate of students in those classes.

- There was a drop in the success rate in CHEM 1A after implementation of AB 705 in Fall 2018. However, this drop is not driven by an increase in the number of students who take CHEM 1A without first passing MATH 48A. Rather, more students had successfully passed MATH 48A prior to taking CHEM 1A after AB 705 implementation.

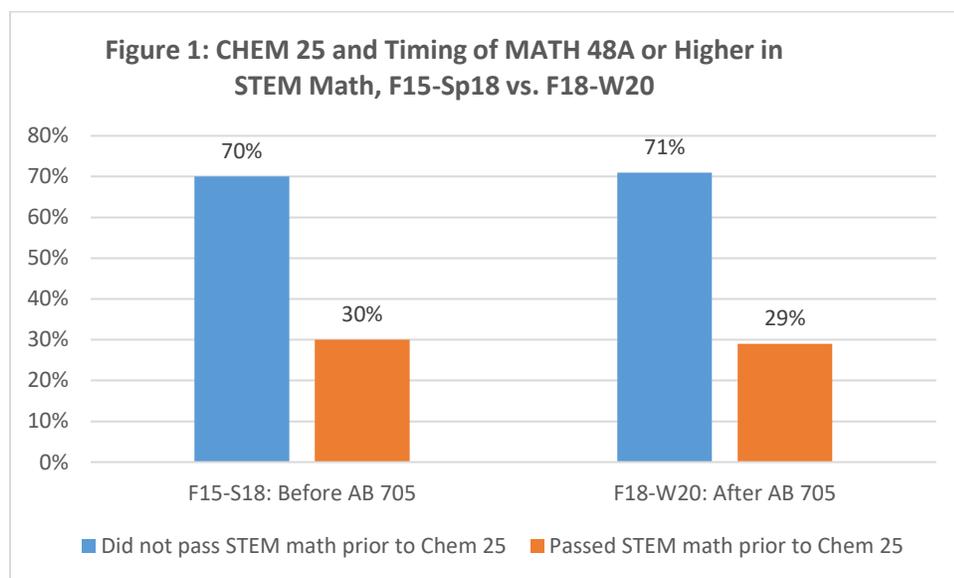
## Results Detail:

### I. Analyses on Access

#### ***How would changing the math prerequisite for CHEM 25 affect access to that class?***

##### Post-AB 705:

As shown in Figure 1, the percent of students who took CHEM 25 after passing MATH 48A or a higher STEM math class was similar (30% vs. 29%) regardless of whether placement into transfer-level math was assured (per AB 705). This finding suggests that access to transfer-level math did not increase enrollment of students to CHEM 25 who had not yet successfully passed MATH 48A.



##### Pre-AB 705:

Among the 1,700 students who first attempted CHEM 25 between Fall 2015 and Spring 2018:

- 56% (953) did not pass MATH 48A or higher in the STEM math sequence<sup>1</sup> prior to taking CHEM 25 or in the same term as CHEM 25.

<sup>1</sup> The STEM math sequence at Foothill College begins with MATH 48A and contains the following additional courses (not all of which are needed for all STEM majors): MATH 48B, MATH 48C, MATH 1A, MATH 1B, MATH 1C, MATH 1D, MATH 2A, MATH 2B, MATH 12, and MATH 22.

- 14% (234) first passed MATH 48A or higher in the STEM math sequence in the same term as they first took CHEM 25.<sup>2</sup>
- 30% (513) passed MATH 48A or higher in the STEM math sequence prior to taking CHEM 25.

As shown in Table 1, compared to students who did not pass STEM math prior to or while taking CHEM 25, the 30% of students who would have satisfied a MATH 48A prerequisite were:

- Less likely to be African-American (2% vs. 5%), Filipinx (3% vs. 8%), or Latinx (16% vs. 30%), and more likely to be Asian (42% vs. 31%) or Decline to State (16% vs. 4%).
- Less likely to be female (42% vs. 59%).
- Less likely to be first generation (16% vs. 29%).

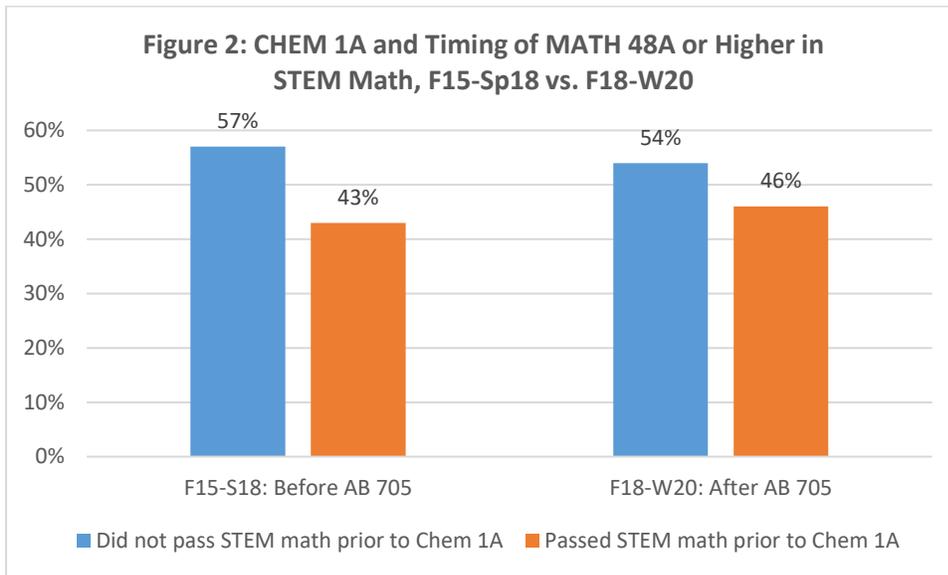
<b>Table 1: CHEM 25 and Timing of MATH 48A or Higher in STEM Math, F15-Sp18</b>						
	<b>Did Not Pass Prior to or While Concurrently Enrolled w/ CHEM 25</b>		<b>Passed While Concurrently Enrolled w/ CHEM 25</b>		<b>Passed Prior to CHEM 25</b>	
	Count	Percent	Count	Percent	Count	Percent
<b>By Ethnicity:</b>						
African American	49	5%	6	3%	9	2%
Asian	292	31%	84	36%	217	42%
Filipinx	74	8%	17	7%	16	3%
Latinx	283	30%	49	21%	83	16%
Native American	5	1%	1	0%	1	0%
Pacific Islander	16	2%	1	0%	3	1%
White	199	21%	63	27%	101	20%
Decline to State	35	4%	13	6%	83	16%
<b>By Gender:</b>						
Female	561	59%	110	47%	217	42%
Male	387	41%	124	53%	295	58%
Decline to State	5	1%	0	0%	1	0%
<b>By First Generation Status:</b>						
Not First Gen.	640	67%	186	79%	423	82%
First Gen.	278	29%	40	17%	80	16%
Status Unknown	35	4%	8	3%	10	2%
<b>Total</b>	<b>953</b>	<b>100%</b>	<b>234</b>	<b>100%</b>	<b>513</b>	<b>100%</b>

<sup>2</sup> For CHEM 25 access, Chemistry faculty requested to see concurrent students pulled out as a separate group.

## How would changing the math prerequisite for CHEM 1A affect access to that class?

### Post-AB 705:

As shown in Figure 2, the percent of students who enrolled in CHEM 1A after passing MATH 48A or a higher STEM math class was slightly higher (46% vs. 43%) after all students were given access to transfer-level math in Fall 2018, in accordance with AB 705. Access to transfer-level math did not reduce enrollment of students to CHEM 1A who had successfully passed MATH 48A; instead, it increased it.



### Pre-AB 705:

Among the 1,382 students who attempted CHEM 1A for the first time between Fall 2015 and Spring 2018:

- 57% (791) did not pass MATH 48A or higher in the STEM math sequence prior to taking CHEM 1A.
- 43% (591) passed MATH 48A or higher in the STEM math sequence prior to taking CHEM 1A.

As shown in Table 2, a comparison between students who either passed or did not pass a STEM math class prior to CHEM 1A enrollment shows that those who passed MATH 48 or higher:

- More likely to decline to state their ethnicity (11% vs. 6%).
- Less likely to be female (41% vs. 53%).
- Less likely to be first generation (13% vs. 18%).

<b>Table 2: CHEM 1A and Timing of MATH 48A or Higher in STEM Math, F15-Sp18</b>				
	<b>Did Not Pass Prior to CHEM 1A</b>		<b>Passed Prior to CHEM 1A</b>	
	Count	Percent	Count	Percent
<b>By Ethnicity:</b>				
African American	13	2%	11	2%
Asian	328	41%	236	40%
Filipinx	47	6%	29	5%
Latinx	136	17%	100	17%
Native American	4	1%	4	1%
Pacific Islander	5	1%	4	1%
White	209	26%	142	24%
Decline to State	49	6%	65	11%
<b>By Gender:</b>				
Female	421	53%	245	41%
Male	367	46%	344	58%
Decline to State	3	0%	2	0%
<b>By First Generation Status:</b>				
Not First Gen.	622	79%	500	85%
First Gen.	142	18%	78	13%
Status Unknown	27	3%	13	2%
<b>Total</b>	<b>791</b>	<b>100%</b>	<b>591</b>	<b>100%</b>

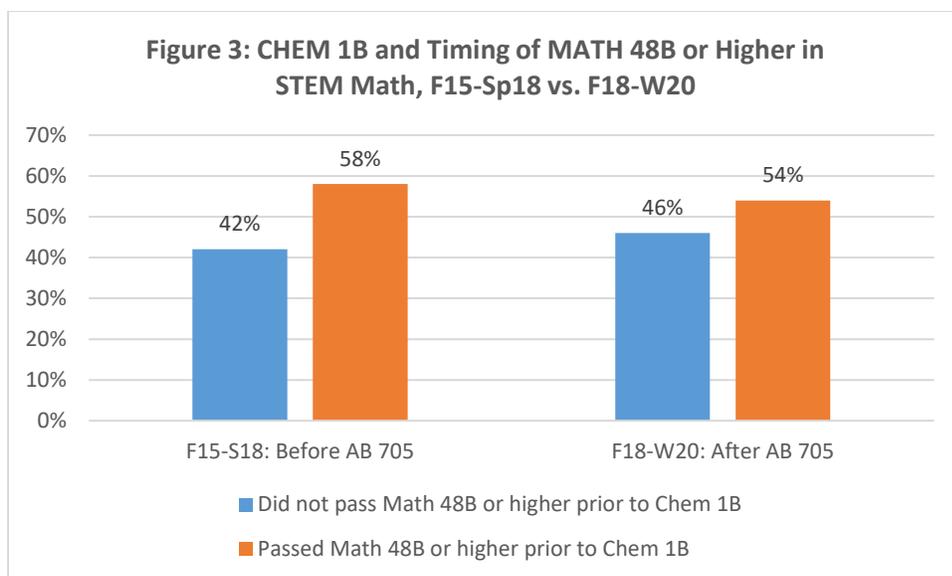
*If there were a prerequisite of MATH 48B for CHEM 1B, how would that affect access to that class?<sup>3</sup>*

Post-AB 705:

As shown in Figure 3, the percent of students who took CHEM 1B after passing MATH 48B or a higher STEM math class was slightly lower (54% vs. 58%) after all students were given access to transfer-level math in Fall 2018.

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<sup>3</sup> Chemistry faculty requested to see this analysis. STEM math courses included were MATH 48B, MATH 48C, MATH 1A, MATH 1B, MATH 1C, MATH 1D, MATH 2A, MATH 2B, MATH 12, and MATH 22.



**Pre-AB 705:**

A total of 941 students took CHEM 1B for the first time between Fall 2015 and Spring 2018. Of these 941 students:

- 42% (398) did not pass MATH 48B or higher in the STEM math sequence prior to taking CHEM 1B.
- 58% (543) passed MATH 48B or higher in the STEM math sequence prior to taking CHEM 1B.

As shown in Table 3, compared to students who did not pass MATH 48B or higher in the STEM math sequence prior to taking CHEM 1B, the 58% of CHEM 1B students who would have satisfied a MATH 48B prerequisite were:

- Less likely to be Asian (42% vs. 46%) or Filipinx (3% vs. 7%), and more likely to decline to state their ethnicity (14% vs. 4%).
- Less likely to be female (39% vs. 56%).
- Less likely to be first generation (11% vs. 16%).

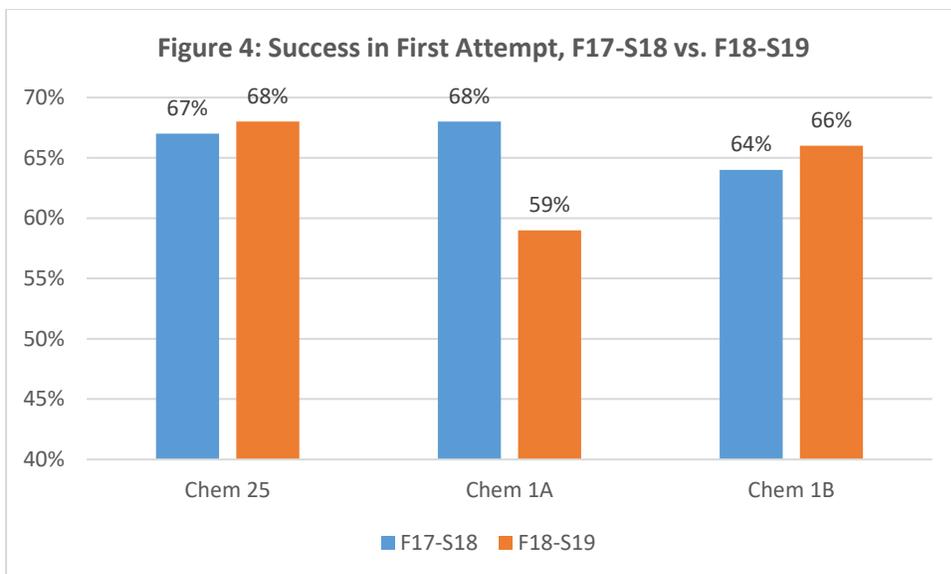
<b>Table 3: CHEM 1B and Timing of MATH 48B or Higher in STEM Math, F15-Sp18</b>				
	<b>Did Not Pass Prior to CHEM 1B</b>		<b>Passed Prior to CHEM 1B</b>	
	Count	Percent	Count	Percent
<b>By Ethnicity:</b>				
African American	8	2%	8	1%
Asian	183	46%	227	42%
Filipinx	26	7%	14	3%
Latinx	55	14%	70	13%
Native American	0	0%	4	1%
Pacific Islander	2	1%	4	1%
White	110	28%	139	26%
Decline to State	14	4%	77	14%
<b>By Gender:</b>				
Female	222	56%	213	39%
Male	175	44%	329	61%
Decline to State	1	0%	1	0%
<b>By First Generation Status:</b>				
Not First Gen.	324	81%	476	88%
First Gen.	64	16%	61	11%
Status Unknown	10	3%	6	1%
<b>Total</b>	<b>398</b>	<b>100%</b>	<b>543</b>	<b>100%</b>

## II. Analyses on Success

### Post-AB 705:

#### ***Was there a change in the success rate in CHEM 25, CHEM 1A, or CHEM 1B after all students were given access to transfer-level math in Fall 2018?***

As all students were newly given access to transfer-level math in Fall 2018, in accordance with AB 705, a way to determine whether this change had an effect on chemistry success is to compare the success rates for CHEM 25, CHEM 1A, and CHEM 1B for the academic year immediately prior to the change (Fall '17 – Spring '18) vs. the success rates for these courses in the academic year immediately after the change (Fall '18 – Spring '19). Figure 4 compares the success rates for students whose first attempt at these courses occurred in these two academic years. There was a drop in the success rate for CHEM 1A, but there was no drop in success rate for CHEM 25 or for CHEM 1B.



The drop in CHEM 1A success rate across these two consecutive years suggests that the implementation of AB 705 had a negative impact on CHEM 1A success. However, this drop in success is not driven by an increase in the number of students who take CHEM 1A without first passing MATH 48A. Rather, the opposite is true:

- More students passed MATH 48A or higher in the STEM math sequence prior to CHEM 1A in F18-S19 (49%) than in F17-S18 (44%).

This trend was also found across multiple years pre- and post-AB 705, as illustrated earlier in Figure 2.

Pre-AB 705:

***Does taking MATH 48A prior to taking CHEM 25 improve the success rate of students in CHEM 25?***

A total of 351 students took CHEM 25 for the first time between Fall 2015 and Spring 2018 and also passed MATH 48A on their first attempt<sup>4</sup>. As shown in Table 4, passing MATH 48A prior to CHEM 25 instead of concurrently or after did not improve the success rate of students in CHEM 25.

<b>Table 4: CHEM 25 and Timing of Passing First Attempt of MATH 48A, F15-Sp18</b>		
	<b>Count</b>	<b>CHEM 25 Success Rate</b>
Prior to CHEM 25	182	70%
Concurrently or After CHEM 25	169	76%

<sup>4</sup> By limiting the comparison to students who passed MATH 48A on their first attempt, there is no confounding based on whether students attempted MATH 48A more than once.

***Does taking MATH 48A prior to taking CHEM 1A improve the success rate of students in CHEM 1A?***

A total of 256 students took CHEM 1A for the first time between Fall 2015 and Spring 2018 and also passed MATH 48A on their first attempt. As shown in Table 5, passing MATH 48A prior to CHEM 1A instead of concurrently or after did not improve the success rate of students in CHEM 1A.

<b>Table 5: CHEM 1A and Timing of Passing First Attempt of MATH 48A, F15-Sp18</b>		
	<b>Count</b>	<b>CHEM 1A Success Rate</b>
Prior to CHEM 1A	191	56%
Concurrently or After CHEM 1A	65	63%

***Does taking MATH 48B prior to taking CHEM 1B improve the success rate of students in CHEM 1B?<sup>5</sup>***

A total of 209 students took CHEM 1B for the first time between Fall 2015 and Spring 2018 and also passed MATH 48B on their first attempt. As shown in Table 6, passing MATH 48B prior to CHEM 1B instead of concurrently or after resulted in a higher success rate in CHEM 1B.

<b>Table 6: CHEM 1B and Timing of Passing First Attempt of MATH 48B, F15-Sp18</b>		
	<b>Count</b>	<b>CHEM 1B Success Rate</b>
Prior to CHEM 1B	177	65%
Concurrently or After CHEM 1B	32	47%

**Methodology:**

Data on enrollment in chemistry and math was pulled from the ODS database Registration\_Analysis. Student demographics were pulled from the ODS database SS\_Student\_Term\_Attributes.

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<sup>5</sup> Chemistry faculty requested to see this analysis.