

California Community Colleges

Comparative Throughput Analysis for AB 705 Compliance

Disaggregation by Gender and Ethnicity to Check for Disproportionate Impact

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Executive Summary

Introduction

The Multiple Measures Assessment Project (MMAP)[1] is a collaborative effort led by the Research and Planning Group for California Community Colleges (RP Group) and the Educational Results Partnerships' (ERP) Cal-PASS Plus system, with input and support from the California Community College Chancellor's Office (CCCCO) and the Academic Senate for California Community Colleges (ASCCC). With the recent passage of California Assembly Bill (AB) 705, the MMAP research team conducted a study to examine whether student completion of a transfer-level course in math or English within one year varies by students' gender or ethnicity and whether throughput rates vary if a student started at transfer-level compared to one-level below transfer. The data are disaggregated by gender and ethnicity and across high school grade point average (HSGPA) ranges associated with different levels of college course performance as determined by the Multiple Measures Assessment Project decision trees[2] for transfer-level English, statistics, and pre-calculus. **Our investigation indicated that while variations occur within groups, students placed into transfer-level completed courses at a higher rate than those placed one-level below.**

Methodology

The original goal of MMAP was to identify students who are highly likely to succeed at a particular level in order to determine which students should be placed directly into transfer-level courses. In contrast, AB 705 created new guidelines requiring the identification of students who are highly unlikely to succeed if directly placed into transfer-level and determine whether their outcomes are better (i.e., "maximized") if they start directly at transfer-level or in basic skills coursework. Thus, to help the state meet AB 705 compliance, the MMAP research team focused on students in the lowest nodes (i.e., with the lowest high school performance) with the lowest likelihood of success, as these students are theoretically least likely to succeed in the target course and presumably most likely to benefit from placement into developmental education courses.

1 http://rpgroup.org/All-Projects/ArticleView/articleId/118/Multiple-Measures-Assessment-Project-MMAP
2 http://rpgroup.org/Portals/0/Documents/Projects/MultipleMeasures/DecisionRulesandAnalysisCode/Statewide-Decision-Rules-5_18_16_1.pdf

Key Findings

Highlights of the data findings also include the following:

English

- Both female and male students with similar levels of high school performance are two to three times more likely to complete transfer-level English if they start at that level than if they start one level below.
- Across all ethnic groups and all high school performance levels, students with similar levels of high school performance are one to two times more likely to complete transfer-level English if they start there.

Statistics

- Female and male students with similar levels of high school performance are two to four times more likely to complete a transfer-level math course if they start in statistics than if they start one level below.
- Students across all ethnic groups with similar levels of high school performance exhibited throughput rates two to four times higher when placed directly into statistics than when placed below transfer-level.

Pre-Calculus/STEM

- All ethnic groups and both genders see meaningful gains in their throughput rates if directly placed into pre-calculus compared to starting one level below.

Conclusion

This analysis did not find evidence that students would have higher throughput rates by being placed into basic skills courses, whether based on students' ethnicity, gender, or high school performance. Thus, within the timeframe of data availability and given the curricular design and support structures that existed systemwide at this time, we are unable to identify any group of students who complete the transfer-level English, statistics, or pre-calculus course at a lower rate when placed directly into those courses as opposed to being placed one level below transfer.

Introduction

Project Purpose and Overview

There are two objectives of this report, conducted by a research team from the Multiple Measures Assessment Project, a collaborative effort led by the Research and Planning Group for California Community Colleges (RP Group) and the Educational Results Partnerships' (ERP) Cal-PASS Plus system, with input and support from the California Community College Chancellor's Office (CCCCO) and the Academic Senate for California Community Colleges (ASCCC). First, we sought to examine whether student completion of a transfer-level course in math or English within one year (two semesters or three quarters) varies by students' gender or ethnicity. Second, we looked to explore any variance in throughput rates based on whether a students' first course in the discipline is at transfer-level or one level below transfer.

For each ethnic group and gender, success rates in the gateway transfer-level course for students who started at transfer-level[3] were compared to the successful completion of a gateway transfer-level course within one year for students who began one-level below transfer for English, statistics, and pre-calculus. Both investigations were disaggregated across high school grade point average (HSGPA) ranges as determined by the Multiple Measures Assessment Project (MMAP) decision trees for transfer-level English, statistics, and pre-calculus, and by gender and ethnicity. Statistics was chosen as a key example of a transfer-level course for students taking a social sciences or liberal arts pathway in mathematics, and precalculus was chosen as the most rigorous entry-level transfer-level STEM course occurring after intermediate algebra across the California Community Colleges.[4]

In this Report

This report presents the throughput rates for students whose first course at a California Community College (CCC) was either at transfer-level or one level below transfer in English, statistics, and pre-calculus to determine whether observations of higher throughput for direct placement are consistent across subpopulations in the CCCs. The analysis disaggregates student outcomes at each level of placement by gender and ethnicity to examine whether there are disproportionate impacts on certain groups in the potential use of high school performance-based placement practices.

In the first section of the report, we briefly describe the MMAP methodology and use of decision trees to establish how these analyses examine students in three ranges of high school performance. Next, the report presents the throughput rates for students either beginning in transfer-level courses or courses one-level below, first by gender then by ethnicity. The report concludes with an overview of the primary takeaways from this research and overall recommendations for administrators, faculty, and researchers.

3 Throughput rates for students who start at transfer-level or one term success rates.

4 Starting in pre-calculus represents the highest possible bar and students with the same level of performance in high school would be expected to be less successful if placed directly there than if placed in a lower starting course like college algebra or trigonometry. Thus, if students placed directly into pre-calculus are more likely to successfully complete a transfer-level math course if placed there directly, similar students placed into college algebra, for example, would be even more likely to successfully complete that course when placed there directly.

Methodology

The MMAP decision tree[5] analyses include all students enrolled in an English or math course in the CCC system who also had four full years of high school data available in the California Partnership for Achieving Student Success (Cal-PASS Plus) data system, resulting in about 250,000 cases. As such, the MMAP research is based on retrospective data—students who had already been placed, enrolled, and completed courses in the CCC system, mostly between 2007 and 2014. The decision trees summarize students' success rates using course grades in the first English or math course they completed at a CCC and information on students' high school achievement. Examples of high school achievement information included in the models include cumulative unweighted high school grade point average (HSGPA), highest courses completed, type of course completed (by level and subject matter), and time between high school and college.

Placement recommendations were formed by setting certain criterion on the decision tree nodes, so that if students met or exceeded a minimum average probability of success at a certain level, they would be grouped together. The chosen criterion (70% predicted success rate at transfer-level[6]) represents the minimum average successful completion rate of groups of students that the model places into that level of courses.

In the decision trees, a machine-learning algorithm divides the data to create groups or "nodes" of past students with similar success rates based on the inputs (high school transcript information). For example, students with an HSGPA below 1.9 had a 43% predicted success rate in transfer-level English (the lowest node), while students with an HSGPA greater than or equal to 3.1 had an 87% predicted success rate (the highest node).

The original goal of MMAP was to identify students who are highly likely to succeed at a particular level in order to determine which students should be placed directly into transfer-level courses. In contrast, AB 705 created new guidelines requiring the identification of students who are highly unlikely to succeed if directly placed into transfer-level and determine whether their outcomes are better (i.e., "maximized") if they start directly at transfer-level or in basic skills coursework. Thus, to help the state meet AB 705 compliance, the MMAP research team focused on students in the lowest nodes (i.e., with the lowest high school performance) with the lowest likelihood of success, as these students are theoretically least likely to succeed in the target course and presumably most likely to benefit from placement into developmental education courses. The student characteristics identified in these lowest nodes involve only HSGPA; the utility of other aspects of high school achievement are examined throughout but prove more important, for example, in higher nodes for math courses, such as whether or not a student took pre-calculus.

5 Decision trees are a form of data modeling that results in a set of "if-then" rules, where the if-then statements are referred to as "nodes" or "leaves" of the tree.

6 The criterion was determined by the statewide Multiple Measures Work Group, a subcommittee of the Common Assessment Initiative, with discipline and counseling faculty as well as assessment and registration staff stakeholders from across the state represented. This criterion represents the approximate average statewide success rate in transfer-level English courses and is slightly higher than that rate in transfer-level mathematics courses.

Throughout this report, we examine the percentage of students who successfully complete transfer-level English or math courses with a grade of C or better within two primary semesters or three primary quarters of their first attempt in the discipline, also known as "throughput." Importantly, throughput rates for students who start directly in a transfer-level course versus one level below are compared within three ranges of student high school performance as established by the original MMAP decision tree analysis. The top range is a combination of all nodes with success rates above 70% (i.e., students highly likely to succeed in the course as determined by the original MMAP research). The bottom range is the lowest terminal node, representing the group of lowest performing high school students least likely to success in the transfer-level course if placed there directly. The middle range contains all of the nodes between the other two ranges of performance. Each of the three ranges for college composition (English), statistics, and pre-calculus are described in Table 1.

TABLE 1. DECISION TREE NODES BY TRANSFER-LEVEL SUBJECT

Transfer-Level Subject	**Range 1 (lowest node)**	**Range 2 (all intermediate nodes)**	**Range 3 (all nodes w/≥70% success rate)**
English	HS GPA<1.9	HS GPA≥1.9 and <2.6	HS GPA≥2.6
Statistics[7]	HS GPA<2.3	HS GPA≥2.3 and <3.0	HS GPA≥3.0
Pre-calculus[8]	HS GPA<2.6 and no Pre-calculus in HS	HS GPA≥2.6 or Pre-calculus in HS	HS GPA≥3.4 or 11th grade GPA≥2.6 with Calculus in HS

7 Statistics includes a recommendation of as least successful completion of Algebra I.
8 Pre-calculus includes a recommendation of at least successful completion of Algebra II.

Successful Completion of Transfer-Level English

GENDER

Summary of Throughput Rates for English by Gender

Comparing tables 2 and 3, an analysis of students' completion of transfer-level English courses by gender shows that both female and male students in the lowest range of high school performance are almost three times more likely to complete the transfer-level course if they start at transfer-level than if they start one level below transfer. Additionally, both female and male students in the higher ranges of high school performance are almost twice as likely to complete transfer-level English if they start there.

Success Rates in Transfer-Level English for Students who Started at Transfer Level

Table 2 displays success rates by gender for students who started at transfer-level English. There was no gender difference in completion rates greater than three percentage points across the three ranges of high school performance. A larger proportion of female students comprise the highest high school performance ranges than male students.

TABLE 2. ENGLISH SUCCESS RATES BY GENDER—TRANSFER-LEVEL

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<1.9**		**HS GPA≥1.9 and <2.6**		**HS GPA≥2.6**	
	Rate	N	Rate	N	Rate	N
Female	42%	2,721	60%	11,022	81%	29,312
Male	42%	4,527	58%	12,913	78%	22,728

Throughput Rates Through Transfer-level English for Students Starting One-Level Below Transfer

Table 3 displays throughput rates by gender for students who started at one-level below transfer-level English. Throughput rates for male and female students were similar for students in the lowest range of high school performance but were slightly higher for female students than male students in the highest ranges of high school performance. Similar to the findings at the transfer level, a larger proportion of female students comprise the higher HSGPA ranges than male students.

TABLE 3. ENGLISH THROUGHPUT RATES BY GENDER—ONE-LEVEL BELOW

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<1.9**		**HS GPA≥1.9 and <2.6**		**HS GPA≥2.6**	
	Rate	N	Rate	N	Rate	N
Female	17%	5,697	31%	14,695	46%	18,907
Male	16%	7,477	28%	14,356	42%	12,885

ETHNICITY

Summary of Throughput Rates for English by Ethnicity

Students across all ethnic groups in the lowest range of high school performance are two times more likely to complete the transfer-level course if they start at transfer-level than if they start one-level below transfer and one to two times more likely in the middle and highest high school performance range to pass transfer level if they start there.

Success Rates in Transfer-Level English for Students who Started at Transfer Level

Table 4 displays success rates for students by ethnicity who started at transfer-level English. Key findings include the following:

- For the lowest range of high school performance, success rates differed the most for Asian and Native American students (48% vs. 25% respectively).
- For the intermediate range, success rates differed by as much as 14 percentage points, with Asian students at 66% and African American students at 52%.
- Across the three ranges, African American, Hispanic, Native American, and Pacific Islander students had success rates that were lower than White and Asian students.

TABLE 4. ENGLISH SUCCESS RATES BY ETHNICITY—TRANSFER LEVEL

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<1.9**		**HS GPA≥1.9 and <2.6**		**HS GPA≥2.6**	
	Rate	N	Rate	N	Rate	N
Asian	48%	347	66%	1,654	85%	5,855
African American	34%	488	52%	1,183	71%	1,319
Filipino	45%	131	62%	540	83%	1,751
Hispanic	41%	3,424	56%	9,094	76%	15,091
Native American	25%	55	53%	164	76%	214
Pacific Islander	37%	52	53%	129	72%	233
Two or more races	40%	164	56%	616	79%	1,374
White	46%	1,929	61%	8,507	82%	21,671
Unknown	42%	658	60%	2,048	80%	4,532

Throughput Rates Through Transfer-level English for Students Starting One-Level Below Transfer

Table 5 displays the throughput rates by ethnicity for students who started at one-level below transfer-level in English. African American students exhibited the lowest throughput rates across the highest HSGPA range.

TABLE 5. ENGLISH THROUGHPUT RATES BY ETHNICITY—ONE-LEVEL BELOW

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<1.9**		**HS GPA≥1.9 and <2.6**		**HS GPA≥2.6**	
	Rate	N	Rate	N	Rate	N
Asian	27%	566	37%	1,940	39%	4,253
African American	12%	1,124	24%	1,752	36%	1,131
Filipino	21%	231	37%	670	48%	1,230
Hispanic	15%	7,439	28%	14,009	42%	12,326
Native American	18%	81	23%	143	45%	148
Pacific Islander	8%	71	26%	186	41%	188
Two or more races	16%	257	28%	636	43%	659
White	20%	2,348	31%	7,462	50%	9,434
Unknown	18%	1,057	30%	2,253	47%	2,423

Success in Statistics Courses

GENDER

Summary of Throughput Rates for Statistics by Gender

The data presented in this section show that both female and male students in the lowest range of high school performance are four times more likely to complete a transfer-level math course if they start in statistics than if they start one-level below in mathematics. In addition, both female and male students in the higher ranges of high school performance are two to three times more likely to complete a transfer-level math course if they start in statistics.

Success Rates in Statistics for Students who Started in Statistics

Table 6 examines the success rates by gender for students whose first math course was statistics. Male students exhibit moderately higher success rates compared to female students in the lowest high school performance ranges when starting in statistics, but the same success rates in the highest range of high school performance. However, a larger proportion of female students comprise the range with the highest HSGPA.

TABLE 6. STATISTICS SUCCESS RATES BY GENDER

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<2.3**		**HS GPA≥2.3 & <3.0**		**HS GPA≥3.0**	
	Rate	N	Rate	N	Rate	N
Female	38%	577	56%	2,601	82%	5,074
Male	41%	908	58%	2,474	82%	2,641

Throughput Rates to Statistics for Students Starting One-Level Below Statistics

Table 7 displays throughput rates by gender for students who started one-level below any transfer-level math course. Throughput rates are similar for female and male students across the two lowest ranges and slightly higher for females in the highest range.

TABLE 7. STATISTICS THROUGHPUT RATES BY GENDER

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<2.3**		**HS GPA≥2.3 & <3.0**		**HS GPA≥3.0**	
	Rate	N	Rate	N	Rate	N
Female	9%	4,323	18%	9,264	30%	6,540
Male	9%	6,986	19%	8,715	27%	3,846

ETHNICITY

Summary of Throughput Rates for Statistics by Ethnicity

Comparing tables 8 and 9, in the lowest range of high school performance, students of all ethnic groups exhibited throughput rates three to four times higher when placed directly into transfer-level statistics than if placed one level below transfer-level. In the higher ranges of high school performance, students of all ethnic groups exhibited throughput rates at least two to three times higher (and as much as seven times higher) when placed directly into transfer-level statistics than if placed below transfer-level. Overall, the gaps in success rates were smaller in transfer level statistics for minority students when compared to White and Asian students than when placed one level below. Further, regardless of HSGPA, no ethnic group completed statistics at a rate higher than 35% when starting one-level below.

Success Rates in Statistics for Students who Started in Statistics

Table 8 shows the success rates by ethnicity for students whose first math course was statistics. Asian, Filipino, and Pacific Islander students the highest success rates across the lowest range, Asian, Filipino and Two or More races exhibited the highest success rates in the middle range, and Asian, Filipino and Pacific Islander students exhibited the highest success rates in the highest range.

TABLE 8. STATISTICS SUCCESS RATES BY ETHNICITY

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<1.9**		**HS GPA≥1.9 and <2.6**		**HS GPA≥2.6**	
	Rate	N	Rate	N	Rate	N
Asian	48%	156	64%	745	87%	1,388
African American	33%	121	47%	235	69%	191
Filipino	50%	52	58%	182	84%	372
Hispanic	35%	628	52%	1,724	76%	1,868
Native American	22%	9	54%	24	81%	31
Pacific Islander	64%	11	44%	25	88%	40
Two or more races	41%	22	63%	123	78%	185
White	44%	348	60%	1,607	85%	2,933
Unknown	40%	138	53%	410	82%	707

Throughput Rates to Transfer-Level for Students Starting One-Level Below Transfer

Table 9 examines throughput rates by ethnicity for students who started one-level below transfer-level math. Native American and African-American students generally exhibit the lowest throughput rates, while Asian and White students generally exhibit the highest throughput rates.

TABLE 9. ONE-LEVEL BELOW TRANSFER-LEVEL THROUGHPUT RATES BY ETHNICITY

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<1.9**		**HS GPA≥1.9 and <2.6**		**HS GPA≥2.6**	
	Rate	N	Rate	N	Rate	N
Asian	10%	952	20%	1,885	26%	1,644
African American	6%	835	11%	868	24%	336
Filipino	10%	302	22%	644	23%	493
Hispanic	8%	5,585	16%	7,752	27%	3,832
Native American	5%	56	18%	86	11%	41
Pacific Islander	5%	88	13%	136	27%	50
Two or more races	9%	227	18%	453	21%	212
White	9%	2,390	21%	4,772	35%	2,972
Unknown	11%	874	18%	1,383	28%	806

Student Completion in Pre-calculus

GENDER

Summary of Throughput Rates for Pre-calculus by Gender

When comparing tables 10 and 11, an examination of student success in pre-calculus demonstrated that both female and male students in the lowest high school performance range are two to three times more likely to complete pre-calculus if they start at pre-calculus than they are to complete any Business-STEM (BSTEM) transfer-level math if they start one level below in mathematics. Across all ranges of high school performance, throughput rates were 1-2 times higher when students were placed directly into pre-calculus compared to when they started one level below in mathematics.

Success Rates to Pre-calculus for Students who Started in Pre-calculus

Table 10 displays success rates by gender for students whose first math course was pre-calculus. Male students exhibit slightly higher success rates of three to four percentage points compared to females in the two lowest high school performance ranges. However, there was no difference between male and female students in the highest range of high school performance.

TABLE 10. PRE-CALCULUS SUCCESS RATES BY GENDER

	Range 1		Range 2		Range 3	
Gender	**HS GPA<2.6 and no Pre-calculus in HS**		**HS GPA≥2.6 or Pre-calculus in HS**		**HS GPA≥3.4 or 11th grade GPA≥2.6 with Calculus in HS**	
	Rate	N	Rate	N	Rate	N
Female	36%	498	55%	1,772	78%	1,066
Male	39%	1,255	59%	3,009	78%	1,048

Throughput Rates to Pre-calculus for Students Starting One-Level Below Transfer

Table 11 explores throughput rates to completion of any business-STEM transfer-level course by gender for students whose first course was one level below transfer-level in mathematics. Male students exhibit higher throughput rates in the lowest two ranges of high school performance but only 1 percentage point higher in the highest range.

TABLE 11. PRE-CALCULUS THROUGHPUT RATES BY GENDER

	Range 1		Range 2		Range 3	
Gender	**HS GPA<2.6 and no Pre-calculus in HS**		**HS GPA≥2.6 or Pre-calculus in HS**		**HS GPA≥3.4 or 11th grade GPA≥2.6 with Calculus in HS**	
	Rate	N	Rate	N	Rate	N
Female	12%	7,590	29%	10,250	47%	2,287
Male	16%	11,327	37%	7,968	48%	1,251

ETHNICITY

Summary of Throughput Rates for Pre-calculus by Ethnicity

All ethnic groups see large gains in their throughput rates for students in the lower two ranges of high school performance, with students one-and-a-half to six times more likely to complete pre-calculus when placed there directly than to complete any BSTEM course if starting one-level below in mathematics. For example, African American students in the lowest range of high school performance are three times more likely to complete a transfer-level math course starting in pre-calculus than one level below, going from 8% to 25%, a 17 percentage point increase. For Hispanic students in the same range, the increase is from 14% to 34%, a 20 percentage point increase.

Success Rates to Pre-calculus for Students who Started in Pre-calculus

Table 12 displays success rates by ethnicity for students whose first math course was pre-calculus. Success rates in the highest range of high school performance were all above 67%.

TABLE 12. PRE-CALCULUS SUCCESS RATES BY ETHNICITY

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<2.6 and no Pre-calculus in HS**		**HS GPA≥2.6 or Pre-calculus in HS**		**HS GPA≥3.4 or 11th grade GPA≥2.6 with Calculus in HS**	
	Rate	N	Rate	N	Rate	N
Asian	49%	303	63%	1,051	83%	625
African American	25%	78	50%	122	73%	30
Filipino	27%	33	59%	189	76%	104
Hispanic	34%	695	53%	1,440	73%	550
Native American	43%	14	53%	15	67%	6
Pacific Islander	14%	15	40%	20	67%	6
Two or more races	47%	42	54%	115	76%	46
White	38%	384	60%	1,434	80%	560
Unknown	40%	189	60%	395	75%	187

Throughput Rates to Business-STEM Transfer-Level Courses for Students Starting One-Level Below Transfer

Table 13 on the next page shows throughput rates through any business-STEM transfer-level math course by ethnicity for students whose first course was one-level below in mathematics. African American and Pacific Islander students exhibit the lowest throughput rates across all ranges of high school performance.

TABLE 13. ONE-LEVEL BELOW BUSINESS-STEM TRANSFER-LEVEL COURSES THROUGHPUT RATES BY ETHNICITY

	Range 1		**Range 2**		**Range 3**	
Gender	**HS GPA<2.6 and no Pre-calculus in HS**		**HS GPA≥2.6 or Pre-calculus in HS**		**HS GPA≥3.4 or 11th grade GPA≥2.6 with Calculus in HS**	
	Rate	N	Rate	N	Rate	N
Asian	19%	1,717	32%	2,053	30%	811
African American	8%	1,184	27%	779	6%	76
Filipino	21%	504	38%	770	25%	165
Hispanic	14%	8,916	30%	7,443	58%	1,209
Native American	0%	89	32%	86	57%	8
Pacific Islander	10%	142	20%	114	25%	18
Two or more races	10%	495	23%	421	60%	76
White	14%	4,314	37%	5,124	54%	896
Unknown	15%	1,556	30%	1,428	50%	279

Conclusion

For all three gateway courses, across gender, ethnicity, and all ranges of high school performance, student completion of a gateway transfer-level course or throughput was generally from two to four times higher when students were placed directly into a transfer-level course compared to those who were placed one-level below the transfer-level course for students in the same range of high school performance. This was found to be particularly apparent among the lowest performing high school students.

In English, there were few meaningful differences in throughput rates by gender whether students began at transfer-level or one-level below. Male students exhibit moderately higher success rates compared to female students in the lowest high school performance ranges when starting in statistics, but the same success rates in the highest range of high school performance. Male students exhibit higher success rates of 10 percentage points among the lowest performing high school students. However, there was little to no difference between male and female students in the higher ranges of high school performance.

There were some substantive differences by ethnicity for English and statistics, where historically underrepresented minority students, particularly African American students, exhibited consistently lower success rates than White students when starting at transfer-level.

One notable additional finding consistent with the overall MMAP research is that for virtually every subgroup across all three subjects, student success rates or throughput increases as a function of high school performance (with only minor exceptions with very small sample sizes). However, this strong and consistent effect of high school performance is somewhat muted for students who start one-level below transfer, with the attrition effects of that placement reducing the throughput of all students, even the highest performing high school students.

In closing, within the timeframe of data availability and given the curricular design and support structures that existed systemwide at this time, **virtually every student group[9] is more likely to successfully complete transfer-level courses when placed directly into the transfer-level course in all subjects examined**. However, historically underrepresented populations exhibited lower throughput rates in most cases when compared to Asian and White students.

It is recommended that each college conduct its own analyses to compare throughput rates below transfer-level to success rates at transfer-level at each level of high school achievement, disaggregated by gender and ethnicity, both with and without specialized support (such as co-requisites) to ensure that local data align with the statewide findings. Further, colleges are encouraged to evaluate and assess their placement process, curricular design, concurrent supports, and non-curricular support as well as determine and address disproportionate outcomes for historically underrepresented populations.

9 With only a few minor exceptions of low sample size. Further, the success rates for these groups if placed directly into pre-calculus (compared to their throughput to any BSTEM course) very strongly suggests that they are not at all close to highly unlikely to succeed and so still should not be placed one-level below transfer-level.