Five Years of First Year Math:

An Analysis of Student Success Outcomes Following the Implementation of EO 1110, Academic Years 2018-19 to 2022-23

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Fast Facts

1. Decline in B4 course attempt and completion rates: First-term and first-year B4 course attempt and completion rates are declining among first-time full-time (FTFT) freshmen. 87% of Fall 2022 FTFT freshmen attempted a B4 course in their first year; attempt rates for previous cohorts were between 91-95%. Just 58% of Fall 2022 FTFT freshmen completed a B4 course in their first year while first-year completion rates were between 71-81% for previous cohorts. Improving FYM completion rates is tied to increasing graduation rates for FTFT freshmen under GI 2025.

2. Completing B4 courses predicts retention: Successful completion of the B4 requirement is associated with high retention rates among FTFT (96% who completed the requirement in their first term are retained from Fall to Spring and 88% who completed the requirement in their first year are retained to their second Fall). However, for some students – including Black, Pell eligible, and STEM students – having an unsuccessful attempt in B4 during the first year is associated with lower retention rates than not attempting a B4 course at all.

3. First Year Math interventions can help improve outcomes: Visiting the Learning Resource Center, having an Embedded Peer Tutor, and participating in the Math MINDS program are associated with higher pass rates among all students in B4 math courses. Although B4 students who participated in the ASSETS Scholars FYM community are not more likely to pass their B4 course than non-ASSET Scholars FYM community students, they are more likely to be retained from Fall to Spring, even when they don't pass their B4 course.

Background

In Fall 2018, CSU Channel Islands (CSUCI) began implementing CSU Executive Order (EO) 1110. EO 1110 calls for the enrollment of new freshmen in college credit-bearing courses to satisfy B4 (Mathematics/Quantitative Reasoning) and A2 (Written Communication) General Education (GE) course requirements. EO 1110 also dictates how those students are placed in the recommended courses. Within the CSU system, students are assigned one of four math/quantitative reasoning placement statuses: M1 (fulfilled GE B4 requirements), M2 (placement in GE B4 course), M3 (GE B4 course with support recommended), M4 (GE B4 course with support or stretch required).[1]

At CSUCI, the GE B4 requirement is satisfied by completing a First Year Math (FYM) course, ideally within the first year. In the last five years, CSUCI has developed a robust First Year Math program to enroll and

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[1] Currently, the recommendation or requirement to enroll in a FYM support or stretch course is presented to students through orientation and advising as well as guided registration, but students are ultimately able to enroll in the FYM and FYM support/stretch courses of their choice through self-directed placement regardless of their math/quantitative reasoning placement status.
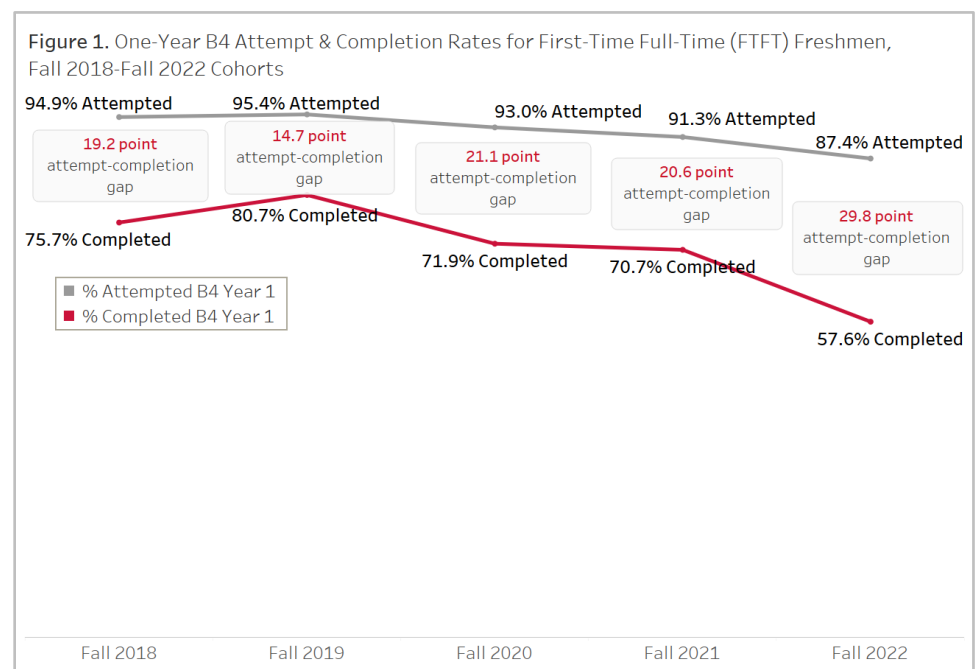
support those students. This includes the recommendation of the appropriate FYM course by major, the development of support and stretch courses, as well as additional interventions and support, such as pre-matriculation summer support through the Early Start Program,[2] the use of embedded peer tutors (EPTs) in many FYM sections and other tutoring support through the Learning Resource Center (LRC), the Math Institute for Nurturing Developing Skills (MINDS) program, and the Academic Student Success Excellence Team (ASSET) Scholars program's FYM community.

This data brief summarizes the key findings from an in-depth analysis of FYM at CSUCI. The results that follow explore FYM attempt and completion rates among new freshmen, other student success outcomes such as course DFWI rates,[3] one-semester and one-year retention rates, as well as performance in subsequent math courses. Differences across a variety of student characteristics are analyzed in order to understand equity gaps within these outcomes. Reducing DFWI rates and increasing FYM completion rates are key components of the CSU's Graduation Initiative 2025 designed to improve graduation rates and close achievement gaps. Please note that while the FYM attempt, completion, and retention rate analyses focus on FTFT freshmen cohorts only, other student success outcomes related to FYM include all students enrolled in FYM courses.

FYM Attempts & Completions (First-Time Full-Time Freshmen)

Under EO 1110, students are expected to complete their B4 FYM requirement within their first year. A minimum grade of C- is necessary to successfully complete this requirement.[4] As Figure 1 shows, nearly all (approximately 95%) FTFT students in the first two cohorts under EO 1110 (Fall 2018 and 2019) attempted a B4 course within their first year with at least every 3 out of 4 students (76-81%) completing the requirement within their first year. Among the most recent cohort – Fall 2022 FTFT freshmen – 87% of

Figure 1. One-Year B4 Attempt & Completion Rates for First-Time Full-Time (FTFT) Freshmen, Fall 2018-Fall 2022 Cohorts

94.9% Attempted   95.4% Attempted   93.0% Attempted   91.3% Attempted   87.4% Attempted

19.2 point attempt-completion gap

14.7 point attempt-completion gap

21.1 point attempt-completion gap

20.6 point attempt-completion gap

29.8 point attempt-completion gap

75.7% Completed   80.7% Completed   71.9% Completed   70.7% Completed   57.6% Completed

■ % Attempted B4 Year 1
■ % Completed B4 Year 1

Fall 2018   Fall 2019   Fall 2020   Fall 2021   Fall 2022

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[2] Currently, the recommendation or requirement to participate in the Early Start Program is not enforced. Additionally, CSUCI students can complete their early start requirements at a host CSU campus prior to matriculating at their home campus of CSUCI.

[3] DFWI rates are a measure of the percentage of students who have unsuccessful outcomes in a given course or class section, with grades including D+, D, D-, F, NC, W, WU, I, and IC.

[4] Due to the COVID-19 pandemic, students could successfully complete their GE B4 requirement with a grade of Credit rather than a letter grade during Spring 2020 and the 2020-21 academic year.

students attempted the B4 requirement within the first year, but just 58% completed the requirement.[5] As the trends over the last five years indicate, not only are a smaller proportion of students attempting their B4 requirement within their first year, but they are also less likely to complete the requirement with the gap between attempt and completion rates growing to 30 percentage points for the Fall 2022 cohort.

When examining B4 completion rates across high school GPA, some interesting patterns emerge. Although FTFT students with higher high school GPAs have always been more likely to complete their B4 requirement within the first year, students with lower high school GPAs from the more recent cohorts are far less likely to complete their B4 requirement than similar students from earlier cohorts. For example, 59% of FTFT students from the Fall 2018-2020 cohorts with a GPA below a 3.00 completed their B4 requirement within the first year; the completion rate drops to 39% for their counterparts from the Fall 2021 and Fall 2022 cohorts. This is a drop of 20 points in the completion rate for students with a GPA below 3.00; the decline in completion rates is smaller for students with a high school GPA between 3.00 and 3.99 (13-point decrease) and with a high school GPA of 4.00 and above (2-point decrease).

Figure 2. One-Year B4 Attempt & Completion Rates for Fall 2018-2022 FTFT Cohorts by Race
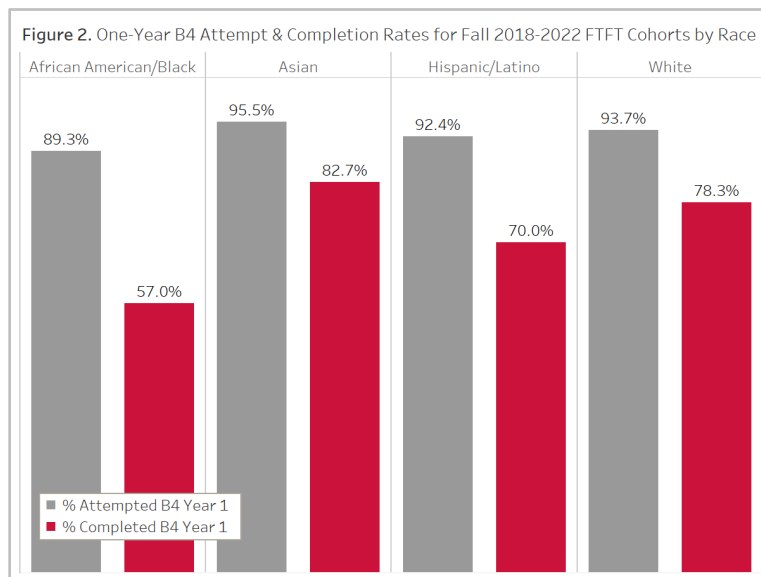
Equity gaps in B4 attempt and completion rates also point to inequalities across race and ethnicity, Pell eligibility (low income), and parents' education/first-generation status. As Figure 2 indicates, Latinx and Black FTFT freshmen in the Fall 2018-2022 cohorts were less likely than their Asian and white counterparts to complete a B4 course within their first year and the gap between attempting and completing a B4 course was also larger for Latinx and Black students. For example, while 92% of Latinx students attempted a B4 course within their first year, just 70% complete it within their first year – an attempt-completion gap of 22 percentage points, compared to a 15-point attempt-completion gap for white students. The attempt-completion gap for Black students is 32 points, with 57% of Black FTFT students completing the B4 requirement within the first year. When looking at the Fall 2022 cohort alone, the gap between attempt and completion rates is even more substantial: 25-points for white students, 27-points for Asian students, 32-points for Latinx students, and 40-points for Black students.

Pell eligible and first-generation college students also completed their B4 requirement within the first year at lower rates – 69% and 70% respectively – than their historically privileged peers (i.e., not Pell eligible and continuing-generation students). Math/quantitative reasoning placement status is

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[5] As of June 5, 2023, there were 255 students (out of 602) in the Fall 2022 FTFT cohort that still needed to complete their B4 requirement. 150 of those students are enrolled in at least one class in Summer 2023 and/or Fall 2023. 74 of those students are enrolled in at least one B4 course in Summer or Fall 2023 (11 in summer, with a projection of increasing the one-year completion rate to 59%).

associated with declines in B4 attempt and completion rates as well – just 55% of M4 students completed the B4 requirement within their first year, compared to 80% of M2 students. Additionally, STEM students are somewhat more likely to complete the B4 requirement within the first year than non-STEM students (76% and 71%, respectively).
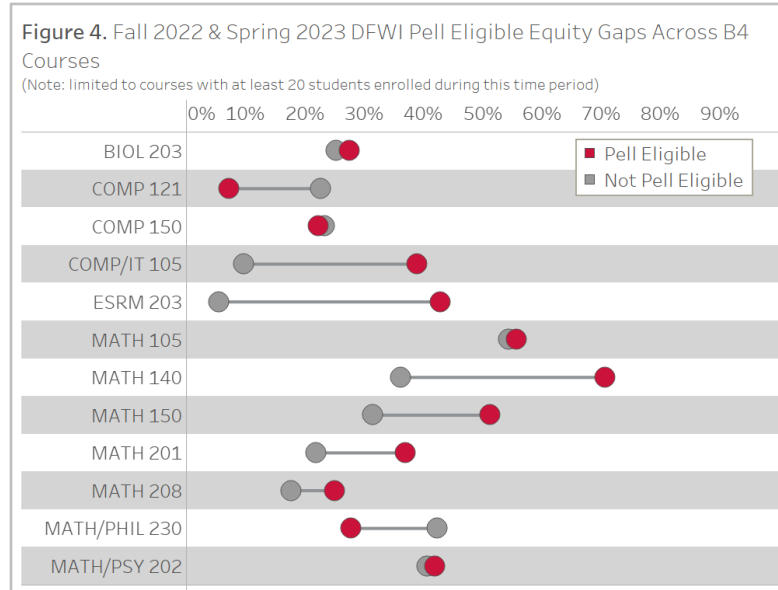
Student Success Outcomes
Course Outcomes (All Students)

When looking at FYM outcomes for all students, the overall DFWI rates for B4 courses have trended toward increasing over time, with the DFWI rate for B4 courses during the 2022-23 Academic Year (Fall 2022 and Spring 2023) at an all-time high of 35%. Of the 1416 grades earned in B4 courses during this timeframe, 490 were non-passing grades. This means that more than 1 out of every 3 student enrollments in a B4 course did not have a successful outcome.[6] These DFWI rates vary dramatically across B4 courses and class sections. In the 2022-23 Academic Year, four courses had DFWI rates over 40% for all students enrolled in those courses: ESRM 203: Introduction to Environmental Statistics (44%), MATH 105: Pre-Calculus (55%), MATH 140: Calculus for Business (42%), and MATH/PSY 202: Biostatistics (41%).[7] Within courses, DFWI rates vary substantially by class section and instructor as well. For example, among the four sections of Pre-Calculus in Fall 2022, DFWI rates ranged from 47-71%.

Figure 3. Fall 2022 & Spring 2023 DFWI Rates Across B4 Courses

Course	DFWI Rate
BIOL 203	26.2%
COMP 121	33.3%
COMP 150	23.1%
COMP/IT 105	19.4%
ESRM 203	43.8%
MATH 104	22.2%
MATH 105	54.9%
MATH 108	29.2%
MATH 140	42.7%
MATH 150	36.4%
MATH 201	25.4%
MATH 208	20.0%
MATH/PHIL 230	39.0%
MATH/PSY 202	41.1%

Substantial equity gaps in these courses across race and ethnicity, Pell eligibility, and parents' education/first-generation status are also observed. For example, during the 2022-23 Academic Year,

Figure 4. Fall 2022 & Spring 2023 DFWI Pell Eligible Equity Gaps Across B4 Courses
(Note: limited to courses with at least 20 students enrolled during this time period)

39% of Pell eligible students earned a DFWI in COMP/IT 105: Introduction to Computer Programming, compared to just 10% of not Pell eligible students. It should be noted that while Pre-Calculus and Biostatistics have high DFWI rates overall, the Pell equity gaps in these courses was relatively small during this time period (1-2 percentage points). However, the race/ethnicity and first-generation equity gaps are larger in these courses (e.g., an 18-point HUGs[8] gap in Pre-Calculus and a 19-point HUGs

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[6] A student may enroll in more than one B4 course in a given semester, therefore the counts provided are based on the number of student enrollments rather than individual students.

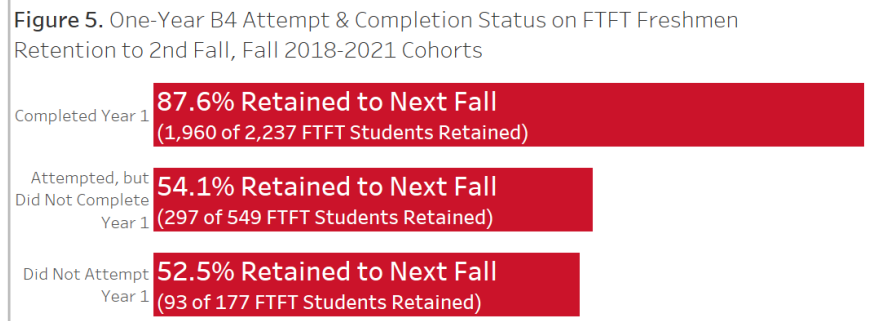[7] In Fall 2022, the DFWI rate in MATH 150: Calculus I was also above 40%, at 48%.

[8] HUGs are Historically Underrepresented Groups and include Black/African American, Hispanic/Latino, and Native American/Alaskan students. In older analyses, dashboards, etc., this group of students is sometimes referred to as underrepresented minorities (URM).

gap in Biostatistics). These and many other equity gaps in B4 courses can be explored on the Class Dashboard Equity Gaps page.
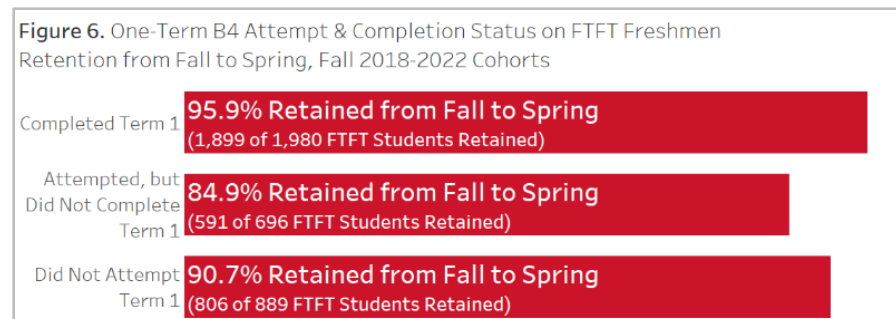
The Impact on Retention (First-Time Full-Time Freshmen)
Among FTFT freshmen, completing the B4 requirement within the first year is positively associated with retention. As Figure 5 shows, 88% of FTFT from the first four cohorts under EO 1110 (Fall 2018-2021) who completed their B4 requirement in their first year were retained to their second fall semester. Retention

Figure 5. One-Year B4 Attempt & Completion Status on FTFT Freshmen Retention to 2nd Fall, Fall 2018-2021 Cohorts

Completed Year 1 — **87.6% Retained to Next Fall** (1,960 of 2,237 FTFT Students Retained)

Attempted, but Did Not Complete Year 1 — **54.1% Retained to Next Fall** (297 of 549 FTFT Students Retained)

Did Not Attempt Year 1 — **52.5% Retained to Next Fall** (93 of 177 FTFT Students Retained)

rates for FTFT who either 1) attempted but did not complete or 2) did not attempt the B4 requirement in their first year are substantially lower – 54% and 53% respectively. This suggests that successfully completing the B4 requirement within the first year is strongly correlated with retention to the second year. Students who do not complete the B4 requirement – whether they don't pass or don't attempt it – are far less likely to be retained. Across race and ethnic groups, successfully completing the B4 requirement within the first year is strongly associated with higher retention rates. For example, among the Fall 2018-2021 cohorts, 67% of Black students were retained to their second fall. This retention rate increases to 83% for Black students who complete their B4 requirement (an increase of 16 points). Conversely, attempting but not completing the B4 requirement leads to a lower retention rate for Black students than not attempting the requirement at all (38% and 50%, respectively). Latinx (89%) and Asian (92%) FTFT freshmen who complete the B4 requirement have higher one-year retention rates than their Black (83%) and white (83%) counterparts. However, attempting but not successfully completing the B4 requirement does not have the same negative impact on non-Black students.

Similar equity gaps in one-year retention across Pell eligibility, but not first-generation status are observed. Additionally, Pell eligible and STEM students experience a similar negative impact of attempting but not completing their B4 requirement in the first year. Although 88% of STEM students who successfully complete the requirement are retained to their second fall, 52% who attempt but do not complete compared to 61% who do not attempt are retained to their second fall. This suggests that having an unsuccessful outcome in B4 courses is more detrimental to Black, Pell eligible and STEM student retention than not attempting the B4 course in their first year at all. Figure 6 demonstrates that retention from the first fall to the first spring is similarly impacted by an unsuccessful attempt in a B4 course, with 85% of FTFT students from the Fall 2018-2022 Cohorts retained to spring when they

attempted but did not complete their B4 requirement within the first term. On the other hand, 91% of students who do not attempt the B4 requirement are retained to spring.

Figure 6. One-Term B4 Attempt & Completion Status on FTFT Freshmen Retention from Fall to Spring, Fall 2018-2022 Cohorts

Completed Term 1 — **95.9% Retained from Fall to Spring** (1,899 of 1,980 FTFT Students Retained)

Attempted, but Did Not Complete Term 1 — **84.9% Retained from Fall to Spring** (591 of 696 FTFT Students Retained)

Did Not Attempt Term 1 — **90.7% Retained from Fall to Spring** (806 of 889 FTFT Students Retained)

Separate from B4 attempt and completion status, students' math/quantitative reasoning placement status is also strongly associated with retention to the second year. 92% of M1 students are retained to their second fall while 83% of M2, 79% of M3, and 69% of M4 students are retained. This suggests that students who are less prepared for math/quantitative reasoning courses would benefit from retention supports in addition to math/quantitative reasoning support.

Subsequent Math Course Outcomes [9]

Figure 7. The Relationship Between Pre-Calculus (MATH 105) & Calculus I (MATH 150) Grades, Fall 2021-Spring 2023
(Note: students with multiple attempts are counted multiple times, therefore total percentages within each pre-calculus grade group can exceed one hundred percent)

Pre-Calculus Grade Group	Calculus I Grade Group	
A	C/CR or Better	88.4% (N=114)
	DFWI	14.7% (N=19)
B	C/CR or Better	86.0% (N=86)
	DFWI	22.0% (N=22)
C/CR	C/CR or Better	68.0% (N=70)
	DFWI	45.6% (N=47)
D	C/CR or Better	63.9% (N=23)
	DFWI	41.7% (N=15)
F/NC	C/CR or Better	57.1% (N=16)
	DFWI	57.1% (N=16)

In addition to providing a pathway to complete the B4 GE requirement, some FYM courses are also designed to prepare student for subsequent math courses. The relationship between MATH 105: Pre-Calculus and MATH 150: Calculus I from Fall 2021 to Spring 2023 for all students was the focus of this analysis. As Figure 7 shows, there is a strong relationship between the grade earned in Pre-Calculus and the likelihood of a successful outcome in Calculus. Students earning an A in Pre-Calculus have an 88% chance of passing Calculus, while students earning a B in Pre-Calculus are similarly likely to pass Calculus (86%). In other words, the vast majority of students who pass Pre-Calculus with an A or B also pass Calculus. That likelihood declines somewhat for students who earn a C/CR or D in Pre-Calculus; 68% and 64% of those students ultimately pass Calculus. This suggests that earning a C or D in Pre-Calculus decreases the likelihood of passing Calculus by approximately 20 percentage points when compared to earning an A or a B.

From Fall 2021-Spring 2023, 179 students earned a grade of F or No Credit in Pre-Calculus. Just 28 of those students went on to take Calculus I at some point from Spring 2022-Spring 2023. 16 of those students failed Calculus at least once (57%), while 57% ultimately passed Calculus (four students initially

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[9] All Pre-Calculus attempts and subsequent Calculus attempts were included in this analysis. This means that if a student attempts Pre-Calculus twice – first earning an F and then a C, for example – both attempts/grades are included in the analysis. Therefore, percentages in the figure above can exceed one hundred percent.

failed Calculus and then passed in a later semester). The latter percentage will likely improve as these students continue to retake and ultimately pass Calculus in future semesters.

The Impact of FYM Interventions (All Students)

Analysis of a variety of intervention and support programs for FYM demonstrate that overall these programs are associated with more successful course outcomes for FYM students. For example, efforts to provide more detailed advising and guided registration toward the appropriate FYM course by major has improved both course offerings and course-taking patterns among new freshmen. In the first semester of EO 1110 (Fall 2018), eight sections of MATH 101: College Algebra enrolled 141 new freshmen with a 34% DFWI rate, including the majority of undeclared freshmen and students from majors in the Humanities and Fine Arts. Not only were these students more likely to have an unsuccessful outcome in College Algebra, but even if they successfully completed the course it did not fulfill the B4 GE requirement those students needed. The number of College Algebra sections offered has steadily declined (1 was offered in Fall 2021, none in Fall 2022), with greater proportions of new freshmen enrolling in the appropriate course by major. Now that 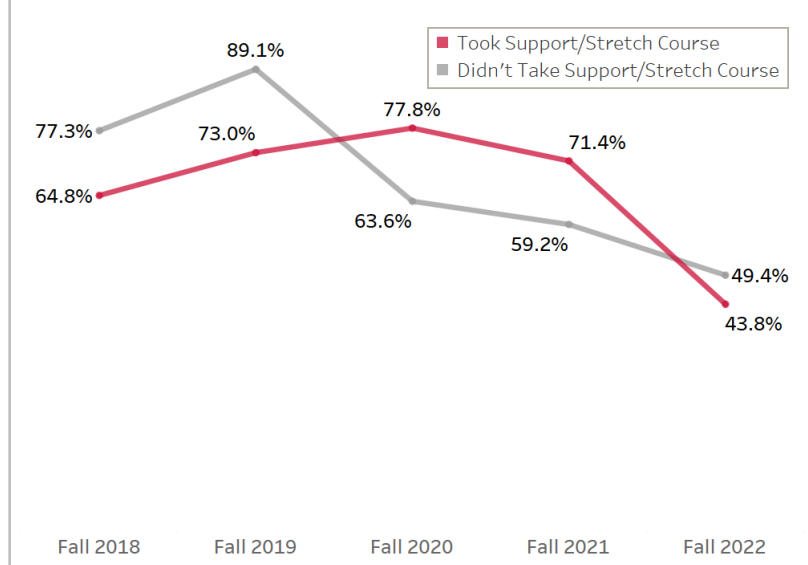more students are enrolling in the correct courses, the focus needs to shift to improving those course outcomes. For example, MATH/PSY 202: Biostatistics is one of the recommended statistics B4 courses for Health Science and Nursing Majors and is required for Psychology majors.

Figure 8. Fall 2022 DFWI Rates by Student Program & Appropriate B4 Course

	Health Science	Nursing	Psychology
BIOL 203	37.5%	33.3%	
MATH 201	25.0%	26.5%	0.0%
MATH/PSY 202	42.1%	51.3%	35.3%

However, as Figure 8 shows, Health Science and Nursing students are more likely to have an unsuccessful outcome in Biostatistics than the other B4 statistics options. Psychology students are correctly enrolling in the required Biostatistics course, but one in three who attempt the course in their first semester do not pass the class.

Additionally, students are still less likely to take a support/stretch course option, even when recommended or required based on their math/quantitative reasoning placement status (65% of M3 and 59% of M4 students from the Fall 2018-2022 cohorts did not take a support/stretch course). The relationship between success in a support/stretch course and success in the associated B4 course is inconsistent across cohorts. In a reversal from the

Figure 9. Impact of Support/Stretch Course on B4 Completion, Fall 2018-Fall 2022 Cohorts

- Took Support/Stretch Course
- Didn't Take Support/Stretch Course

Took Support/Stretch Course: 64.8% (Fall 2018), 73.0% (Fall 2019), 77.8% (Fall 2020), 71.4% (Fall 2021), 43.8% (Fall 2022)

Didn't Take Support/Stretch Course: 77.3% (Fall 2018), 89.1% (Fall 2019), 63.6% (Fall 2020), 59.2% (Fall 2021), 49.4% (Fall 2022)

Fall 2018 and Fall 2019 cohorts, M4 students from the Fall 2020 and Fall 2021 cohorts who took a support/stretch course were more likely to fulfill their B4 requirement (see Figure 9). Unfortunately,

this trend reversed again with the Fall 2022 cohort, where M4 students who did not take the support/stretch course were more likely to pass their associated B4 course. It should be noted, however, that for the Fall 2021 and Fall 2022 cohorts, very few M4 students took a support/stretch course at all – 14 students in the Fall 2021 cohort and 16 in Fall 2022 cohort.

Figure 10. Fall 2022 Math MINDS Participation & Pass Rates in B4 Courses

Math MINDS
71.4% B4 Pass Rate
(N=14)

Not Math MINDS
63.7% B4 Pass Rate
(N=711)

The impact of EPT and ASSET scholars have been evaluated in more detail in other analyses and reports and it's clear that students who visited the LRC or had an EPT in their B4 course in concert with visiting the LRC in Fall 2022 were more likely to pass their B4 course. As Figure 10 demonstrates, students who participated in the new Math MINDS program in Fall 2022 were more likely to pass their B4 courses; they were also more likely to be retained to Spring 2023 than those who did not participate. Although Fall 2022 participants in the ASSET Scholars FYM community did not pass their B4 courses at higher rates than their non-ASSET Scholars FYM community peers, they were more likely to be retained from Fall to Spring (94% to 87%, respectively). It's important to note that the relationships between FYM interventions and FYM success may be impacted by selection bias in that those students who participate in these interventions may be systematically different from those who do not participate.

Conclusion & Implications

The FYM program at CSUCI has undergone several curricular and co-curricular changes since the implementation of EO 1110 in Fall 2018. This assessment of the last five years of FYM indicates both areas of success and areas still in need of improvement. In particular, attention needs to be placed on increasing both the one-year attempt and completion rates for FTFT freshmen. Additional support and/or culturally responsive pedagogy is needed, particularly to improve the completion rates among Latinx and Black students. Supports for students taking and faculty teaching high DFWI B4 courses such as ESRM 203: Introduction to Environmental Statistics, MATH 105: Pre-Calculus, MATH 140: Calculus for Business, MATH 150: Calculus I, and MATH/PSY 202: Biostatistics should also be explored.

Since Fall 2018, improvements have been made in guiding students toward taking the appropriate B4 course for their major. Most programs/interventions designed to support FYM students are associated with more successful outcomes in B4 courses. However, most of these supports currently reach a relatively small number of students. Fluctuating patterns in the relationship between support/stretch and B4 courses as well as the relatively low number of students taking support/stretch courses suggests the need for more curriculum alignment between support/stretch and B4 courses as well as improved advising/incentives to increase support/stretch course enrollment. Students who participated in Math MINDS were more likely to pass their B4 course and be retained from fall to spring. ASSET Scholars in the FYM Community who were enrolled in a B4 course were also more likely to be retained from fall to spring. Each of these programs/communities consisted of fewer than 20 students, however. Expanding these programs in the coming years will allow for a more thorough assessment of their impact. As an intervention that has grown over the last few years, the LRC and EPT supports for FYM continue to be associated with more successful B4 course outcomes even as they reach more students and courses. Future research will continue to explore FYM outcomes and interventions.

Additional FYM Resources

For more information about FYM at CSUCI, see: https://www.csuci.edu/registrar/first-year-math-and-english/first-year-math.htm

For more information about EO 1110, see: https://www.calstate.edu/csu-system/why-the-csu-matters/graduation-initiative-2025/academic-preparation/Pages/eo-1100-and-1110-policy-changes.aspx

CSUCI employees can access a dashboard with detailed EO 1110 data here: https://oneci.csuci.edu/#/site/IRPE/views/EO110Dashboard/Overview

CSUCI employees can also access a dashboard with detailed course and class section outcomes here: https://oneci.csuci.edu/#/site/IRPE/views/ClassDashboard_16305110073720/Outcomes

For more information about navigating CSUCI dashboards, see: https://sites.google.com/myci.csuci.edu/datachampions/home/dive-into-your-class-data?authuser=0

For pedagogical support and resources related to improving course outcomes from CSUCI's Teaching and Learning Innovations (TLi), see: https://sites.google.com/myci.csuci.edu/datachampions/home?authuser=0

For other questions about CSUCI's FYM data and analysis, please contact Dr. Kristin M. Jordan at kristin.jordan@csuci.edu.