

# Preliminary Outcomes for California State University Students in Early Start Mathematics

An examination of Early Start in seven  
campuses under Executive Order 1110

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**Kathy Reeves Bracco**  
**Vanessa Ximenes Barrat**  
**Susann Skjoldhorne**  
**Neal Finkelstein**

**April 2021**

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Suggested citation: Bracco, K. R., Barrat, V. X., Skjoldhorne, S., & Finkelstein, N. (2021). Preliminary outcomes for California State University students in Early Start mathematics. WestEd.

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# Executive Summary

WestEd is undertaking a series of implementation studies intended to inform the California State University (CSU) system about the implementation of Executive Order 1110 (EO 1110). A major policy adopted by the CSU Chancellor’s Office in 2017, EO 1110 requires CSU campuses to eliminate noncredit developmental courses — often known as “remedial” courses — in Written Communication (WC) and Mathematics/Quantitative Reasoning (QR), change the process for how students are placed into WC and QR courses, and improve how students are supported to succeed. The policy also calls for changes to the system’s Early Start programs that would enable students designated as needing additional support in WC or QR (designated as placement Categories III and IV) to obtain baccalaureate-level credit during the summer prior to their initial fall enrollment. This report examines initial outcomes for students who enrolled in summer 2019 Early Start mathematics courses that were offered to students in response to the policy. On several campuses, but not all, the Early Start courses were changed significantly from prior years to provide additional supports for students as they transitioned to their first year of college.

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Since 2011, the CSU system has designated summer Early Start programs, which generally offered some sort of pre-baccalaureate coursework for incoming students, as a key strategy for supporting students designated as “not college ready.” EO 1110 asked campuses to revamp their Early Start offerings starting in 2019 to provide baccalaureate-level courses in WC and QR during the summer. Per the language of the Executive Order, Early Start is “required” for

students placed in Category IV (those determined to have the highest need for additional academic support in WC or QR) and “recommended” for those in Category III (those determined to need some additional academic support). Because not all campuses offered courses that met the requirements of the new policy in the summer of 2019, WestEd researchers, in close consultation with staff from the CSU Chancellor’s Office, limited this report’s analysis to a subset of seven campuses identified as having a robust implementation of Early Start in the summer of 2019. In addition, because very few Early Start courses either met the General Education (GE) requirement for WC or served as the first course in a two-semester WC sequence, the study is limited to focusing on QR courses. This study considers Early Start outcomes on seven of the 22 CSU campuses that offer Early Start and, as a result, does not draw conclusions about “systemwide” Early Start policy or implementation.

Although EO 1110 recommends and/or requires that students designated as needing additional support in QR attend Early Start in the summer prior to their first fall enrollment, not all students do so. As a result, outcomes can be compared for two groups of students: those who participated in Early Start and those who were in the same placement category and at the same campus but chose not to participate in Early Start.

This analysis of short-term outcomes of Early Start participation on seven campuses shows that, after a single semester, enrolling in the new Early Start courses in QR had a positive impact on students’ ability not only to complete a baccalaureate-level math course of three or more units but also to complete the GE requirement in QR (referred to as the B4 requirement) by the end of the fall term. Additionally, there was a small, statistically significant short-term impact on retention for students in Category IV.

- Students who participated in Early Start across the seven campuses not only attempted a math course of three or more units at higher rates than their counterparts who opted out of Early Start participation, but they also had higher success rates in those courses.
  - For students who participated in Early Start, 91 percent of students in Category III and 83 percent of students in Category IV completed a math course of three or more units by the end of fall 2019. For those who did not participate in Early Start, 53 percent of students in Categories III and IV completed a math course of three or more units by the end of fall 2019.
- Students who participated in Early Start at any of the seven campuses included in this study completed the B4 requirement by the end of fall 2019 at higher rates than their non–Early Start peers in the same QR placement.
  - Seventy-four percent of students in Category III who participated in Early Start completed the B4 requirement by the end of the fall semester, compared to 29 percent of Category III students who did not participate in Early Start. Similarly, 60 percent of Category IV students who enrolled in Early Start completed the B4 requirement by the end of fall 2019, compared to 25 percent of Category IV students who did not enroll in Early Start.

- In terms of retention to the spring 2020 semester, although there was little difference between Category III students who participated in Early Start and those who did not, there were statistically significant differences in retention rates for students in Category IV who participated in Early Start.
  - Ninety-one percent of students in Category IV who participated in Early Start on these seven campuses reenrolled in the spring 2020 term, compared to 87 percent of those in the same placement category who did not participate in Early Start.

Although these short-term outcomes are positive, it is too soon to tell whether these benefits will have an impact on retention and completion in the long run. Additionally, this analysis cannot determine whether the success in the summer courses was due to the focused time on one course, the additional supports provided in the summer, or a difference in the course itself. What does seem clear, however, is that allowing students to take baccalaureate-level courses in the summer does provide students with an advantage that allows them to make initial short-term gains toward fulfilling their GE math requirements.

# Preliminary Outcomes for California State University Students in Early Start Mathematics

WestEd is undertaking a multiyear series of implementation studies intended to inform the California State University (CSU) system about the implementation of Executive Order 1110 (EO 1110). A major policy adopted by the CSU Chancellor's Office in 2017, EO 1110 requires CSU campuses to eliminate noncredit developmental courses (often known as "remedial" courses) in Written Communication (WC) and Mathematics/Quantitative Reasoning (QR), change the process for how students are placed into WC and QR courses, and improve how students are supported to succeed. WestEd's first EO 1110 report (Bracco et al., 2019) describes the variation in course models and instructional approaches adopted by campuses in response to this major policy change. A second report (Bracco et al., 2020) examines the progress of nearly 60,000 students during the policy's first year of implementation, the 2018/19 academic year. The third report (Bracco et al., 2021) examines outcomes for students who entered the CSU system in 2018 in comparison with those who entered in 2017, prior to the new policy's implementation. This fourth report examines the initial impacts of participation in redesigned Early Start QR courses, a major component of the EO 1110 policy.

As discussed in the previous reports in this series, the policy changes enacted by EO 1110 are part of a broader effort to improve completion rates in the CSU system, the largest public four-year university system in the country, with particular focus on reducing the gap in achievement for students from traditionally underrepresented populations. The policy changes (eliminating developmental education courses and relying on multiple measures for placement rather than single high-stakes tests) draw upon research concerning the impact of developmental coursework. Researchers have found that many students who begin their college careers in noncredit developmental courses often drop out before enrolling in General Education (GE) courses or completing their degrees, and many students who are placed into these courses could be successful without them (Burdman, 2017; Rutschow & Mayer, 2018).

Whereas WestEd's earlier reports in this series on EO 1110 are focused on outcomes in the traditional fall and spring terms, this report looks at another significant change dictated by the policy, the summer Early Start programs. EO 1110 called upon campuses to make changes to their summer offerings for those students designated as needing support in WC and/or QR. The changes to Early Start are intended to help these students earn baccalaureate credit and potentially even meet their GE requirement in WC and/or QR in the summer term prior to their first fall enrollment term.

## Background on Early Start

In California and nationally, to help students entering higher education who are not quite ready for college-level work, summer programs have long been part of a strategy to improve these students' chances for college success (Barnett et al., 2012; Kurlaender et al., 2018). Although the summer programs vary, their shared goal is to provide additional supports, both academic and nonacademic, prior to students' enrollment in a full-semester course load. Researchers have found that these programs have had positive short-term outcomes, but long-term impacts have not been as evident (Barnett et al., 2012; Scrivener et al., 2018; Kurlaender et al., 2018).

Since 2011, the CSU system has designated summer Early Start programs as a key strategy for supporting students designated as "not college ready." Although intended to be implemented systemwide, Early Start's exact program components, duration, and intensity have varied significantly by campus. Prior to EO 1110, Early Start offerings included a wide range of strategies such as intensive summer bridge programs designed to better prepare students for the academic and affective demands of college as well as single-unit, one-week online courses designed to help students who wished to retake a placement test in order to change their initial placement into developmental courses.

With the implementation of the EO 1110 policy, campuses were asked to revamp their Early Start offerings beginning in 2019 to provide baccalaureate-level courses in WC and QR during the summer. Per the language of the Executive Order, Early Start is "required" for students

placed in Category IV (i.e., those determined to have the highest need for additional academic support) and “recommended” for those in Category III (those determined to need some additional academic support).<sup>1</sup> To better support the students who enroll in Early Start, the policy calls upon campuses to offer one or more of the following options in the summer:

- Baccalaureate-credit courses that meet the CSU’s GE requirement in WC (referred to as the A2 requirement) or in QR (referred to as the B4 requirement)
- Baccalaureate-level courses that provide the first course of a two-semester (often referred to as “stretch”) sequence leading to the A2 or B4 requirement in the next semester
- Baccalaureate courses that prepare students for fall courses that satisfy the A2 or B4 requirement (the summer courses could be baccalaureate-level, non-GE courses and be offered with up to two units of concurrent pre-baccalaureate support in QR or WC)

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“Effective summer 2019, Early Start Programs shall offer primarily baccalaureate credit-bearing general education written communication and mathematics/quantitative reasoning courses, and those courses shall be offered in sufficient numbers to meet student demand. Instructional content considered pre-baccalaureate will carry a maximum of two units and shall be offered concurrently with a college-level, baccalaureate credit-bearing course.”<sup>2</sup>

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### Campus-level concerns prior to Early Start modifications

In the fall of 2018, WestEd researchers met with faculty and administrators on nine CSU campuses to understand how the implementation of EO 1110 was proceeding (Bracco et al., 2019). At that time, most campuses had not determined exactly how they were going to revamp their Early Start offerings to meet the requirements of the new policy. Many campus representatives did not think the prior iteration of Early Start had been very impactful, particularly the one-week, one-unit courses. Some campuses had more robust program

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<sup>1</sup> See Box One, page 11, for additional detail on the placement categories.

<sup>2</sup> CSU Executive Order 1110 Frequently Asked Questions (FAQ). Updated: May 10, 2019. <https://www2.calstate.edu/csu-system/why-the-csu-matters/graduation-initiative-2025/files/academic-preparation-faq.pdf>

offerings that were focused on a smaller number of students, including bridge programs that aimed not only to shore up academic skills but also to familiarize students with campus policies and procedures and acclimate them to campus life. Campus teams noted the importance of supporting students in a transition to campus life, providing information on how to access campus-based resources, build peer communities, and manage multiple new time commitments. While changes to Early Start for summer 2019 were still in early planning stages at the time of these visits, campus interviewees expressed some concerns about the Early Start requirement and its potential to be helpful.

- Campus representatives expressed concerns that the Early Start requirement could send mixed messages to students about their college readiness or create financial or other burdens by requiring students to attend college in the summer. In particular, interviewees noted that many students work during the summer, and the Early Start requirement could inhibit their ability to save money needed for the academic year.

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“Our students, generally speaking, are first-generation college students. Summer courses are way more expensive for them than other courses, and summer is when a lot of our students tend to make their money. And so, for them to try to come to campus from wherever, it’s expensive for them, and not just transportation-wise, but because they’re missing hours of work.”

– CSU campus faculty member 2018

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- Both WC and QR instructors questioned whether GE course content was best offered in a condensed summer format. Faculty particularly questioned whether the shorter summer time frame provided adequate time for STEM students to gain the skills necessary to succeed in future coursework. The two-semester stretch model (whereby the traditional one semester course is “stretched” over two semesters) can also be problematic to begin in the summer, particularly if a student takes an Early Start stretch course at one campus and then enrolls in the fall at a different campus where the courses are not aligned with those of the first campus.
- Interviewees on many campuses wanted the flexibility to design holistic programming that would help prepare students to succeed at their campuses, including addressing

affective dimensions such as study skills, critical self-reflection around disciplinary content, and orientation to specific support resources at destination campuses.

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“Summer Bridge programs have demonstrated an opportunity to really transition students, particularly first-generation, lowest-performing, to come to the university, to get oriented to campus, to build a community, to get associated with mentors and other faculty. Unfortunately, because the Early Start program is so massive, it’s just really impossible to do that.”

– CSU campus faculty member 2018

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Interviewees also noted the different contexts of the various CSU campuses and wanted more flexibility to determine Early Start programming that works for their individual students. Subsequent to researchers’ fall 2018 visits, the Chancellor’s Office did allow for additional flexibility for Early Start in summer 2019. Although students designated as Category IV were still technically required to enroll in Early Start, there would be no penalty for not doing so. And although campuses were encouraged to offer baccalaureate-level courses and courses that met A2 or B4 requirements (or contributed to meeting those requirements), campuses were allowed to offer a baccalaureate-level elective course (one or more units) concurrently with pre-baccalaureate support units (two units maximum) for either WC or QR.

## Methodology

The variation in Early Start programming across campuses has been considerable since the inception of the program. Because not all campuses offered courses that met the requirements of the new policy in the summer of 2019, WestEd researchers, in close consultation with staff from the CSU Chancellor’s Office, limited this analysis to a subset of campuses. This report focuses on initial outcomes for students who participated in Early Start on seven campuses that were identified as having a robust implementation of Early Start in summer 2019. Therefore, this analysis examines programming most aligned with the policy at that time, and the study’s results cannot be generalized to the other campuses; also, Early Start offerings have continued to evolve since summer 2019. In addition, because very few Early Start courses in 2019 either met the GE requirement for WC or served as the first course in a WC stretch sequence, the

study focuses on QR. The seven campuses included in this study<sup>3</sup> all had at least 100 students enrolled in Early Start QR, and all offered baccalaureate-level courses.

The findings in this report are based on WestEd researchers' analysis of data for a cohort of 24,616 students who were entering the CSU system as first-year students in the 2019 fall term at seven campuses. The study particularly focuses on the students from this entering cohort who were placed in QR Categories III and IV at the beginning of the summer, a total of 7,367 students, and even more specifically, the 7,000 with adequate data for the study. All of these students were recommended or required to attend Early Start. The first part of this report provides descriptive statistics on their participation rates in Early Start, disaggregated by gender, race/ethnicity, declared major, and campus.

**To begin to understand the potential impact of participation in Early Start on these campuses under the policy, this study then examines outcomes on several indicators for two groups: students who participated in Early Start and a comparison group of students who were enrolled at the same campus and also required or recommended to attend Early Start but who chose not to participate in Early Start.**

Accordingly, the population of 7,367 students placed in QR Categories III and IV at the beginning of summer 2019 was narrowed to the 7,000 students who enrolled for the fall 2019 term and had the full set of demographics and placement information needed to construct the two comparable groups: students who did participate in Early Start in summer 2019 and those who did not.<sup>4</sup> Within this sample, 2,559 had enrolled in Early Start in summer 2019 and then enrolled in fall 2019 at the same campus where they had been in Early Start.

Because Early Start is intended to help students fully complete their GE QR requirements by the end of their first year, the analysis would ideally focus on outcomes at the end of an entire academic year, but the disruptions to the spring 2020 term by COVID-19 introduced a number of confounding factors that severely limited researchers' ability to make analytical inferences from student outcomes during the spring term. The analysis therefore focuses on the early effects of Early Start participation, specifically

- completion of a math course of three or more units by the end of the fall 2019 term,
- completion of the GE requirement in math (also known as the B4 requirement) by the end of the fall 2019 term, and
- reenrollment in the spring 2020 term.

Descriptive statistics were used to examine the association of Early Start participation with math completion in the fall. This study first presents, by QR placement category, the

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<sup>3</sup> Campuses included in this analysis are Dominguez Hills, Fullerton, Los Angeles, Northridge, Pomona, San Jose, and Stanislaus. Outcomes studied are aggregated rather than broken down by individual campus.

<sup>4</sup> Of the students placed in QR Categories III and IV at the beginning of summer 2019, 367 either enrolled in Early Start at a different campus than that at which they enrolled in fall 2019 or had missing demographic or high school information.

percentage of students who completed a QR course<sup>5</sup> with a grade of C– or better in summer 2019 (for Early Start participants) and in fall 2019 (for Early Start participants compared to non–Early Start participants). A chi-square test of independence was used to assess the statistical significance of the differences in math completion at the end of the fall term between students who enrolled in Early Start and their peers who opted out of Early Start participation.

Next, the study reports the percentage of students who completed the B4 requirement in summer 2019 (for Early Start participants) and in fall 2019 (for Early Start participants compared to non–Early Start participants). Again, a chi-square test of independence was used to assess the statistical significance of differences in B4 completion between the two groups.

Finally, the spring 2020 reenrollment rates are reported, by QR placement category, for Early Start participants compared to their non–Early Start peers. Again, the analysis applied a chi-square test to determine whether any observed difference is statistically significant.

To account for differences between Early Start participants and non–Early Start participants on spring 2020 reenrollment rates, a matching analysis using the Mahalanobis distance metric was also performed; students in Categories III and IV who took Early Start math classes in the summer were matched to similar students who did not take Early Start classes. Matching eliminates the systematic differences in baseline characteristics (such as demographic information or placement category) between students who attended Early Start and similar students who did not attend, allowing an assessment of the difference between the two groups with more precision. Early Start students were matched to non–Early Start students using the Mahalanobis distance metric based on the following characteristics: campus of enrollment, QR placement category, high school grade point average (GPA), high school math GPA, major of admission, age, gender, and ethnicity. Each Early Start student was matched to one most similar non–Early Start student, and matching was conducted with replacement (i.e., students who did not participate in Early Start were available for consideration as a potential match for more than one Early Start student). The final analytic sample consisted of 2,559 Early Start students who were matched with 2,559 weighted non–Early Start students.<sup>6</sup> To evaluate the impact of Early Start participation, all matched students were included in a regression model that included as covariates the same variables that were used in the matching process. Appendix A provides additional details on the matching methodology.

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<sup>5</sup> Only math courses of three or more units were considered in this analysis.

<sup>6</sup> For analysis, each Early Start student received a weight of 1, and each matched non–Early Start student received a weight that was proportional to the number of times the student was selected as a match. The total sample sizes of these groups (Early Start and non–Early Start) were equivalent after the weights were applied.

## Early Start Participation

### Summer QR placement

With the implementation of EO 1110, the CSU adopted the use of multiple measures to designate each student's readiness for college-level work, known as the student's placement status. The policy calls on campuses to use a variety of measures, including high school grades and test scores, to designate students in one of four placement categories (Box 1).

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### Box 1 – California State University placement categories, based on multiple measures

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**Category I:** Has fulfilled the requirement for General Education (GE) Subarea A2 (for Written Communication, or WC) or B4 (for mathematics/quantitative reasoning, or QR)

- Student has met the CSU GE Breadth Subarea A2 and/or B4 requirement via Advanced Placement examination, International Baccalaureate examination, or transferable course.

**Category II:** Placement in a GE Subarea A2 or B4 course

- Student has met examination standards and/or multiple measures–informed standards.

**Category III:** Recommend placement in a supported GE Subarea A2 or B4 course

- Based on new multiple measures, student needs additional academic support.
- Participation in the Early Start program is recommended and may be highly advisable for some students, particularly STEM majors.

**Category IV:** Require placement in a supported GE Subarea A2 or B4 course or the first term of an applicable stretch course

- Based on new multiple measures, student needs additional academic support.
- Participation in the Early Start program is required.

Note: Placement categories for WC and QR courses are determined by a combination of student grades and test scores. For a detailed description of the various ways in which a student can be placed into the different categories, see <https://calstate.policystat.com/policy/6656541/latest/>

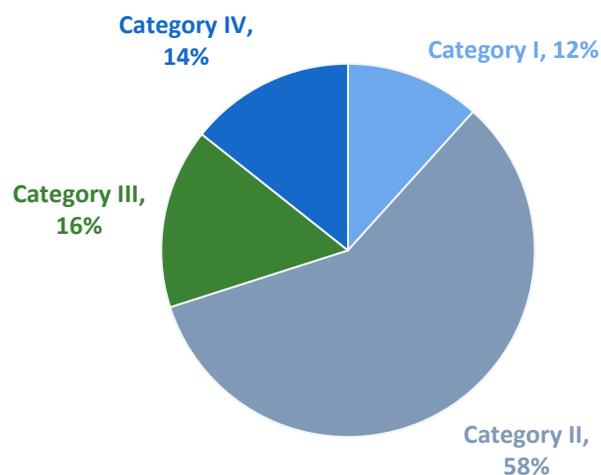
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Student placement designations prior to the summer term dictated whether a student was “recommended” or “required” to enroll in Early Start. Students who went on to complete a B4

requirement in the summer were then recategorized into Category I at the start of the fall 2019 term. Therefore, whereas WestEd’s previous report looked at student placement in the fall term (Bracco et al., 2021), this analysis looks at placement designations at the outset of the summer term. The report first describes the demographic makeup of the students enrolled across the seven campuses placed in QR Category III or IV in summer 2019 and then further describes the characteristics of those students who ultimately participated in Early Start.

A total of 24,616 students enrolled in one of the seven CSU campuses as first-time students in fall 2019. Of this total, 16 percent (3,844) were placed in QR Category III and 14 percent (3,523) were placed in Category IV at the start of the summer session (Figure 1).

**Figure 1. QR placement at the beginning of summer 2019 (admission), first-year entering students in fall 2019**



**Note:** Based on 24,616 first-year students enrolled at one of the seven CSU campuses included in this analysis during the fall 2019 term. For one campus, summer placement data were not available at the time of this analysis and were estimated based on a combination of GPA and SAT/ACT information (see appendix A). Frequency counts are presented in Appendix B, Table B1.

For the purposes of Early Start, this study is most interested in students designated as needing additional supports for their math courses, meaning those who were placed in QR Categories III and IV. Box 2 shows the demographic breakdown for students in these categories for the 2019 summer term: 62 percent are female, 76 percent are Hispanic or Latino, and more than 26 percent had declared a STEM-related major (including Health-Related STEM).

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## Box 2 – Cohort demographics for students in QR Categories III and IV (as of summer 2019)

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### 62% Female

#### Race/Ethnicity

- 76% Hispanic/Latino
- 7% Asian
- 7% Black/African American
- 5% White
- 5% Other

#### Declared Majors

- 46% Not STEM
- 24% STEM (excludes Health-Related STEM)
- 14% Undeclared
- 13% Business
- 3% Health-Related STEM

Note: “Asian,” “Black/African American,” “White,” and “Other” refer to Non-Hispanic students. The “Other” category includes American Indian, Alaska Native, Native Hawaiian, and Other Pacific Islander. Percentages in this box are based on the 7,367 students who were placed in QR Categories III or IV. This analysis uses the IPEDS Race/Ethnicity reporting categories. The CSU uses a slightly different method to report race/ethnicity in which any students who are non-U.S. citizens with an “F,” “J,” or “other” visa or who are non-U.S. citizens with no visa or undetermined status are put into their own category as International Students/Non-Resident Alien Students. Additional demographic details are presented in Appendix B, Tables B2–B4.

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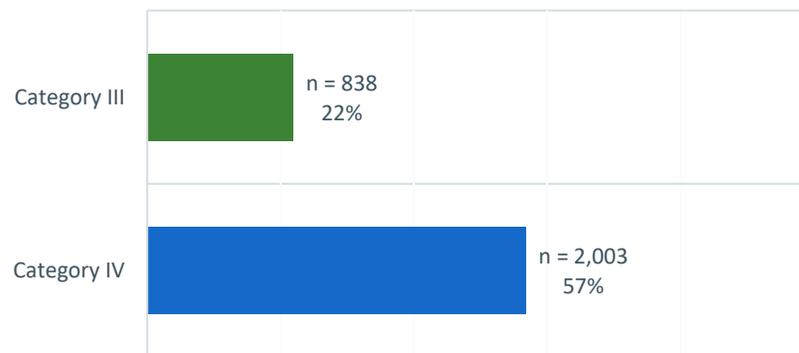
### Participation in Early Start, by student characteristics

Although EO 1110 states that all students placed in Category IV are “required” to enroll in Early Start, not all students did so, presumably for a variety of reasons. Campus interviewees noted that some students may have faced too much difficulty getting to campus in the summer while also trying to work and save money for the upcoming semester. Additionally, some students were designated as Category IV in both QR and WC. According to EO 1110, although students could choose to enroll in Early Start in both subject areas, they were only required to choose one. Although campus leaders shared that they would likely encourage students to enroll in QR if they were placed in Category IV in both subject areas, the choice was ultimately up to students.

### Participation in Early Start, by placement category

Twenty-two percent of students in QR Category III and 57 percent of students in QR Category IV enrolled in an Early Start QR course in the summer of 2019 (Figure 2). The higher percentage of Category IV students enrolling in Early Start may be reflective of the fact that these students were “required” to enroll, whereas participation was only “recommended” for students in Category III.

**Figure 2. Participation in Early Start, by placement category, for students in QR Categories III and IV, 2019 cohort**

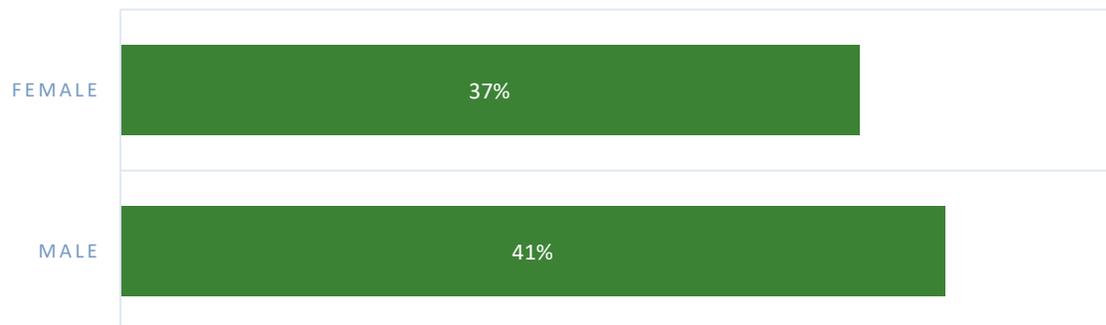


**Note:** Based on the 7,367 students in QR Categories III and IV at admission (i.e., at the onset of the summer 2019 term). Frequency counts are presented in Appendix B, Table B5.

### Participation in Early Start, by gender

A slightly higher percentage of males (41%) in Categories III and IV participated in Early Start QR courses in the summer of 2019, compared to their female counterparts (37%) (Figure 3).

**Figure 3. Participation in Early Start for students in QR Categories III and IV, by gender, 2019 cohort**



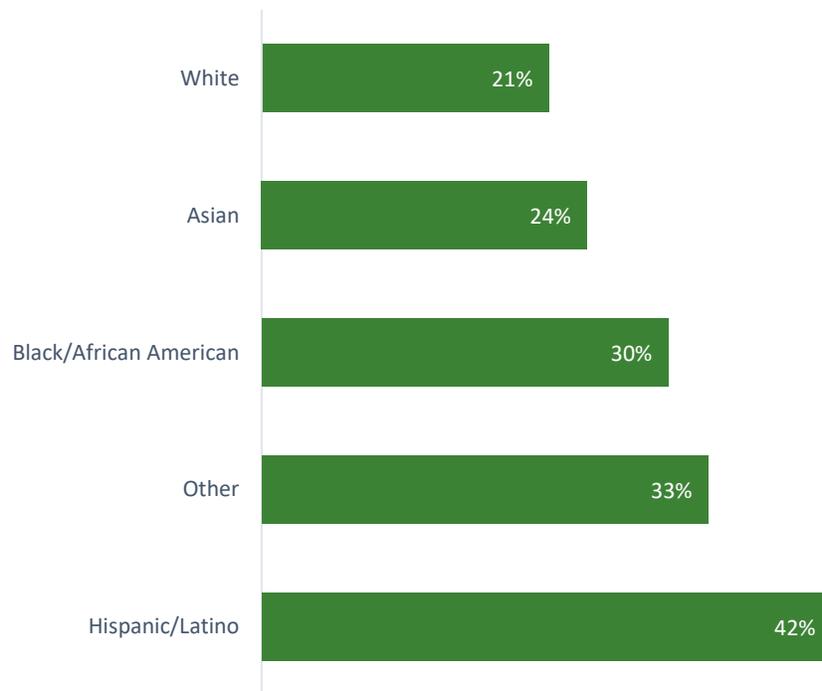
**Note:** Based on the 7,367 students in QR Categories III and IV at admission (i.e., at the onset of the summer 2019 term). The figure does not include the 10 students who did not indicate female or male as their gender and were placed in an “Other” category. Frequency counts are presented in Appendix B, Table B6.

#### Participation in Early Start, by race/ethnicity

Earlier research (Bracco et al., 2020, 2021) indicates that Hispanic/Latino and Black/African American students are overrepresented in Categories III and IV relative to their representation in the larger first-year cohort in the CSU system. Whether or not these students were specifically encouraged to enroll in Early Start, a higher percentage of Hispanic/Latino (42%) and Black/African American (33%) students in Categories III and IV participated in Early Start in the summer of 2019 than their Asian (24%) or White (21%) counterparts (Figure 4). These differences were most pronounced when looking at Early Start participation for Category IV students only: 61 percent of Hispanic/Latino students and 46 percent of Black/African American students who were designated as QR Category IV participated in Early Start, whereas 39 percent of Asian and 36 percent of White students in this category participated.<sup>7</sup>

<sup>7</sup> Frequency counts for Category IV students’ Early Start participation, by ethnicity, are in Appendix B, Table B7.2.

**Figure 4. Participation in Early Start for students in QR Categories III and IV, by race/ethnicity, 2019 cohort**

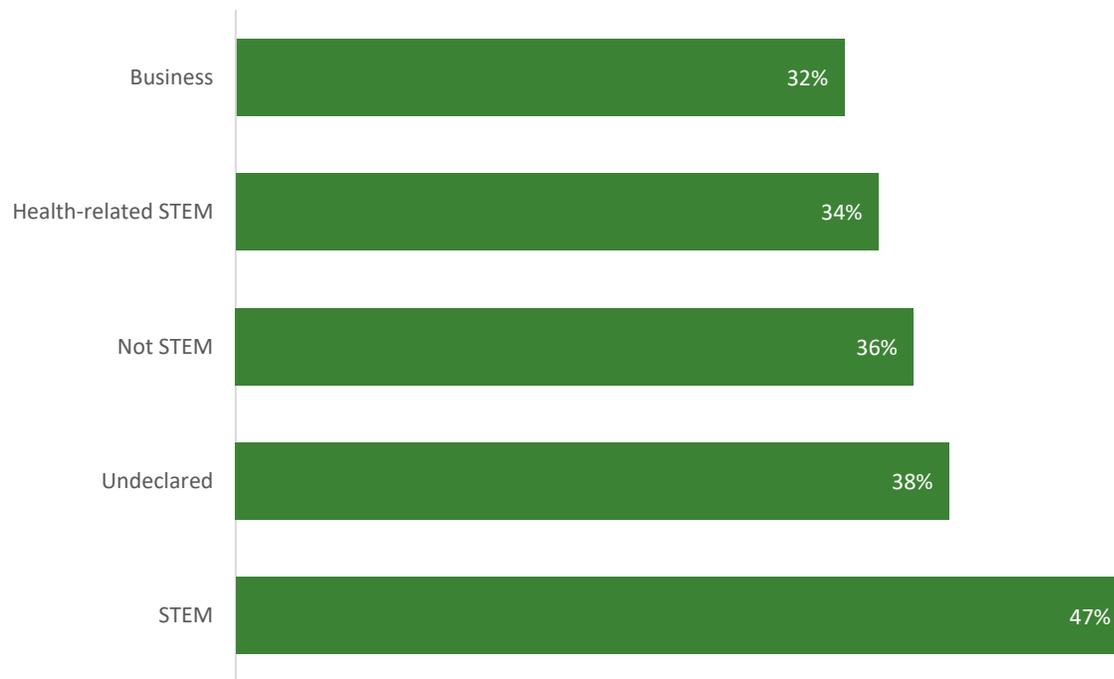


**Note:** Based on the 7,367 students in QR Categories III and IV. “Asian,” “Black/African American,” “White,” and “Other” refer to Non-Hispanic students. Frequency counts are presented in Appendix B, Table B7.

### Participation in Early Start, by declared major

Students who were in QR Categories III and IV and planned to major in a STEM field were more likely to enroll in Early Start than their peers who had declared other majors (Figure 5). This finding may be important because students in STEM fields are likely to need significantly more math courses than students in other majors, so the ability to get started early toward the completion of their B4 requirement may be especially helpful. However, this difference only holds when considering students in Categories III and IV taken together. When examining only students in Category IV, students who had not yet declared a major were the most likely to participate in Early Start: Approximately 62 percent of those with an undeclared major participated in Early Start, compared with 59 percent of non-STEM and 57 percent of STEM students (see Appendix B, Table B8.2).

**Figure 5. Participation in Early Start for students in QR Categories III and IV, by declared major, 2019 cohort**

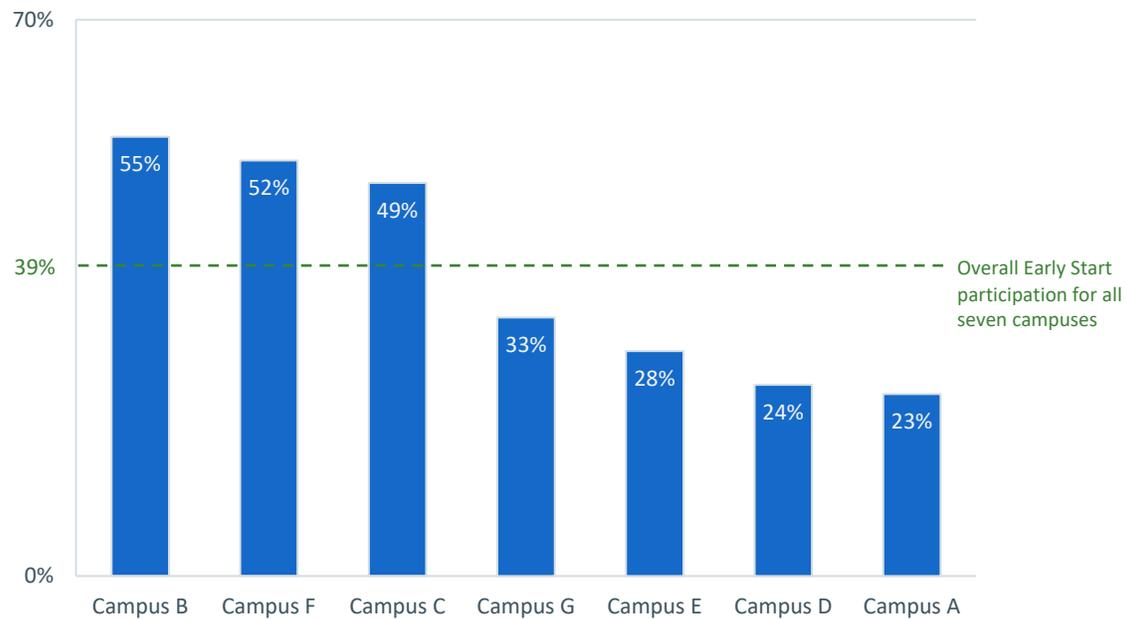


**Note:** Based on the 7,367 students in QR Categories III and IV. “STEM” excludes students in health-related STEM majors, who comprise their own grouping. Frequency counts are presented in Appendix B, Table B8.

### Participation in Early Start, by campus

To understand whether trends in Early Start participation differed across the seven campuses, researchers examined the percentage of students in Categories III and IV who enrolled in Early Start on each campus. Across all seven campuses, 39 percent of students in Categories III and IV enrolled in Early Start, but this figure varied significantly by campus (Figure 6). On two campuses, more than 50 percent of students in these placement categories participated in Early Start, whereas three of the campuses had fewer than 30 percent of these students enroll in Early Start in the summer of 2019. (Note that these figures include students who enrolled in Early Start on any campus, not just the destination campus where they ended up enrolling in fall 2019.) The study cannot explain the differences in participation rates or suggest any bias that these differences imply. Further work to understand campus support for communication about Early Start and encouragement of attendance would be relevant.

**Figure 6. Distribution of Early Start Participation across campuses for students in QR Categories III and IV, 2019 cohort**



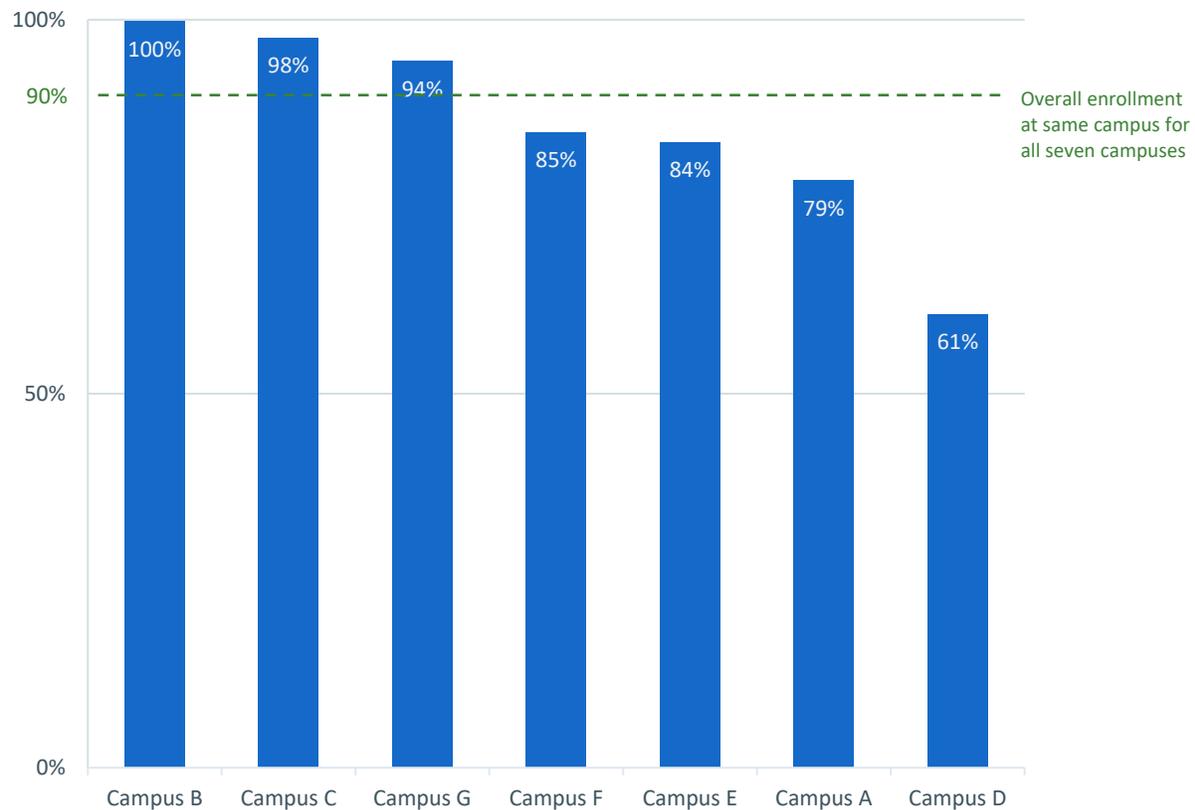
**Note:** Based on the 7,367 students in QR Categories III and IV. Frequency counts are presented in Appendix B, Table B9.

### Percentage of Early Start participants enrolling at same campus in fall 2019

EO 1110 allows students to enroll in Early Start at any of the 22 CSU campuses<sup>8</sup> that offer the program. Even with this flexible option, a vast majority of students in the sample (over 90%) had enrolled in Early Start on the same campus at which they enrolled during the fall semester. This figure varied by campus, with 61 percent to 100 percent of students who participated in Early Start enrolling at the same campus in the fall (Figure 7).

<sup>8</sup> The CSU Maritime Academy does not offer Early Start courses.

**Figure 7. Distribution of the percentage of Early Start participants taking Early Start classes at their campus of enrollment in fall 2019, 2019 cohort**



**Note:** Based on the 2,841 students in QR Categories III and IV who participated in Early Start in summer 2019. Frequency counts are presented in Appendix B, Table B10.

To understand the potential impact of the Early Start courses offered on these seven campuses, the remainder of the analysis looks only at those students who enrolled in the fall at the same campus where they had enrolled in Early Start in the summer of 2019.

### Campus course offerings

EO 1110 provided some leeway to campuses as to the type of courses offered for Early Start as long as students were given the option to earn some baccalaureate credits. According to the May 2019 FAQ published by the Chancellor’s Office<sup>9</sup> regarding EO 1110, Early Start courses should meet one of the following criteria:

- Meet the GE requirement in Subareas A2 or B4. This course can be paired with a workshop that carries pre-baccalaureate or baccalaureate credit.

<sup>9</sup> <https://www2.calstate.edu/csu-system/why-the-csu-matters/graduation-initiative-2025/files/academic-preparation-faq.pdf>

- Represent the first part of a stretch sequence that, if passed, allows the student to take a course that meets the A2 or B4 GE requirement in the fall. This course can be paired with a workshop that carries pre-baccalaureate or baccalaureate credit.
- Offer at least one baccalaureate credit and help students build skills in quantitative reasoning or written communication. This course can be paired with a workshop that carries pre-baccalaureate credit.

As a result of this leeway, the seven campuses in this study took different approaches to their Early Start offerings. Whereas most campuses in the sample offered some combination of classes that met the B4 requirement (the GE math requirement), other campuses offered only stretch classes for Early Start. On three campuses, almost all students in Early Start for QR enrolled in a B4 course; on two of the campuses, all students took a first semester stretch or prerequisite course; on the other two campuses, a mix of courses was offered, with some students taking stretch/prerequisite courses and others enrolling in a course that met the B4 requirement. On some campuses, the baccalaureate courses were paired with a pre-baccalaureate workshop. This variation reinforces the point that program structure is determined at the campus level, making the consideration of systemwide outcomes complicated to interpret, particularly in response to EO 1110.

## Findings

As noted in the Methodology section, this study's findings examine outcomes on several indicators to compare students who participated in Early Start with peers who chose not to participate in Early Start but were in the same placement category and enrolled at the same campus. The analysis focuses on three preliminary outcomes with regard to the effects of Early Start participation:

- completion of a math course of three or more units (by passing the course with a grade of C– or better) by the end of the fall 2019 term,
- completion of the B4 requirement by the end of the fall 2019 term, and
- reenrollment in the spring 2020 term.

For math courses of three or more units and courses that satisfy the B4 requirement, the math completion status at the end of each semester is defined as either

- not attempting the course,
- attempting the course and not passing, or
- completing the course (passing with a grade of C– or better).

## Completion of a math course of three or more units

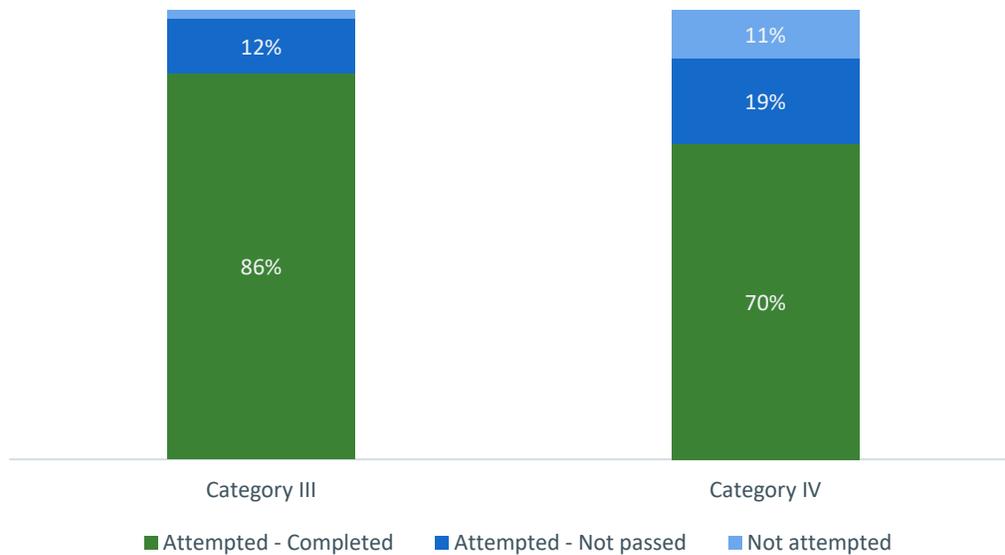
As outlined in an earlier report in this series (Bracco et al., 2019), EO 1110 eliminates the use of pre-baccalaureate developmental math courses and shifts CSU campuses to baccalaureate-level courses with additional supports. In some cases, campuses opted for a two-semester sequence (whether through a stretch or prerequisite model) before students could meet their B4 requirement. Given this approach, in which two semesters are needed for students to meet the B4 requirement, students who did not participate in Early Start would not have the option of a two-semester sequence but could presumably complete at least one math course. A first outcome of interest for this study, therefore, is whether students in Categories III and IV completed at least one three-unit math course (regardless of whether that course met the B4 requirement).

### Completion of a math course of three or more units in summer 2019

**Most Early Start participants completed a math course of three or more units by the end of the summer by completing their Early Start course (Figure 8).**

- Nearly all students in Category III (98%) and most students in Category IV (89%) attempted a math course of three or more units by the end of the summer.
- As a result, 86 percent of Early Start participants in QR Category III and 70 percent of Early Start participants in QR Category IV completed a math course of three or more units during the summer.

**Figure 8. Completion of a math course of three or more units by the end of summer 2019, by QR placement category, for Early Start participants**



**Note:** Based on 2,559 students in QR Categories III and IV who took an Early Start math course in summer 2019. Frequency counts are presented in Appendix B, Table B11.

### Completion of a math course of three or more units by end of fall 2019

**Early Start participants had a math completion status at the end of fall 2019 that was statistically significantly different from their non–Early Start peers in the same QR placement category.<sup>10</sup>**

Among students who did not participate in Early Start math, 74 percent of Category III students and 85 percent of Category IV students had attempted a math course of three or more units by the end of the fall 2019 term. By contrast, virtually all Early Start participants had attempted such a course, most of them during the summer (Figure 9). Students who participated in Early Start not only attempted a math course of three or more units at higher rates than their counterparts who opted out of Early Start participation, they also successfully completed those courses at higher rates (Figure 9).

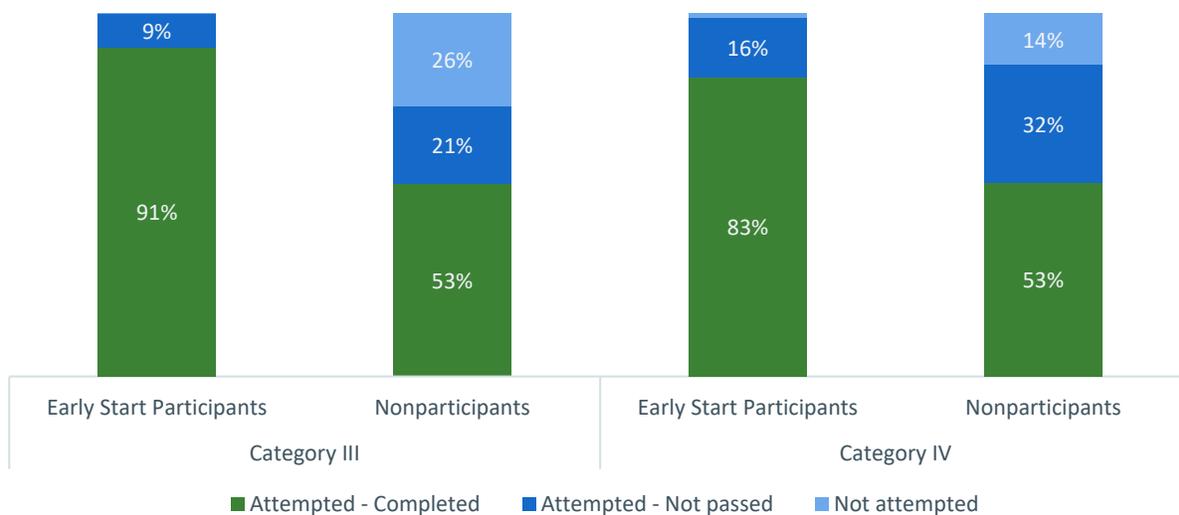
- For students in Category III, 53 percent of those who did not enroll in Early Start and 91 percent of those who did enroll in Early Start completed a math course of three or more units by the end of fall 2019.
- For students in Category IV, 53 percent of those who did not enroll in Early Start and 83 percent of those who did enroll in Early Start completed a math course of three or more units by the end of fall 2019.

<sup>10</sup>  $\chi^2(2, N = 3,778) = 392.9, p < .01$  for students in Category III; and  $\chi^2(2, N = 3,222) = 374.3, p < .01$  for students in Category IV

The possibility of taking a math course of three or more units in summer 2019 gave an advantage to Early Start students and allowed them to reach a higher completion rate of such courses by the end of the fall 2019 semester.

Although the courses offered in the summer generally have the same course name and description as those offered in the fall, there is no way to tell from these data whether the courses are similar or whether courses offered in the summer differ in a significant way. Students who took a math course through Early Start may have had access to additional academic supports, depending on the campus program, than might have been the case during the fall. In addition, taking a single course in the summer without the demands of an additional course load may explain the higher success rates in summer math.

**Figure 9. Completion of a math course of three or more units by the end of fall 2019, by QR placement category and by Early Start participation**



**Note:** Based on 7,000 students in QR Categories III and IV across seven CSU campuses. Math completion status was significantly different between Early Start participants and nonparticipants for both QR placement categories [ $\chi^2(2, N = 3,778) = 392.9, p < .01$  for Category III; and  $\chi^2(2, N = 3,222) = 374.3, p < .01$  for Category IV]. Frequency counts are presented in Appendix B, Table B12.

### Completion of a B4 requirement

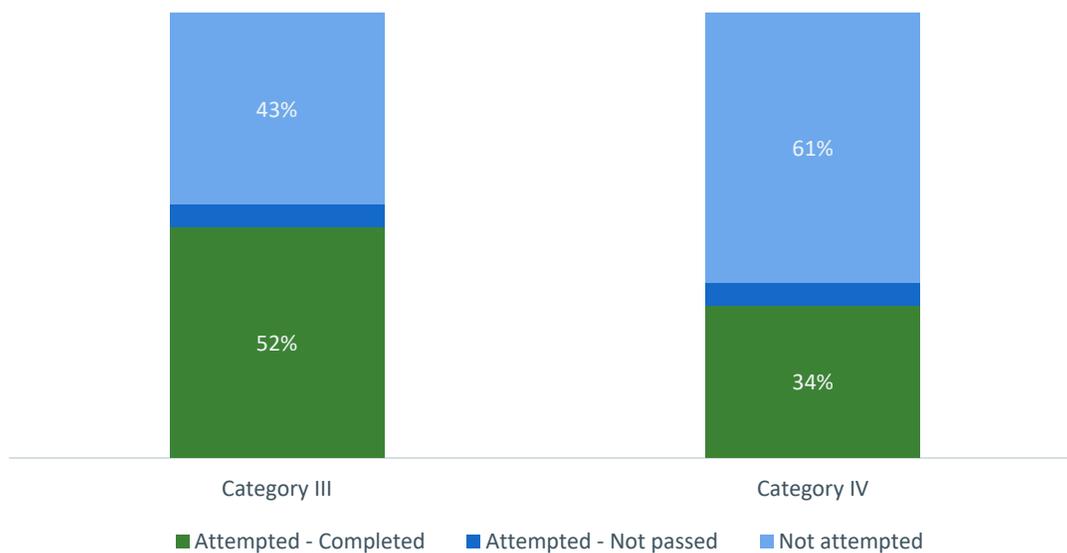
By eliminating developmental courses, EO 1110 seeks to encourage students to complete the B4 requirement as soon as possible. **Whether because they had only to complete one course or because they had the opportunity to complete a two-semester sequence by the end of the fall semester, students who participated in Early Start on the seven study campuses were much more likely to have completed the B4 requirement by the end of the fall term than their counterparts who did not enroll in Early Start.**

### B4 completion in summer 2019 for Early Start students

A large percentage of Early Start students completed a B4 course in summer 2019 (Figure 10).

- Fifty-seven percent of Early Start participants in Category III and 39 percent of participants in Category IV attempted a B4 course by the end of the summer.
- Completion rates were high and, as a result, over half (52%) of Early Start participants in QR Category III and about one third (34%) of Early Start participants in QR Category IV completed a B4 course during the summer.

**Figure 10. Completion of the B4 requirement by the end of summer 2019, by QR placement category, for Early Start participants**



Note: Based on 2,559 students in QR Categories III and IV who participated in Early Start in summer 2019. Frequency counts are presented in Appendix B, Table B13.

### B4 completion by end of fall 2019

Students who participated in Early Start across the seven campuses included in this study had a B4 completion status at the end of fall 2019 that was statistically significantly different from their non–Early Start peers in the same QR placement (Figure 11).<sup>11</sup>

- Forty-two percent of the Category III students who did not enroll in Early Start attempted a B4 course by the end of the fall semester, compared to 85 percent of the Category III students who did participate in Early Start.

<sup>11</sup>  $\chi^2(2, N = 3,778) = 559.5, p < .01$  for students in Category III; and  $\chi^2(2, N = 3,222) = 573.4, p < .01$  for students in Category IV

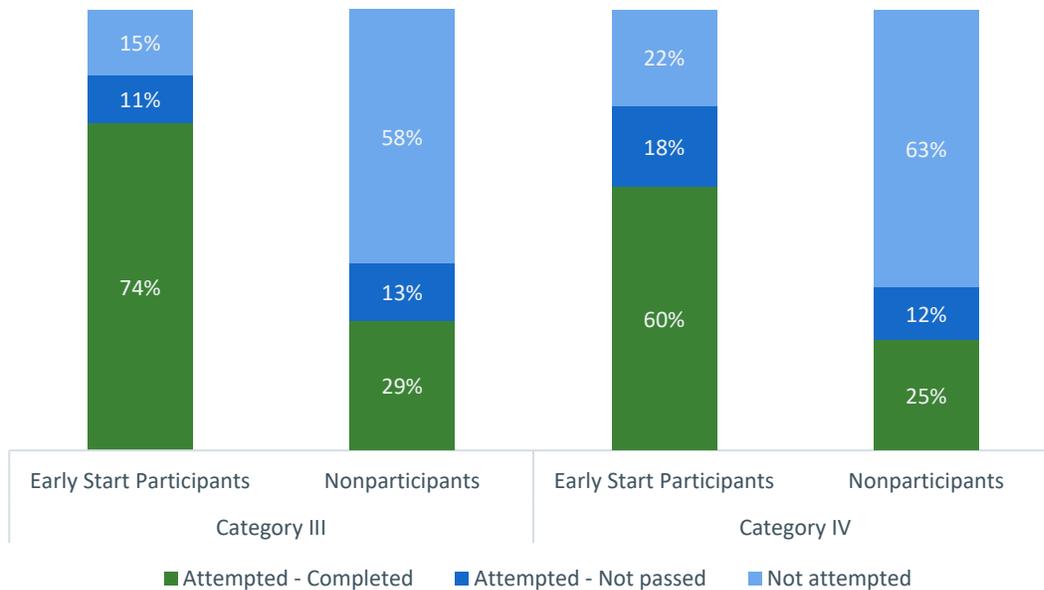
- Thirty-seven percent of the Category IV students who did not enroll in Early Start attempted a B4 course by the end of fall, compared to 78 percent of the Category IV students who did participate in Early Start.

Consequently, among Category III students, 74 percent of those who had participated in Early Start completed the B4 requirement by the end of the fall semester, compared to 29 percent of those who had not participated in Early Start. Similarly, for Category IV, 60 percent of those who had participated in Early Start completed the B4 requirement by the end of fall 2019, compared to 25 percent of those who had not enrolled in Early Start.

By offering an additional term in the summer to take and complete a B4 course before fall enrollment, Early Start created an opportunity for participating students to reach a higher B4 completion rate by the end of fall 2019, compared to non–Early Start students. Further research is needed over a longer period to learn how completing the B4 requirement in the first fall of enrollment is connected to subsequent credit accumulation and retention outcomes.

It will be particularly important to track the long-term consequences of this early completion of the B4 requirement for students in STEM fields. Because STEM students have several additional math requirements, tracking the extent to which the earlier completion of the GE requirement in QR helps with steady movement through subsequent math courses will be crucial to understanding whether this faster move through general education is beneficial for those students.

**Figure 11. Completion of a the B4 requirement by the end of fall 2019, by QR placement category and by Early Start participation**



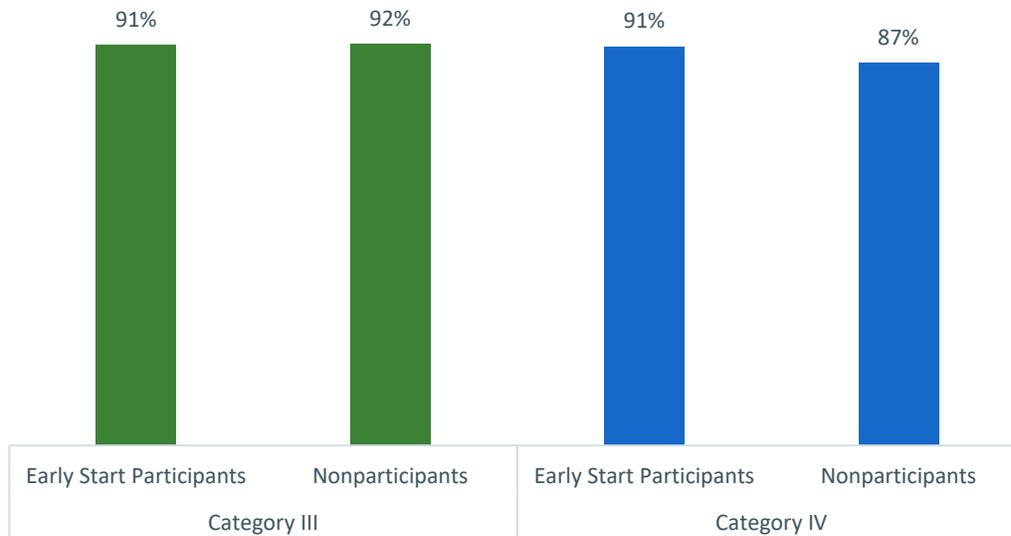
**Note:** Based on 7,000 students in QR Categories III and IV. B4 completion status was significantly different between Early Start participants and nonparticipants for both QR placement categories [ $\chi^2(2, N = 3,778) = 559.5, p < .01$  for Category III; and  $\chi^2(2, N = 3,222) = 573.4, p < .01$  for Category IV]. Frequency counts are presented in Appendix B, Table B14.

### Retention

Although students who enrolled in Early Start did have an advantage in terms of their B4 completion rates, researchers wanted to see whether Early Start participation had any impact on retention rates, specifically on whether students reenrolled to continue their CSU education in the spring 2020 semester. There was very little difference in retention between Category III Early Start and non–Early Start participants (Figure 12).<sup>12</sup> However, there is a statistically significant difference between reenrollment in spring 2020 for Category IV students who did participate in Early Start (91%) and those who did not (87%).

<sup>12</sup>  $\chi^2(1, N = 3,778) = 0.04, p = .84$  for students in Category III; and  $\chi^2(1, N = 3,222) = 11.9, p < .01$  for students in Category IV

**Figure 12. Reenrollment in spring 2020, by Early Start participation and by QR placement category**



**Note:** Based on 7,000 students in QR Categories III and IV. Retention rates between Early Start participants and nonparticipants were not significantly different for Category III students [ $\chi^2(1, N = 3,778) = .04, p = .84$ ] but were statistically different for Category IV students [ $\chi^2(1, N = 3,222) = 11.9, p < .01$  for Category IV]. Frequency counts are presented in Appendix B, Table B15.

This result was confirmed by the matching analysis. Compared to Early Start participants, similar students placed in Category IV who did not take Early Start classes had a lower retention in spring 2020 (91% compared to 88%), and the difference was statistically significant at the 1 percent level (see Appendix A). **This result means that Early Start had a positive impact on short-term retention, and this impact was unlikely to have happened by chance.**<sup>13</sup>

WestEd’s most recent prior report on EO 1110 (Bracco et al., 2021) found that the larger retention drops tend to happen between the second and third semesters. A longer-term analysis is needed to study whether these drops continue or worsen in subsequent semesters.

## Observations and Conclusions

This analysis of short-term outcomes of Early Start participation on seven campuses shows that, after a single semester, enrolling in the new Early Start courses had a positive impact on both students’ ability to complete a baccalaureate-level math course of three or more units and their

<sup>13</sup> The estimated standardized effect of Early Start participation on retention was estimated as the odds ratio for participation in a regression model predicting retention that included as covariates the same variables that were used in the matching process. The estimated odds ratio of 1.44 means that the probability of reenrolling was 1.44 times higher for Early Start participants compared to nonparticipants. The variables were campus of enrollment, QR placement, high school GPA, high school math GPA, major of admission, age, gender, and ethnicity.

ability to complete the B4 requirement (the General Education requirement for math) by the end of the fall term. For students in Category IV (those determined to have the highest need for additional academic support), there was also a small, statistically significant short-term impact on retention, as those students had a slightly greater likelihood of reenrolling in the spring than their counterparts who had not enrolled in Early Start.

Although these short-term outcomes are positive, it is too soon to tell whether these benefits will have an impact on retention and completion in the long run. Additionally, this analysis cannot determine whether the success in the summer courses was due to the focused time on one course, the additional supports provided in the summer, and/or a difference in the courses themselves. What does seem clear, however, is that allowing students to take baccalaureate-level courses in the summer does more for their progress than simply offering a single-unit pre-baccalaureate course. Further research might also consider the potential short- and long-term effects of participating in Early Start on a different campus than the one at which a student enrolls in the fall.

Gathering programwide information would be an important next step in this analysis. Having data from just seven campuses is not enough for determining differences between programs in terms of their encouragement to enroll in Early Start, student engagement, tutorial supports, peer learning situations, and so on. All of these details are important and have the potential to impact the benefits of Early Start at the campus level. Anecdotal information that researchers for this study have collected over the past several years about Early Start indicates significant variation in how the Early Start program is implemented across different CSU campuses and even within the seven campuses that are the focus of this analysis. In that sense, referring to the Early Start “program” is somewhat of a misnomer, and the results of this study may suggest opportunities for strengthening Early Start at some campuses and coordinating how it is implemented across the CSU system.

As noted throughout this report, interpreting this study’s findings requires an extra reminder of not only the short duration between students’ summer 2019 Early Start experiences and the fall 2019 course outcomes but also a recognition that selection effects played a role in two critical ways. First, the identification of just seven campuses (described earlier) was intentional as a way of testing an Early Start implementation model that was perceived to have been largely responsive to the policy intent of EO 1110. Many of these campuses had offered baccalaureate-level math courses during the summer 2018 term and so potentially had additional time to experiment with course design for summer 2019. These campuses may also have been better situated than some to offer in-person Early Start courses because of the geographic proximity of their students.

Second, the relationship between the summer Early Start experience and fall 2019 outcomes was built analytically on a self-selected subsample of students. These students chose to participate in Early Start in response to the recommendation for Category III students and the mandate for Category IV students to attend the program. The bias resulting from this self-

selection cannot be quantified but is worth further investigation at the campus level. Which students, for what reasons, on each campus are inclined to take up the offer to participate in Early Start in the summer before their first semester? How are those students' experiences correlated with math preparation at the end of high school? Moving forward, such selection biases create opportunities to reach further into the campus-specific and student-specific characteristics as policy and programming discussions continue around Early Start investments.

The abrupt move to remote learning in March of 2020 and the continuation of this mode throughout the 2020/21 academic year may make it difficult to fully determine the long-term impacts of Early Start in 2019. Individual campuses, however, may be able to determine the extent to which the components of their Early Start offerings are sufficient for providing more than an initial acceleration toward completing the B4 requirement. It will be important to examine the extent to which campus faculty as well as those who work with student success efforts assess the success of Early Start efforts that are focused primarily on providing students the opportunity to obtain baccalaureate credit (including the opportunity to fully complete the B4 requirement, in some cases) before enrolling in the fall semester. Although some campuses may have approached Early Start as a more comprehensive program that includes supports to help acclimate students to the campus and to provide additional counseling and guidance related to student success, EO 1110 does not require campuses to include such additional nonacademic supports.

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# Appendix A: Methodology

## Population of Study

The findings in this report are based on WestEd researchers' analysis of data on course enrollment provided by the California State University (CSU) Chancellor's Office for the cohort of first-time students entering the CSU system in the fall 2019 term. A total of 24,616 students entered the CSU system as first-year students in fall 2019 across the seven campuses selected in collaboration with the Chancellor's Office to be the focus of this study because of their robust implementation of Early Start math courses. The seven campuses included in this study all had at least 100 students enrolled in Early Start math, and all offered baccalaureate-level courses.

The analysis included in this report focuses on 7,367 students placed in Categories III and IV in Mathematics/Quantitative Reasoning (QR) at the beginning of summer 2019. To focus the analysis on the impact of taking Early Start courses, the findings were next limited to students who took Early Start in summer 2019 at the same campus where they then enrolled in fall 2019 and to non–Early Start students. After further restricting to students with non-missing grade point average (GPA) data, the study reports on 7,000 students, including 2,559 Early Start participants.

## Key Definitions

### Math Early Start participation

Math Early Start participation was defined as taking an Early Start math class at one of the seven sample campuses and enrolling in fall at the same campus.

### Summer placement

Summer placement information was provided by the CSU Chancellor's Office for all students enrolling at six of the seven sample campuses in fall 2019. For one campus, summer placement was not available at the time of this study and instead was estimated based on a combination of overall GPA, high school math GPA, and SAT/ACT information. In addition, for 163 Early Start participants, summer placement was missing. It was imputed from their fall placement value (63 students in Category III and 100 students in Category IV).

## Race/ethnicity

This study used the IPEDS Race/Ethnicity reporting categories. CSU uses a slightly different method to report race/ethnicity, in which any students who are non-U.S. citizens with an “F,” “J,” or “other” visa, or who are non-U.S. citizens with no visa or have undetermined status, are put into their own category as International Students/Non-Resident Alien Students.

## Declared major

The declared major category reported in this analysis was derived based on the Concentration Grouping provided by the CSU Chancellor’s Office. An indicator, STEM/Not STEM, was included in the matching that regrouped Health-related STEM concentration and STEM majors versus all other concentrations (Business, Not STEM, and Undeclared).

## Matching Analysis

This study employed a matching analysis using the Mahalanobis distance metric (see, for instance, Rosenbaum & Rubin, 1983; Imbens, 2015).

## Matching process

The process entailed analytically matching Early Start participants with similar students who did not take Early Start classes in summer 2019 based on the Mahalanobis distance metric, which is defined as the distance  $D_{ij}$  between two values of the covariate vector  $x_i$  and  $x_j$ :

$$D_{ij} = (x_i - x_j)' \Sigma^{-1} (x_i - x_j)$$

where  $\Sigma$  is the sample covariance matrix of the covariates. The matching was conducted in SAS® statistical software (SAS/STAT® 14.2), using the PROC PSMATCH. The following variables were used to compute the Mahalanobis distance metric between students: campus of enrollment, QR placement (summer), overall high school GPA, high school math GPA, major of admission (STEM/Not STEM), age, gender, and race/ethnicity (IPEDS). Students were only matched within the same campus.

In the matching analysis, each Early Start student was matched to the most similar non–Early Start student (“nearest neighbor”) such that the matching was conducted “one-to-one.” The matching procedure only matched Early Start students to similar non–Early Start students. Thus, the resulting estimate is the average treatment effect for the treated subjects (Steiner & Cook, 2013). Matching was conducted “with replacement” such that each non–Early Start student could be a match to multiple Early Start students if that non–Early Start student was similar to multiple Early Start students. For analysis, each Early Start student received a weight of 1, and each matched non–Early Start student received a weight that was proportional to the number of times the student was selected as a match. The total sample sizes of each group

(Early Start and non–Early Start) were equivalent after the weights were applied (2,559 Early Start students and 2,559 non–Early Start students).

### Baseline balance testing

Baseline balance testing is necessary to determine whether the samples of Early Start students and non–Early Start students included in the analysis are similar. This testing is conducted on the final analytic sample after the matching has been performed using weighted frequencies. Baseline distributions of gender, QR placement, race/ethnicity, overall high school GPA, and high school math GPA were compared between the two groups. Weighted standardized differences between treated and untreated subjects are reported in Table A1. A standardized difference of 0.1 or more typically denotes a notable imbalance in the baseline covariate — that is, a difference between the treated and untreated subjects in the matched sample (Austin, 2009). Table A1 shows the standardized mean differences on weighted matched observations with respect to QR placement, gender, age, race/ethnicity, high school GPA, and high school math GPA; all values are largely less than 0.1, indicating negligible difference between the two groups of students.

**Table A1. Standardized mean difference on weighted matched observations**

| Standardized Mean Difference on Weighted Matched Observations |        |
|---|--------|
| Placement in Category IV                                      | 0.016  |
| Female  | -0.008 |
| Age   | 0.034  |
| White   | 0      |
| Black/African American  | 0      |
| Asian   | 0      |
| Overall High School Grade Point Average                       | 0.039  |
| High School Math Grade Point Average                          | 0.008  |
| STEM Concentration  | 0.010  |
| Campus  | 0      |

Note: Standardized mean differences computed for 2,559 Early Start participants and 2,559 weighted matched non–Early Start participants.

### Outcome analysis after matching

After each Early Start student was matched to the most similar non–Early Start student, all of the matched students were included in a logistic regression model that included the same variables as covariates that were used in the matching process. This process was done to make the evaluation more robust in that the matching and the regression protects against

misspecification in either model (Imbens & Wooldridge, 2009). Previous studies have suggested that matching on a set of baseline data that are strongly predictive of the outcome measure and then using regression methods on the matched sample can succeed in replicating experimental impacts in certain contexts (Cook et al., 2008).

The regression model was of the following form:

$$\Pr(\text{reenrollment}_i = 1) = \text{logit}^{-1}(\beta_0 + \beta_1 * \text{Demographics}_i + \beta_2 * \text{EarlyStart}_i + \epsilon)$$

where the subscript refers to student  $i$ ,  $\text{Demographics}_i$  represents the same vector of student characteristics used for matching (campus of enrollment, QR placement, overall high school GPA, high school math GPA, major of admission, age, gender, and race/ethnicity),  $\text{EarlyStart}_i$  represents each student participation in the program,  $\epsilon$  represents the error term, and the coefficients  $\beta$  are estimated from the data. The function  $\text{logit}^{-1}(z) = e^z / (1 + e^z)$  transforms continuous values to the range (0,1) and is used because the dependent variable for reenrollment is binary.

In addition, because non–Early Start students could be included multiple times in the regression analysis, cluster-robust standard errors (Huber, 1967) were used in order to allow for intragroup correlation at the individual level. The use of robust standard errors when conducting a regression after matching with replacement is suggested by Hill and Reiter (2006, p. 2234). Table A2 displays the results from the logistic regression analysis that includes the matched Early Start and non–Early Start students.

The estimate for the Early Start enrollment variable in Table A2 represents the impact estimate for the Early Start participation. Non–Early Start is the reference category and the estimate (0.369) for Early Start students is positive and statistically significant at the 1 percent level. In other words, compared to not taking Early Start courses, enrolling in Early Start was found to have a positive impact on student reenrollment in spring 2020, and this impact was unlikely to have happened by chance.

The estimated effect size of the Early Start participation is provided by the Odds Ratio for Early Start program participation. An odds ratio (OR) is a measure of association between an exposure and an outcome. The OR represents the odds that an outcome (reenroll in spring 2020) will occur given a particular exposure (Early Start), compared to the odds of the outcome occurring in the absence of that exposure (non–Early Start).  $OR=1.44 [1.11, 1.89]$ . The estimated odds ratio of 1.44 means that the probability of reenrolling was 1.44 higher for Early Start participants compared to nonparticipants.

**Table A2. Logistic regression analysis showing the impact of Early Start participation on reenrollment in spring 2020, 2019 cohort**

| Parameter                                   |                              | Estimate |     | Robust Standard Error |
|---|------------------------------|----------|-----|-----------------------|
| <b>Intercept</b>                            |                              | 4.876    | **  | 2.1287                |
| <b>Early Start Participation</b>            | Early Start                  | 0.369    | *** | 0.1356                |
|   | Non–Early Start <sup>†</sup> | 0.000    |     | 0                     |
| <b>Placement</b>                            | Category IV                  | -0.001   |     | 0.1778                |
| <b>Campus</b>                               | Campus B                     | 0.019    |     | 0.2352                |
|   | Campus G                     | 1.117    | **  | 0.5063                |
|   | Campus C                     | 0.812    | *** | 0.2806                |
|   | Campus A                     | 0.623    | **  | 0.2769                |
|   | Campus E                     | 0.782    | **  | 0.3139                |
|   | Campus D                     | -0.480   |     | 0.3079                |
|   | Campus F                     | 0.000    |     | 0                     |
| <b>Gender</b>                               | Female                       | 0.177    |     | 0.1497                |
| <b>Age</b>                                  |                              | -0.303   | *** | 0.1033                |
| <b>Race/Ethnicity</b>                       | Asian                        | 0.491    |     | 0.5304                |
|   | Black/African American       | -0.571   |     | 0.5203                |
|   | Hispanic/Latino              | -0.312   |     | 0.4334                |
|   | Other/Multiple/Unknown       | -0.150   |     | 0.4971                |
|   | White <sup>†</sup>           | 0.000    |     | 0                     |
| <b>High School Grade Point Average</b>      |                              | 0.011    | *** | 0.0034                |
| <b>Math High School Grade Point Average</b> |                              | -0.003   | *   | 0.0018                |
| <b>Major of Admission</b>                   | STEM Concentration           | -0.034   |     | 0.1750                |

Note: \* denotes statistical significance at the 10 percent level; \*\* denotes statistical significance at the 5 percent level; \*\*\* denotes statistical significance at the 1 percent level. † indicates the reference category. Weighted number of observations: 5,118. Robust standard errors calculated using SAS/STAT® PROC GENMOD.

# Appendix B: Data Tables

**Table B1. Distribution of QR placement at the beginning of summer 2019 (admission), first-year entering students in fall 2019**

| Placement category | Number of students | Percent     |
|--------------------|--------------------|-------------|
| Category I         | 2,876              | 12%         |
| Category II        | 14,373             | 58%         |
| Category III       | 3,844              | 16%         |
| Category IV        | 3,523              | 14%         |
| <b>Total</b>       | <b>24,616</b>      | <b>100%</b> |

Note: The numbers presented in Table B1 are shown in Figure 1 in the main report. The numbers in the main report represent 30 percent of students who were placed in Category III or IV.

**Table B2. Number and percentage of students in QR Categories III and IV, by gender**

| Gender       | Number of students | Percent     |
|--------------|--------------------|-------------|
| Female       | 4,530              | 62%         |
| Male         | 2,827              | 38%         |
| Other        | 10                 | 0%          |
| <b>Total</b> | <b>7,367</b>       | <b>100%</b> |

Note: The numbers and percentages shown in Table B2 are presented in Box 2 in the main report. The numbers represent the total number of students in QR Categories III and IV from the 2019 cohort. Category "Other" refers to students who had neither male nor female as their reported gender.

**Table B3. Number and percentage of students in QR Categories III and IV, by race/ethnicity**

| Race/Ethnicity         | Number of students | Percent     |
|------------------------|--------------------|-------------|
| Hispanic/Latino        | 5,619              | 76%         |
| Asian                  | 548                | 7%          |
| Black/African American | 482                | 7%          |
| White                  | 367                | 5%          |
| Other/Multiple/Unknown | 351                | 5%          |
| <b>Total</b>           | <b>7,367</b>       | <b>100%</b> |

Note: Asian, Black/African American, White, and Other represent Non-Hispanic students. The numbers presented in Table B3 are shown in Box 2 in the main report.

**Table B4. Number and percentage of students in QR Categories III and IV, by declared major**

| Declared major                      | Number of students | Percent     |
|-------------------------------------|--------------------|-------------|
| Not STEM                            | 3,408              | 46%         |
| STEM (excludes health-related STEM) | 1,754              | 24%         |
| Undeclared                          | 1,039              | 14%         |
| Business                            | 947                | 13%         |
| Health-related STEM                 | 219                | 3%          |
| <b>Total</b>                        | <b>7,367</b>       | <b>100%</b> |

Note: The numbers presented in Table B4 are shown in Box 2 in the main report.

**Table B5. Early Start participation by summer QR placement distribution for students in QR Categories III and IV**

| Early Start versus non Early Start | Early Start  | Non Early Start | Non Early Start | Non Early Start | Total        | Total       |
|------------------------------------|--------------|-----------------|-----------------|-----------------|--------------|-------------|
| Placement category                 | N            | %               | N               | %               | N            | %           |
| Category III                       | 838          | 22%             | 3,006           | 78%             | 3,844        | 100%        |
| Category IV                        | 2,003        | 57%             | 1,520           | 43%             | 3,523        | 100%        |
| <b>Total</b>                       | <b>2,841</b> | <b>39%</b>      | <b>4,526</b>    | <b>61%</b>      | <b>7,367</b> | <b>100%</b> |

Note: The numbers and percentages from Table B5 are represented in Figure 2 in the main report. N represents number of students and % percentage.

**Table B6. Early Start participation by summer QR placement for students in Categories III and IV, by gender**

| Early Start versus non Early Start | Early Start  | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|------------------------------------|--------------|-------------|-----------------|-----------------|--------------|-------------|
| Gender                             | N            | %           | N               | %               | N            | %           |
| Female                             | 1,670        | 37%         | 2,860           | 63%             | 4,530        | 100%        |
| Male                               | 1,164        | 41%         | 1,663           | 59%             | 2,827        | 100%        |
| Other                              | 7            | 70%         | 3               | 30%             | 10           | 100%        |
| <b>Total</b>                       | <b>2,841</b> | <b>39%</b>  | <b>4,526</b>    | <b>61%</b>      | <b>7,367</b> | <b>100%</b> |

Note: The numbers presented in Table B6 are shown in Figure 3 in the main report. The table shows all students assigned to QR Categories III and IV, by gender. N represents number of students and % percentage.

**Table B7. Early Start participation by summer QR placement for students in Categories III and IV, by race/ethnicity**

| Early Start versus non Early Start | Early Start  | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|------------------------------------|--------------|-------------|-----------------|-----------------|--------------|-------------|
| Race/Ethnicity                     | N            | %           | N               | %               | N            | %           |
| Hispanic/Latino                    | 2,370        | 42%         | 3,249           | 58%             | 5,619        | 100%        |
| Asian                              | 132          | 24%         | 416             | 76%             | 548          | 100%        |
| Black/African American             | 145          | 30%         | 337             | 70%             | 482          | 100%        |
| White                              | 78           | 21%         | 289             | 79%             | 367          | 100%        |
| Other/Multiple/Unknown             | 116          | 33%         | 235             | 67%             | 351          | 100%        |
| <b>Total</b>                       | <b>2,841</b> | <b>39%</b>  | <b>4,526</b>    | <b>61%</b>      | <b>7,367</b> | <b>100%</b> |

Note: Table B7 shows all students in QR Category III or IV as of the beginning of summer 2019. Numbers presented here can be found in Figure 4 in the main report. N represents number of students and % percentage.

**Table B7.1. Early Start participation for students in summer QR Category III, by race/ethnicity**

| QR Category III        | Early Start | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|------------------------|-------------|-------------|-----------------|-----------------|--------------|-------------|
| Race/Ethnicity         | N           | %           | N               | %               | N            | %           |
| Hispanic/Latino        | 721         | 25%         | 2,209           | 75%             | 2,930        | 100%        |
| Asian                  | 25          | 9%          | 252             | 91%             | 277          | 100%        |
| Black/African American | 34          | 14%         | 205             | 86%             | 239          | 100%        |
| White                  | 19          | 9%          | 185             | 91%             | 204          | 100%        |
| Other/Multiple/Unknown | 39          | 20%         | 155             | 80%             | 194          | 100%        |
| <b>Total</b>           | <b>838</b>  | <b>22%</b>  | <b>3,006</b>    | <b>78%</b>      | <b>3,844</b> | <b>100%</b> |

Note: Table B7.1 shows all students in QR Category III as of the beginning of summer 2019. N represents number of students and % percentage.

**Table B7.2. Early Start participation for students in summer QR Category IV, by race/ethnicity**

| QR Category IV         | Early Start | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|------------------------|-------------|-------------|-----------------|-----------------|--------------|-------------|
| Race/Ethnicity         | N           | %           | N               | %               | N            | %           |
| Hispanic/Latino        | 1,649       | 61%         | 1,040           | 39%             | 2,689        | 100%        |
| Asian                  | 107         | 39%         | 164             | 61%             | 271          | 100%        |
| Black/African American | 111         | 46%         | 132             | 54%             | 243          | 100%        |
| White                  | 59          | 36%         | 104             | 64%             | 163          | 100%        |
| Other/Multiple/Unknown | 77          | 49%         | 80              | 51%             | 157          | 100%        |
| <b>Total</b>           | <b>2003</b> | <b>57%</b>  | <b>1,520</b>    | <b>43%</b>      | <b>3,523</b> | <b>100%</b> |

Note: Table B7.2 shows all students in QR Category IV as of the beginning of summer 2019. N represents number of students and % percentage.

**Table B8. Early Start participation by summer QR placement for students in Categories III and IV, by declared major**

| Early Start versus non Early Start  | Early Start  | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|-------------------------------------|--------------|-------------|-----------------|-----------------|--------------|-------------|
| Declared major                      | N            | %           | N               | %               | N            | %           |
| Not STEM                            | 1,231        | 36%         | 2,177           | 64%             | 3,408        | 100%        |
| STEM (excludes health-related STEM) | 833          | 47%         | 921             | 53%             | 1,754        | 100%        |
| Undeclared                          | 395          | 38%         | 644             | 62%             | 1,039        | 100%        |
| Business                            | 307          | 32%         | 640             | 68%             | 947          | 100%        |
| Health-related STEM                 | 75           | 34%         | 144             | 66%             | 219          | 100%        |
| <b>Total</b>                        | <b>2,841</b> | <b>39%</b>  | <b>4,526</b>    | <b>61%</b>      | <b>7,367</b> | <b>100%</b> |

Note: The numbers presented in Table B8 are shown in Figure 5 in the main report. The table shows all students assigned to QR Category III or IV, by declared major. N represents number of students and % percentage.

**Table B8.1. Early Start participation for students in summer QR Category III, by declared major**

| QR Category III                     | Early Start | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|-------------------------------------|-------------|-------------|-----------------|-----------------|--------------|-------------|
|                                     | N           | %           | N               | %               | N            | %           |
| Not STEM                            | 495         | 23%         | 1,660           | 77%             | 2,155        | 100%        |
| STEM (excludes health-related STEM) | 72          | 17%         | 350             | 83%             | 422          | 100%        |
| Undeclared                          | 159         | 24%         | 501             | 76%             | 660          | 100%        |
| Business                            | 97          | 20%         | 397             | 80%             | 494          | 100%        |
| Health-related STEM                 | 15          | 13%         | 98              | 87%             | 113          | 100%        |
| <b>Total</b>                        | <b>838</b>  | <b>22%</b>  | <b>3,006</b>    | <b>78%</b>      | <b>3,844</b> | <b>100%</b> |

Note: Table B8.1 shows all students assigned to QR Category III, by declared major. N represents number of students and % percentage.

**Table B8.2. Early Start participation for students in summer QR Category IV, by declared major**

| QR Category IV                      | Early Start  | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|-------------------------------------|--------------|-------------|-----------------|-----------------|--------------|-------------|
| Declared major                      | N            | %           | N               | %               | N            | %           |
| Not STEM                            | 736          | 59%         | 517             | 41%             | 1,253        | 100%        |
| STEM (excludes health-related STEM) | 761          | 57%         | 571             | 43%             | 1,332        | 100%        |
| Undeclared                          | 236          | 62%         | 143             | 38%             | 379          | 100%        |
| Business                            | 210          | 46%         | 243             | 54%             | 453          | 100%        |
| Health-related STEM                 | 60           | 57%         | 46              | 43%             | 106          | 100%        |
| <b>Total</b>                        | <b>2,003</b> | <b>57%</b>  | <b>1,520</b>    | <b>43%</b>      | <b>3,523</b> | <b>100%</b> |

Note: Table B8.2 shows all students assigned to QR Category IV, by declared major. N represents number of students and % percentage.

**Table B9. Early Start participation, by campus, for students in QR Categories III and IV**

| Early Start versus non Early Start | Early Start  | Early Start | Non Early Start | Non Early Start | Total        | Total       |
|------------------------------------|--------------|-------------|-----------------|-----------------|--------------|-------------|
| Campus                             | N            | %           | N               | %               | N            | %           |
| Campus A                           | 400          | 23%         | 1,346           | 77%             | 1,746        | 100%        |
| Campus B                           | 838          | 55%         | 678             | 45%             | 1,516        | 100%        |
| Campus C                           | 656          | 49%         | 670             | 51%             | 1,326        | 100%        |
| Campus D                           | 193          | 24%         | 609             | 76%             | 802          | 100%        |
| Campus E                           | 214          | 28%         | 542             | 72%             | 756          | 100%        |
| Campus F                           | 378          | 52%         | 345             | 48%             | 723          | 100%        |
| Campus G                           | 162          | 33%         | 336             | 67%             | 498          | 100%        |
| <b>Total</b>                       | <b>2,841</b> | <b>39%</b>  | <b>4,526</b>    | <b>61%</b>      | <b>7,367</b> | <b>100%</b> |

Note: Table B9 shows all students in QR Categories III and IV as of the beginning of summer 2019, by campus. Numbers presented here can be found in Figure 6 in the main report. N represents number of students and % percentage.

**Table B10. Percentage of students who took Early Start classes at the same campus as their campus of enrollment in fall 2019, by campus, for Early Start participants in QR Categories III and IV**

| Enrollment Fall 2019 | Same Campus  |            | Different Campus |            | Total        |             |
|----------------------|--------------|------------|------------------|------------|--------------|-------------|
| Campus               | N            | %          | N                | %          | N            | %           |
| Campus A             | 314          | 79%        | 86               | 22%        | 400          | 100%        |
| Campus B             | 836          | 100%       | 2                | 0%         | 838          | 100%        |
| Campus C             | 640          | 98%        | 16               | 2%         | 656          | 100%        |
| Campus D             | 117          | 61%        | 76               | 39%        | 193          | 100%        |
| Campus E             | 179          | 84%        | 35               | 16%        | 214          | 100%        |
| Campus F             | 321          | 85%        | 57               | 15%        | 378          | 100%        |
| Campus G             | 153          | 94%        | 9                | 6%         | 162          | 100%        |
| <b>Total</b>         | <b>2,560</b> | <b>90%</b> | <b>281</b>       | <b>10%</b> | <b>2,841</b> | <b>100%</b> |

Note: Table B10 shows all students who participated in Early Start and were in QR Category III or IV as of the beginning of summer 2019, by campus. Numbers presented here can be found in Figure 7 in the main report. N represents number of students and % percentage.

**Table B11. Completion of a math course of three or more units by the end of summer 2019, by QR Category III or IV**

| 3+ units math class       | Not attempted | Not attempted | Attempted not passed | Attempted not passed | Earned       | Earned     | Total        | Total       |
|---------------------------|---------------|---------------|----------------------|----------------------|--------------|------------|--------------|-------------|
| Placement – participation | N             | %             | N                    | %                    | N            | %          | N            | %           |
| Category III – ES         | 15            | 2%            | 97                   | 12%                  | 675          | 86%        | 787          | 100%        |
| Category III – Non-ES     | 2,991         | 100%          | 0                    | 0%                   | 0            | 0%         | 2,991        | 100%        |
| Category IV – ES          | 192           | 11%           | 337                  | 19%                  | 1,243        | 70%        | 1,772        | 100%        |
| Category IV – non-ES      | 1,450         | 100%          | 0                    | 0%                   | 0            | 0%         | 1,450        | 100%        |
| <b>Total</b>              | <b>4,648</b>  | <b>66%</b>    | <b>434</b>           | <b>6%</b>            | <b>1,918</b> | <b>27%</b> | <b>7,000</b> | <b>100%</b> |

Note: The numbers presented in Table B11 are shown in Figure 8 in the main report. The table shows all students assigned to QR Categories III and IV. N represents number of students and % percentage.

**Table B12. Completion of a math course of three or more units by the end of fall 2019, by QR Category III or IV**

| 3+ units math class       | Not attempted | Not attempted | Attempted not passed | Attempted not passed | Earned       | Earned     | Total        | Total       |
|---------------------------|---------------|---------------|----------------------|----------------------|--------------|------------|--------------|-------------|
| Placement – participation | N             | %             | N                    | %                    | N            | %          | N            | %           |
| Category III – ES         | 1             | 0%            | 72                   | 9%                   | 714          | 91%        | 787          | 100%        |
| Category III – Non-ES     | 736           | 26%           | 640                  | 21%                  | 1,588        | 53%        | 2,991        | 100%        |
| Category IV – ES          | 23            | 1%            | 286                  | 16%                  | 1,463        | 83%        | 1,772        | 100%        |
| Category IV – non-ES      | 205           | 14%           | 471                  | 32%                  | 774          | 53%        | 1,450        | 100%        |
| <b>Total</b>              | <b>992</b>    | <b>14%</b>    | <b>1,469</b>         | <b>21%</b>           | <b>4,539</b> | <b>65%</b> | <b>7,000</b> | <b>100%</b> |

Note: The numbers presented in Table B12 are shown in Figure 9 in the main report. The table shows all students assigned to QR Categories III and IV. N represents number of students and % percentage.

**Table B13. Completion status of a B4 requirement by the end of summer 2019, by QR Category III or IV**

| B4 requirement            | Not attempted | Not attempted | Attempted not passed | Attempted not passed | Earned       | Earned     | Total        | Total       |
|---------------------------|---------------|---------------|----------------------|----------------------|--------------|------------|--------------|-------------|
| Placement – participation | N             | %             | N                    | %                    | N            | %          | N            | %           |
| Category III – ES         | 340           | 43%           | 39                   | 5%                   | 408          | 52%        | 787          | 100%        |
| Category III – non-ES     | 2,991         | 100%          | 0                    | 0%                   | 0            | 0%         | 2,991        | 100%        |
| Category IV – ES          | 1,077         | 61%           | 88                   | 5%                   | 607          | 34%        | 1,772        | 100%        |
| Category IV – non-ES      | 1,450         | 100%          | 0                    | 0%                   | 0            | 0%         | 1,450        | 100%        |
| <b>Total</b>              | <b>5,858</b>  | <b>84%</b>    | <b>127</b>           | <b>2%</b>            | <b>1,015</b> | <b>15%</b> | <b>7,000</b> | <b>100%</b> |

Note: The numbers presented in Table B13 are shown in Figure 10 in the main report. The table shows all students assigned to QR Categories III and IV. N represents number of students and % percentage.

**Table B14. Completion status of a B4 requirement by the end of fall 2019, by QR Category III or IV**

| B4 requirement            | Not attempted | Not attempted | Attempted not passed | Attempted not passed | Earned       | Earned     | Total        | Total       |
|---------------------------|---------------|---------------|----------------------|----------------------|--------------|------------|--------------|-------------|
| Placement – participation | N             | %             | N                    | %                    | N            | %          | N            | %           |
| Category III – ES         | 116           | 15%           | 86                   | 11%                  | 585          | 74%        | 787          | 100%        |
| Category III – non-ES     | 1,721         | 58%           | 388                  | 13%                  | 882          | 29%        | 2,991        | 100%        |
| Category IV – ES          | 386           | 22%           | 327                  | 18%                  | 1,059        | 60%        | 1,772        | 100%        |
| Category IV – non-ES      | 912           | 63%           | 175                  | 12%                  | 363          | 25%        | 1,450        | 100%        |
| <b>Total</b>              | <b>3,135</b>  | <b>45%</b>    | <b>976</b>           | <b>14%</b>           | <b>2,889</b> | <b>41%</b> | <b>7,000</b> | <b>100%</b> |

Note: The numbers presented in Table B14 are shown in Figure 11 in the main report. The table shows all students assigned to QR Categories III and IV. N represents number of students and % percentage.

**Table B15. Reenrollment in spring 2020, by QR Category III or IV**

| Retention                 | Reenrolled   | Reenrolled | Did not reenroll | Did not reenroll | Total        | Total       |
|---------------------------|--------------|------------|------------------|------------------|--------------|-------------|
| Placement – participation | N            | %          | N                | %                | N            | %           |
| Category III – ES         | 720          | 91%        | 67               | 9%               | 787          | 100%        |
| Category III – non-ES     | 2,743        | 92%        | 248              | 8%               | 2,991        | 100%        |
| Category IV – ES          | 1,615        | 91%        | 157              | 9%               | 1,772        | 100%        |
| Category IV – non-ES      | 1,267        | 87%        | 183              | 13%              | 1,450        | 100%        |
| <b>Total</b>              | <b>6,345</b> | <b>91%</b> | <b>655</b>       | <b>9%</b>        | <b>7,000</b> | <b>100%</b> |

Note: The numbers presented in Table B15 are shown in Figure 12 in the main report. The table shows all students assigned to QR Categories III and IV. N represents number of students and % percentage.