COLLEGE PROMISE PROJECT

DO PART-TIME STUDENTS BENEFIT FROM COLLEGE PROMISE PROGRAMS?

Evidence from Cerritos Complete

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INTRODUCTION

College Promise programs provide support for students to attend and complete college based on where they live or where they attend school.[1] The first College Promise program was established in the United States in 2005.[2] The growth of new programs was slow and steady until 2015 when several factors, including the proposal outlined in President Obama's State of the Union address to provide free community college tuition through a federal-state partnership,[3] resulted in a dramatic increase in new programs across the country.

There are currently 368 institution-, city-, and state-run programs[4] with a wide range of structures. While all College Promise programs provide some support intended to help students attend, persevere in, and complete college, a program's design influences the extent to which low-income students and students of color are being served.

Why This Study

There is a growing body of research on the relationship between participation in individual College Promise programs and college enrollment, persistence, and completion.[5] However, the variation in program design (including program eligibility requirements and benefits) limits the extent to which study findings are generalizable. Further, most studies analyze the outcomes of student participation in the whole program rather than specific program features within programs.

This study explored the relationship between one program feature, part-time student eligibility, on College Promise participant outcomes. In doing so, we investigated the relationship between part-time program participation and the likelihood of increasing enrollment to full time, and the interaction between level of enrollment and certificate and degree completion.

Full-time enrollment is a strong predictor of degree completion and transfer,[6] but requiring students to enroll on a full-time basis has equity implications. Sixty percent of community college students enroll part time and these students are disproportionately low-income, first-generation, and underrepresented in higher education.[7] There is evidence that full-time enrollment requirements in College Promise programs

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[1] Rauner, M., Perna, L., & Kanter, M. (2018). California College Promise: Program characteristics and perceptions from the field. WestEd. https://www.wested.org/resources/california-college-promise-program-characteristics-and-perceptions/

[2] The first College Promise program in the current movement was the Kalamazoo Promise, a community-based program in Kalamazoo, Michigan. Miller-Adams, M. (2021). *The Path to Free College: In Pursuit of Access, Equity, and Prosperity*. Cambridge: Harvard Education Press.

[3] The White House. (2015). Remarks by the President in State of the Union address | January 20, 2015. https://www.whitehouse.gov/the-press-office/2015/01/20/remarks-president-state-union-address-january-20-2015

[4] College Promise. https://www.collegepromise.org/

[5] Miller and Weiss, 2020; Li and Gandara, 2020; Bartik, 2019. Swanson and Ritter, 2018; Daughterty and Gonzalez, 2016; Page, 2018; Carruthers & Fox, 2016; Gurantz, 2020; Bifulco et al., 2019; Harris et al. 2018; Harris and Mills 2021.

[6] Park, T. J. (2015). The impact of full-time enrollment in the first semester on community college transfer rates: New evidence from Texas with pre-college determinants. *Teachers College Record, 117*(12), n12.

[7] Hubbard, C., Rolfes, M., Hussak, L., Richards, R., & Hinnenkamp, K. (2018). Reframing the question of equity: Understanding the growing importance of success for community colleges' part-time students. EAB Global, Inc. https://www.eab.com/-/media/EAB/Technology/Student-SuccessNavigate/36143-AA/ASCC-Whitepaper.pdf, Fisher, S. B. (2016). The California Community Colleges Board of Governors Fee Waiver: A Comparison of State Aid Programs. California Community Colleges Chancellor's Office. http://californiacommunitycolleges.cccco.edu/Portals/0/Reports/2016-CCCCO-BOG-FeeWaiver-Reportfinal.pdf

are a barrier to participation, especially for low-income students.[8] For example, requiring high levels of credit was the primary reason that students were rejected from the state of New York's Excelsior Scholarship program, which launched in 2018 and only served 3.2 percent of all undergraduates statewide.[9]

In addition to improving equity, including part-time students may, in fact, benefit overall institutional outcomes. A national survey of 1,500 institutions and 35,500 students found that a larger share (20 percent) of first-time enrollees attending two-year public colleges who worked part time had attained an associate degree within three years, compared with students who did not work at all during their first year (10 percent) and students who worked full time (9 percent).[10] With financial support and student services from College Promise programs, part-time students may have even better outcomes.

The College Promise Project at WestEd and Cerritos College in southern California collaborated to investigate the relationship between participation in Cerritos Complete Promise, a student success program at Cerritos College. We are not aware of any studies that explore the relationship between participation in College Promise and student outcomes for part-time students. This study begins to fill this gap by exploring the following research questions:

1. Are part-time students who participate in Cerritos Complete more likely than non-participants to enroll full time during at least one term?
2. Are Cerritos Complete participants significantly more likely to complete credentials than students who do not participate in the program? Do the outcomes differ for part-time students?

The findings will provide evidence for practitioners and policymakers to use in developing or revising their College Promise programs and policy at the local, state, and national levels. This paper is organized into six sections. The first section includes a brief outline of California state funding for College Promise that helps explain why most programs exclude part-time students. The second section provides an overview of the Cerritos Complete program, including the student eligibility requirements that make this particular College Promise program unique. The third section describes the data used to answer the study's research questions and how key measures in the study were operationalized by the evaluation team. The next section describes the findings of the descriptive analysis portion of the study. This section is followed by a section detailing the findings of the statistical analysis portion, including the results of the evaluation team's probability models predicting the completion outcomes. The final discussion section reviews the study's findings, while highlighting several implications for practice, research, and policy.

California Context

California community colleges did not charge tuition or fees until 1985 when a per-unit tuition fee was initiated, along with the California Board of Governors (BOG) Fee Waiver program for part-time and full-time students with family incomes below 150 percent of the national poverty level.[11] When College Promise programs emerged in the state, beginning in 2006, they used the fee waiver to cover tuition for eligible students and used philanthropic dollars and other funding streams to pay for tuition waivers for

[8] Jones, T., & Berger, H. (2018). A promise fulfilled: A framework for equitable free college programs. The Education Trust. https://s3-us-east-2.amazonaws.com/edtrustmain/wpcontent/uploads/2018/09/05155636/A-Promise-Fulfilled-A-Framework-for-Equitable-Free-CollegePrograms-9.6-18.pdf

[9] Hilliard, T. (2018, August). Excelsior Scholarship serving very few New York students. Center for an Urban Future. https://nycfuture.org/research/excelsior-scholarship

[10] Velez, E. D., & Horn, L. (2018). What high schoolers and their parents know about public 4-year tuition and fees in their state (NCES 2019-404). U.S. Department of Education. Washington, DC: National Center for Education Statistics. https://nces.ed.gov/pubs2019/2019404.pdf

[11] The Board of Governor's Fee Waiver (BOG Fee Waiver) was renamed the California College Promise Grant (CCPG) in 2017, but the program itself did not change.

the students who were not eligible, and for their program's academic and student support features.[12] In 2017 and 2019, when California College Promise legislation passed (Assembly Bills 19 and 2), the number of programs that were established increased dramatically from 42 in 2017 to 118 in 2019. Although the guidelines for using AB19 and AB2 funding were flexible,[13] if colleges decided to use it for fee waivers, they could only fund full-time students. Thus, programs that wanted to include part-time students who were not eligible for the low-income fee waiver needed to use other funds to pay for their tuition and fees, resulting in a disincentive to include part-time students in their programs.

Program Overview

Cerritos Complete was established in 2015 as an outgrowth of Cerritos College's K–16 Bridge program, which provided high-touch services to local high school students to complete matriculation requirements during their transition from high school to college. The following year, a scholarship was added to the program and it was renamed Cerritos Complete. This student success initiative at Cerritos College was designed to support students so they can reduce the time it takes to earn and complete their degrees or certificates.

The following sections describe the eligibility requirements and benefits for the students who joined Cerritos Complete in fall 2016 — the cohort included in this study. At that time, students were eligible if they graduated from the college's local partner high school districts in spring 2016. They were also required to complete the FAFSA or Dream Act application; complete a mandatory assessment[14]; participate in an on-campus, in-person orientation; attend a counseling class during the summer[15]; and submit an intent form and commitment contract. As part of the summer course, students were required to complete a two-semester education plan reviewed and approved by a Cerritos College counselor.[16] Notably, part-time students have been eligible to participate in Cerritos Complete from the beginning of the program, one of the few programs in California that does not limit participation to full-time enrollment status.

To continue with the program in the spring semester, students were required to enroll in and successfully complete English/ESL and math courses in the fall and enroll in both math and English/ESL during the spring semester. They also needed to maintain at least a 2.0 grade point average (GPA) and receive a C or better in both English/ESL and math. Finally, program participants were required to attend a Career and

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[12] For detailed information about the history of College Promise in California, see Rauner, M., & Lundquist, S. (2019). College Promise in California: Recommendations for Advancing Implementation, Impact, and Equity. San Francisco, CA: WestEd. https://californiacollegepromise.wested.org/wp-content/uploads/2019/11/California-College-Promise-Legislation-Brief-FINAL.pdf

[13] The guidelines for using funding from College Promise legislation (AB19 and AB2) is flexible and can pay for tuition, other financial support (books, transportation, childcare), or staff to support students, including program and counseling staff.

[14] In spring 2016, Cerritos College used the Accuplacer assessment, a series of tests developed by the College Board that evaluate students' skills in reading, writing, and math to help college administrators place them in courses that match their skills.

[15] Cerritos Complete students were required to attend a Summer Connections counseling class that introduced them to the history and mission of the system of higher education in California; student services offered at Cerritos College; relevant campus policies and procedures; and educational planning, including major and general education requirements and course sequencing. As part of the class, students were offered the opportunity to tour the Cerritos College campus to acquaint themselves with the campus in general and the location of offices where services are provided.

[16] In fall 2021, the eligibility requirements to participate and remain in Cerritos Complete were largely the same with three revisions and two additions. The first revision is that the Accuplacer assessment that was used in 2016 had been replaced with a "self-report tool" that was designed by Cerritos College and places students in transfer level math and English courses based on GPA and previously completed math courses using a tool developed by the RP Group, a nonprofit research and planning organization. The second revision is the replacement of the summer connections course, during which students completed an education plan, with a similar course, during which students complete a long-term education plan that includes the basic transfer requirements for the California State University and the University of California systems.

Educational Planning Workshop and meet with a counselor to receive their spring schedule and follow their education plan.[17]

All students in the program were eligible for a tuition waiver for one year. Low-income students who were eligible for the Board of Governor's Fee Waiver (BOG Fee Waiver) were also eligible for a $200 voucher each semester to pay for books at the campus bookstore.

In addition to the financial support provided through Cerritos Complete, participants received support from counselors and program staff when they applied to the program, matriculated to Cerritos College, and enrolled in coursework. From each participating high school, a "point counselor" worked closely with the Cerritos Complete program coordinator to support students during the application and matriculation process. To help them prepare for this role, the counselors attended four meetings to learn about the program and discuss strategies to help students apply to Cerritos Complete and matriculate to Cerritos College. The Cerritos Complete program coordinator also provided support to students when they began their coursework. The coordinator sent emails and made phone calls to remind students of important deadlines and direct students to resources. Students also benefitted from interactions with counselors when they participated in the summer counseling class and educational planning and career workshops, which they may not have experienced if these were not a program requirement.[18]

Data

Data for this analysis was provided to the College Promise Project team at WestEd by the Office of Institutional Effectiveness, Research, Planning, and Grants at Cerritos College. The analytic sample includes data for a single cohort of first-time Cerritos College students over a four-year period, from summer 2016 through summer 2020. The dataset included outcome, demographic, and academic information for 3,165 students: 514 students who participated in the Cerritos Complete program and 2,651 who did not participate in Cerritos Complete but shared similar demographic and academic characteristics. Demographic characteristics included gender, race/ethnicity, and age; academic characteristics included students' transfer plans, cumulative GPA, placement into transfer-level English/ESL and math, receipt of a fee waiver, and major area of study.

Predictors

Cerritos Complete Participation. The primary predictor in the study was a binary indicator of whether a student in the final, analytic sample was a Cerritos Complete participant.

Outcome Measures

In this study, the research team explored the relationship between participation in Cerritos Complete and four student outcomes: part-time to full-time enrollment, associate's degree of arts (AA) and associate's degree of science (AS) completion, associate degree for transfer (ADT) completion, and certificate completion.

Part-time to Full-time Enrollment. The part-time to full-time enrollment outcome was operationalized as a binary indicator of whether a student enrolled full-time during at least one term after initially

[17] Requirements to continue with the program for the second semester (and through the second year) also remained largely the same, with two changes. First, the requirement that students must enroll in math and English was revised to indicate that this is only required if the courses are necessary for the students' degree goal and that math and English enrollment must continue until the student passes transfer level coursework.

[18] In 2021, the program participants became eligible for tuition and fee waivers for two years; the program no longer provides vouchers for books. In addition, the program staff expanded to include a full-time Cerritos Complete Program Assistant who provides reminders and meets frequently with students. Additionally, six of seven participating districts co-funded (with Cerritos College) a site liaison who is embedded in high schools and supports students to complete all of the steps necessary to matriculate to Cerritos College. Other program changes include a mid-semester fall progress report to identify students who could benefit from targeted support; timely email messages reminding students about support opportunities and important deadlines; and a student requirement to participate in activities at the campus success center during their first year.

enrolling part-time. Students who met this condition had values equal to one, students who never enrolled full-time in a subsequent semester after first enrolling part-time had values equal to zero. Students enrolled full-time in their first semester were not included in this outcome measure.

Credential Completion. Each of the three completion measures were operationalized similarly, as binary indicators of whether a student earned an AA/AS, ADT, or certificate at some point within the time frame of the study.

Control Measures

To properly condition the estimated relationship between participation in Cerritos Complete and the outcomes on a number of potential confounding factors, the team included covariates in its empirical analyses. In addition to a binary indicator of sex/gender, a categorical measure of race/ethnicity, and continuous measures of age and cumulative GPA, several other covariates were included in the analysis and are described below.

Percentage of Full-time Enrollment. Because there were multiple observations for the same students across each academic term over four years, the research team was able to assess fluctuations in the number of units in which students enrolled. Changes in enrollment level were common in the data — roughly 33 percent of students in the sample fluctuated between part- and full-time enrollment at least once during the four years of the study and no students enrolled full-time exclusively. To fully capture the fluctuation, the research team created a "percent full-time" predictor by dividing the number of terms a student enrolled full-time by the total number of terms a student enrolled. For example, if a student enrolled in Cerritos College for six semesters within the study time frame and was enrolled full-time during two of those sessions, this student's full-time enrollment rate would be 0.33, or 33 percent (e.g., (2/6)*100). A student who never enrolled full-time would have a value equal to zero on this measure.

Fee Waiver Receipt. Whether or not a student received a California state-mandated fee waiver (BOG Fee Waiver) was used as a proxy for students from low-income families.

GPA. This measure is operationalized as the cumulative GPA for each student from summer 2016 to summer 2020.

College English. The research team included a binary measure of whether a student was placed into a transfer-level English course during their first term at Cerritos College. This measure was included because students placed into developmental English would likely require more time to earn credentials.

College Math. A binary indicator was also created to indicate whether or not a student was placed into a transfer-level math course when they initially enrolled at Cerritos College. This measure was included because students placed into developmental math would likely require more time to earn credentials.

STEM Major. Students majoring in STEM fields often require additional time to earn degrees or transfer.[19] Furthermore, degree completion rates among STEM students are lower, on average, than students pursuing non-STEM fields.[20] The research team created a binary indicator to control for the differences.[21]

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[19] The research team examined nationally representative community college student data from the Beginning Postsecondary Students Longitudinal Study of 2012 and found that, on average, STEM majors required three more months to transfer to a four-year post-secondary institution and six more months to earn a bachelor's degree compared to non-STEM majors. U.S. Department of Education, National Center for Education Statistics, 2011–12 Beginning Postsecondary Students Longitudinal Study of 2011 (BPS: 2011–17).

[20] Malcom, S., Feder, M. (2016). Barriers and opportunities for 2-year and 4-year STEM degrees: Systemic change to support students' diverse pathways. National Academy of Engineering; National Academies of Sciences, Engineering, and Medicine. https://www.ncbi.nlm.nih.gov/books/NBK368175/

[21] Chen, X. (2009). Students Who Study Science, Technology, Engineering, and Mathematics (STEM) in Postsecondary Education (NCES 2009-161). U.S. Department of Education. Washington, DC: National Center for Education.

Four-Year Transfer Goal. The research team examined students' self-reported academic goals in order to create a binary indicator of whether a student had aspirations to transfer to a four-year college. This was included as a control measure because we posited students' transfer aspirations would be correlated with the completion outcomes. For example, students who intended to transfer to a four-year institution would have been more likely to pursue AA/AS and ADT degrees than certificates.

Descriptive Exploration

Methods

The first stage of the evaluation was to explore the degree to which students in the Cerritos Complete and the comparison group were descriptively similar or dissimilar. The purpose of this exploration was to determine baseline, unconditional differences between Cerritos Complete students and the comparison group and to identify preliminary evidence of the relationship between Cerritos Complete participation and student outcomes.

Findings

Cerritos Complete students closely resembled comparison group students, with some exceptions.

Overall, the descriptive exploration showed that the differences on observable measures between Cerritos Complete participants and the comparison group were small, that is, less than 5 percentage points (see Table A1). There were, however, three control variables for which the averages of Cerritos Complete students were at least 5 percentage points higher than the comparison group students. A higher rate of Cerritos complete students were female (10 percentage points), were placed in transfer-level English courses during their first semester (27 percentage points), and reported their intention to transfer to a four-year institution to earn a bachelor's degree (9 percentage points).

The largest difference (27 percentage points) between Cerritos Complete students and the comparison group was placement into transfer-level English courses. Rather than indicating an inherent difference between Cerritos Complete and comparison group students, the difference may be partly explained by the Cerritos Complete onboarding process. Prior to the orientation, Cerritos Complete counselors analyzed student transcripts to identify whether students have taken an expository reading and writing course (ERWC) which will make them automatically eligible for transfer-level English. Most students who are not in Cerritos Complete enroll for the course they are assigned based on their placement test, even if they took an ERWC.

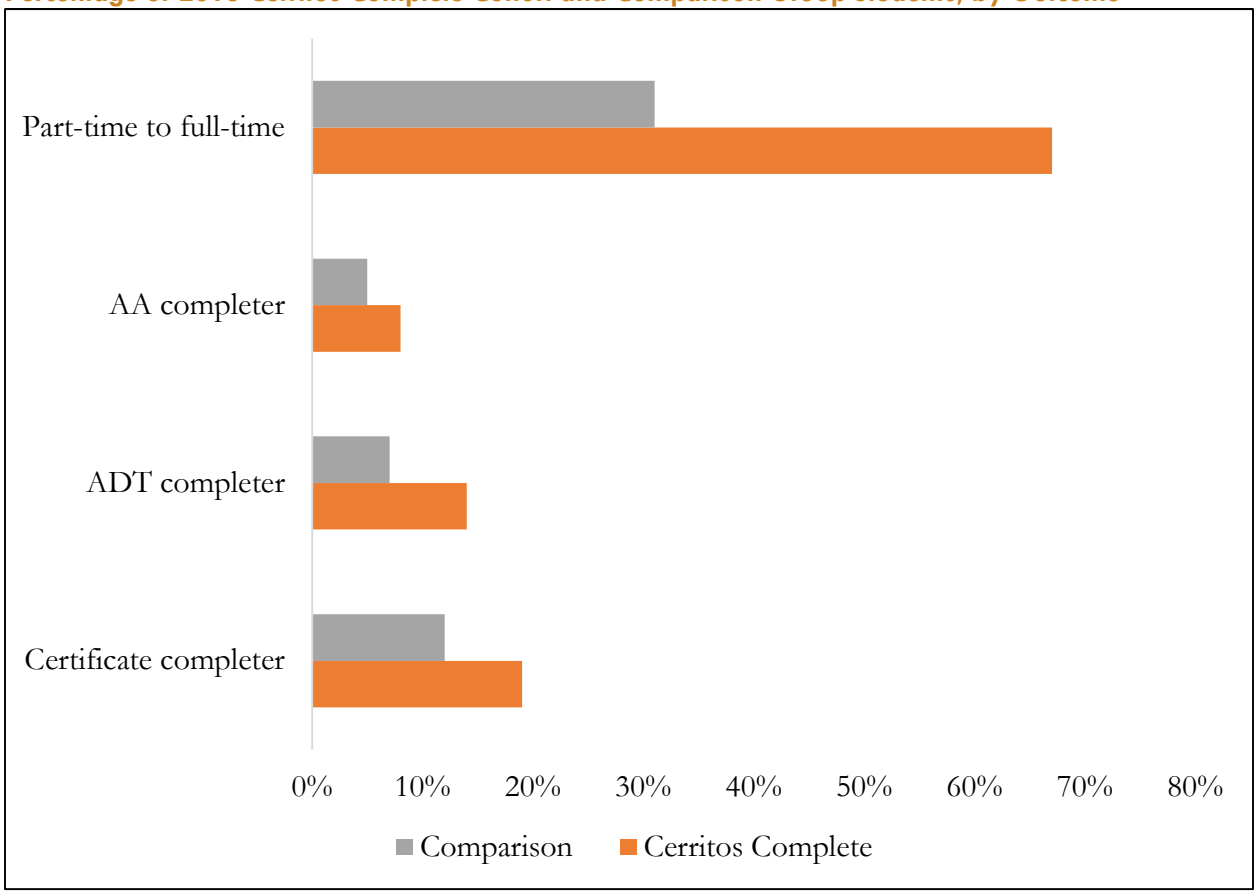
A higher percentage of part-time Cerritos Complete students than comparison group students enrolled full-time during at least one semester.

The evaluation team also compared the number of students in each group who initially enrolled part-time and increased their enrollment rate to full-time during at least one semester during the study period (see Figure 1; Table A1). Sixty-seven percent of part-time Cerritos Complete students increased their enrollment to full time while 31 percent of the comparison group did so — a difference of 36 percentage points.

A higher percentage of Cerritos Complete students earned certificates, AA/ASs, and ADTs than students who did not participate in Cerritos Complete.

The desriptive exploration also showed that a higher percentage of students who participated in Cerritos Complete completed degrees and certificates than the comparison group of students who did not participate in the program (see Figure 1; Table A1). Specifically, Cerritos Complete participants had higher completion rates of AA/AS degrees (3 percentage points), ADTs (7 percentage points), and certificates (9 percentage points).

Figure 1
Percentage of 2016 Cerritos Complete Cohort and Comparison Group Students, by Outcome



Note: This figure represents the evaluation team's analysis of data provided by the Office of Institutional Effectiveness, Research, Planning and Grants at Cerritos College.

Statistical Analyses

Methods

To effectively account for potential estimation bias stemming from the observed differences between the Cerritos Complete and non-Cerritos Complete samples uncovered in the initial descriptive analysis, as well as any additional unobserved differences between the groups, the research team used a quasi-experimental technique known as coarsened exact matching (CEM). This method approximates random assignment by restricting the analyses to "treated" and "control" group students in the sample who are statistically similar to each other on observable characteristics in the data (see Appendix for additional methodological details).

The first analyses assessed whether Cerritos Complete students had significantly different probabilities than the comparison group of moving from part-time to full-time enrollment for at least one term, after controlling for demographic and academic control measures. The control measures were sex/gender, race/ethnicity, age, cumulative GPA, fee waiver receipt, placement in transfer-level English, placement in transfer-level math, whether a student was a STEM major, and if the student aspired to transfer to a four-year institution.

The next analyses corresponded to the second set of research questions. The first set estimated the relationship between Cerritos Complete participation and AA/AS, ADT, and certificate completion while controlling for students' percentage of full-time enrollment, and demographic and academic factors.

The final set explored the interaction between Cerritos Complete participation and percentage of full-time enrollment in order to test whether the relationship between Cerritos Complete participation and the completion outcomes was moderated by (i.e., dependent on) students' percentage of full-time enrollment.

Findings

Part-time Cerritos Complete students were significantly more likely to enroll full-time for at least one term than part-time students who did not participate in Cerritos Complete.

Results from CEM-adjusted regression estimates showed that Cerritos Complete students who started as part-time students were roughly 21 percentage points more likely than the part-time comparison group students to subsequently enroll full-time for at least one term (see Table A2).

Students who participated in Cerritos Complete were significantly more likely to earn ADTs and Certificates than students in the comparison group.

Cerritos Complete students were more likely to earn ADTs than comparison group students. Specifically, the CEM-adjusted regression estimates showed that Cerritos Complete students were 5 percentage points more likely to earn an ADT. Similar CEM-adjusted regression estimates also indicated that Cerritos Complete students were 5 percentage points more likely to earn a certificate than students in the comparison group (see Table A3).

Although the descriptive analysis showed that a higher percentage of Cerritos Complete students were awarded an AA/AS degree, this difference was not found to be statistically significant after reducing between-group variation through CEM and conditioning the regression estimates on the covariates listed in Table A1.

Full-time enrollment was a significant predictor of AA/AS, ADT, and certificate completion for both groups.

Cerritos College students who had higher percentages of semesters with full-time enrollment were more likely to earn transfer an AA/AS, ADT, or certificate, regardless of whether they participated in Cerritos Complete.

The relationship between percentage of full-time enrollment and completion was stronger for Cerritos complete students than for the comparison group.

There was a significantly higher probability of completion for both Cerritos Complete and comparison group students when they had higher rates of full-time enrollment. Further, results showed that the relationship between full-time enrollment and ADT and certificate completion was significantly stronger for Cerritos Complete participants than that of the comparison group (see Table A5; Figures A1, A2).

Cerritos Complete students who enrolled part-time every semester (that is, never enrolled full-time) were not significantly more or less likely to complete an AA/AS degree, ADT degree, or certificate than comparison group students with the same enrollment patterns.

Discussion

This study sought to examine the relationship between participation in the 2016 Cerritos Complete cohort and degree completion, particularly for students who enroll on a part-time basis. Results showed that Cerritos Complete participants were significantly more likely than similar comparison group students to enroll full-time for at least one semester after initially enrolling on a part-time basis. Results also indicated that Cerritos Complete participants were significantly more likely than comparison group students to earn ADTs and certificates. A higher percentage of semesters in which students enroll full-time was associated with higher rates of completion for both Cerritos Complete and comparison group students, and this relationship was significantly stronger for Cerritos Complete students.

Participation in Cerritos Complete participation was positively associated with ADT and certificate completion but was not associated with AA/AS completion. This different may be partially explained by the Cerritos Complete program features that provided participants with more interactions with academic advisors and other student support staff than students who did not participate. Through these interactions, students may have been encouraged to pursue ADTs rather than AA/AS degrees. Another plausible explanation is that a higher percentage of Cerritos Complete students compared to the comparison group had ambitions to transfer, which in turn may have directed them toward ADTs, which are transfer-oriented degrees (see Table A1).

Though most College Promise programs restrict financial and other supports to full-time students, these findings suggest that related policies at the program, state, and federal levels may consider expanding program eligibility to part-time students. Part-time students are more likely to be low-income, first generation, and from racial/ethnic groups that have lower college attendance rates. Including part-time students will increase equitable access to college for these groups and provide them with the support that can increase their chances of persistence and completion, as suggested by the study's findings. Although expanding eligibility to part-time students will be more costly, the positive outcomes shown in this study may justify the additional investment.

Future analysis of Cerritos Complete could analyze the relative impact of Cerritos Complete on subgroups of students by, for example, gender and race/ethnicity. Analyses could also include other cohorts of program participants, which may show stronger results given the expansion of the program to cover two years of financial support and to include robust academic and student services support. Extending future analysis to examine the impacts of financial and advising supports similar to those offered by Cerritos Complete on longer term outcomes such as vertical transfer and bachelor's degree completion would also compliment the current study. Finally, findings from this study cannot be generalizable to programs beyond Cerritos Complete; therefore, similar analyses should be conducted with data from other College Promise programs that include part-time students.

Appendix

Development of Analytic Sample

Data provided by Cerritos College Office of Institutional Research, Planning, and Grants contained 42,207 distinct student-by-year-by-term observations. After performing necessary data transformations and calculations, the research team collapsed the data file to one student observation per row. This condensed the data file to 6,266 distinct student observations. To control for differences in age between Cerritos Complete and comparison group students, the sample was further limited to students who were greater than or equal to 17 and less than or equal to 20 years of age in 2016. This reduced the number of students in the analysis to 3,165. Among these observations were students for whom there were missing values on several key variables of interest. Specifically, there were 67 missing values for sex/gender, 375 missing values for the transfer/BA degree indicator, 769 missing values for the STEM major indicator, and 66 missing values for race/ethnicity. The research team used multiple imputation in order to restore missing observations, increase statistical power, and reduce potential bias stemming from listwise deletion. Successful multiple imputation led to a final analytic sample of 3,165 students — 514 of which were Cerritos Complete students and 2,651 of which were in the comparison group.

Coarsened Exact Matching

Under ideal circumstances, researchers are able to randomly assign study participants to treatment and control conditions. Because the process of random assignment ensures pretreatment characteristics of the particiants are evenly distributed across treatment and control groups, random assignment is considered the gold standard for estimating causal impact. In reality, however, researchers often must make do with secondary, observational data in which study participants are able to self-select in and out of treatment. Such self-selection can be problematic: without the ability to assign participants to treament condition, the condition itself becomes related with observed and unobserved treatment confounds. Researchers are unable to discern unbiased treatment impacts in the presence of such confounds.

Quasi-experimental methods of analysis help researchers address the bias that is introduced through self-selection and to arrive at plausibly causal estimates. One such method includes coarsened exact matching (CEM) which, like it's more familiar cousin, Propensity Score Matching, seeks to approximate random assignment by matching students on pre-treatment characteristics in the data. The ultimate goal of CEM and other matching methods is to eliminate any “covariate imbalances” or differences between treatment and control groups so that subsequent parametric analyses can be performed on study participants who are statistically indistinguishable except for treatment status. Existing research suggests CEM is a superior method for reducing covariate imbalance and unlike PSM which often results in substantial loss in sample size due to the “curse of dimensionality,” CEM maximizes sample size while allowing greater modeling flexibility.[22]

The process of CEM is straightforward. First, the researcher assesses the covariate imbalance in the data among treatment and control group participants. The researcher then seeks to reduce this imbalance by temporarily "coarsening” or reoperationalizing the pre-treatment covariates into meaningful groups or bins. This process of grouping pre-treatment covariates into bins (akin to creating a histogram) reduces the number of potential matching values for a given covariate which in turn increases the number of successful matches achieved. Participants who have at least one opposite exposure exact match in each of the coarsened pretreatment covariate are retained, while participants without a match are dropped. Researchers can then carry out their subsequent analyses on this matched sample. In this analysis, CEM led a non-imputated, matched sample of 1,560 students – 1,172 non-Cerritos Complete and 388 Cerritos Complete students.

Figures in Appendix Table A2 suggest that the researchers' CEM strategy was successful at mitigating observed differences in the pre-treatment covariates prior to regression modeling. Specifically, figures in panel A in Table A2 show the means and standard deviations for each of the covariates included in the CEM matching algorithm for the treated and control groups in the pre-matched sample. The means and standard deviations for both groups in the post-match sample are contained in panel B. Perfectly matched groups will have a standardized mean difference (SMD) of 0 and a variance ratio (VR) of 1 for any given covariate included in the matching algorithm. The evaluation team used an apriori threshold for 0.25 SMD and a threshold for VR between 2.00 and 0.50[23]. Using these thresholds, the evaluation found consistent evidence that the impact estimates of Cerritos Complete were derived from a strongly matched sample of comparison group and Cerritos Complete students.

[22] Ripollone, J. E., Huybrechts, K. F., Rothman, K. J., Ferguson, R. E., & Franklin, J. M. (2020). Evaluating the Utility of Coarsened Exact Matching for Pharmacoepidemiology Using Real and Simulated Claims Data. *American Journal of Epidemiology*, *189*(6), 613–622. https://doi.org/10.1093/aje/kwz268

[23] Rubin, D. B. (2001). Using Propensity Scores to Help Design Observational Studies: Application to the Tobacco Litigation. *Health Services and Outcomes Research Methodology*, *2*(3), 169–188. https://doi.org/10.1023/A:1020363010465

Table A1: Characteristics and Outcomes of Full Sample, Cerritos Complete and Non-Cerritos Complete Students

	Full Sample			Western Hills Complete			Non-Western Hills Complete	
Variable	Mean	SD		Mean	SD		Mean	SD
Outcomes								
Part-time to full-time	0.38	--		0.67	--		0.31	--
AA/AS Completion	0.05	--		0.08	--		0.05	--
ADT Completion	0.08	--		0.14	--		0.07	--
Certificate Completion	0.12	--		0.19	--		0.10	--
Controls								
Female	0.48	--		0.56	--		0.46	--
White	0.05	--		0.04	--		0.05	--
Black	0.07	--		0.04	--		0.07	--
Latinx	0.79	--		0.80	--		0.79	--
Asian	0.06	--		0.08	--		0.06	--
Other	0.04	--		0.04	--		0.03	--
Percent full-time	0.12	0.16		0.16	0.15		0.12	0.16
Planned to transfer/earn BA	0.82	--		0.90	--		0.81	--
First-term GPA	2.24	1.13		2.33	0.98		2.23	1.15
College-level English	0.26	--		0.49	--		0.22	--
Transfer-level Math	0.10	--		0.14	--		0.10	--
Fee waiver recipient	0.78	--		0.86	--		0.76	--
STEM major	0.14	--		0.17	--		0.13	--
Age at enrollment	18.30	0.74		18.02	0.33		18.36	0.78
n	1,796			387			1,409	

Note: Means and standard deviations computed on the non-imputed sample. Data Source: Office of Institutional Effectiveness, Research, Planning, and Grants at Cerritos College

Table A2: Covariate Imbalance, Standardized Differences and Variances for Cerritos Complete, and non-Cerritos Complete Students

a. Pre-Matched Sample										
	Cerritos Complete				Non-Cerritos Complete				Balance	
	Mean	Variance	Skewness		Mean	Variance	Skewness		Standardized Difference	Variance Ratio
Female	0.554	0.248	-0.217		0.476	0.250	0.097		0.157	0.993
White	0.039	0.038	4.748		0.045	0.043	4.391		0.029	0.879
Black	0.037	0.036	4.923		0.067	0.063	3.459		0.137	0.566
Latinx	0.801	0.160	-1.512		0.792	0.165	-1.437		0.024	0.967
Asian	0.081	0.075	3.074		0.066	0.062	3.498		0.057	1.209
Other	0.042	0.040	4.587		0.030	0.029	5.491		0.062	1.366
Planned to transfer/earn BA	0.904	0.087	-2.751		0.819	0.148	-1.656		0.250	0.584
First-term GPA	2.411	0.794	-0.650		2.412	0.845	-0.462		0.001	0.939
Transfer-level English	0.493	0.251	0.029		0.245	0.185	1.188		0.532	1.355
Transfer-level Math	0.152	0.129	1.939		0.114	0.101	2.429		0.112	1.278
Fee waiver recipient	0.863	0.119	-2.108		0.807	0.156	-1.552		0.152	0.760
STEM major	0.172	0.142	1.742		0.132	0.115	2.176		0.111	1.244
Age at enrollment	18.022	0.110	0.406		18.348	0.529	0.830		0.577	0.208
n	514				2,651					
b. Post-Matched Sample										
	Cerritos Complete				Non-Cerritos Complete				Balance	
	Mean	Variance	Skewness		Mean	Variance	Skewness		Standardized Difference	Variance Ratio
Female	0.558	0.247	-0.235		0.558	0.247	-0.235		0.000	1.002
White	0.006	0.006	12.649		0.006	0.006	12.649		0.000	1.002
Black	0.031	0.030	5.443		0.031	0.030	5.443		0.000	1.002
Latinx	0.914	0.079	-2.956		0.914	0.079	-2.956		0.000	1.002
Asian	0.034	0.033	5.164		0.034	0.033	5.164		0.000	1.002
Other	0.015	0.015	7.888		0.015	0.015	7.888		0.000	1.002
Planned to transfer/earn BA	0.923	0.071	-3.182		0.923	0.071	-3.182		0.000	1.002
First-term GPA	2.386	0.751	-0.687		2.371	0.762	-0.493		0.017	0.986
Transfer-level English	0.451	0.248	0.197		0.451	0.248	0.197		0.000	1.002
Transfer-level Math	0.083	0.076	3.027		0.083	0.076	3.027		0.000	1.002
Fee waiver recipient	0.896	0.094	-2.589		0.896	0.094	-2.589		0.000	1.002
STEM major	0.141	0.122	2.062		0.141	0.121	2.062		0.000	1.002
Age at enrollment	18.031	0.079	1.057		18.031	0.079	1.057		0.000	1.002
n	388				1,172					

Note: Standardized differences and variances computed on the non-imputed sample. Data Source: Office of Institutional Effectiveness, Research, Planning and Grants at Cerritos College

Table A3: Coarsened Exact Matching-weighted linear probability estimates of part-time to full-time enrollment

	Part-time to full-time
Cerritos Complete participant	0.21***
	(0.03)
Female	0.03
	(0.02)
Black	-0.07
	(0.08)
Latinx	0.05
	(0.07)
Asian	0.02
	(0.10)
Other	0.20
	(0.12)
Planned to transfer/earn BA	0.05
	(0.05)
First-term GPA	0.21***
	(0.01)
Transfer-level English	0.07**
	(0.03)
Transfer-level Math	0.06
	(0.05)
Fee waiver recipient	-0.01
	(0.04)
STEM major	-0.02
	(0.04)
Age at enrollment	-0.05*
	(0.02)
n	2,046

Note: Standard errors are in parentheses; missing values were estimated using multiple chained imputation, ***p<0.001, *p<0.05. Data Source: Office of Institutional Effectiveness, Research, Planning and Grants at Cerritos College

Table A4: Coarsened Exact Matching-weighted linear probability estimates of AA/AS, ADT, and Certificate Completion

	AA/AS Completion	ADT Completion	Certificate Completion
Cerritos Complete participant	0.02	0.05**	0.05**
	(0.02)	(0.02)	(0.02)
Percent full-time	0.30***	0.60***	0.82***
	(0.06)	(0.07)	(0.08)
Female	0.01	0.01	0.04*
	(0.01)	(0.01)	(0.02)
Black	0.02	-0.02	-0.03
	(0.04)	(0.04)	(0.05)
Latinx	0.01	0.02	0.02
	(0.03)	(0.04)	(0.04)
Asian	0.03	0.04	-0.01
	(0.06)	(0.07)	(0.08)
Other	0.03	0.01	-0.03
	(0.05)	(0.06)	(0.07)
Planned to transfer/earn BA	-0.01	0.02	-0.02
	(0.03)	(0.03)	(0.03)
First-term GPA	0.03***	0.04***	0.06***
	(0.01)	(0.01)	(0.01)
Transfer-level English	0.02	-0.02	-0.01
	(0.01)	(0.02)	(0.02)
Transfer-level Math	0.03	0.03	0.03
	(0.04)	(0.04)	(0.04)
Fee waiver recipient	-0.04	-0.01	-0.02
	(0.03)	(0.03)	(0.03)
STEM major	0.02	-0.08**	-0.04
	(0.02)	(0.02)	(0.03)
Age at enrollment	-0.00	0.00	-0.01
	(0.01)	(0.01)	(0.01)
n	2,471	2,471	2,471

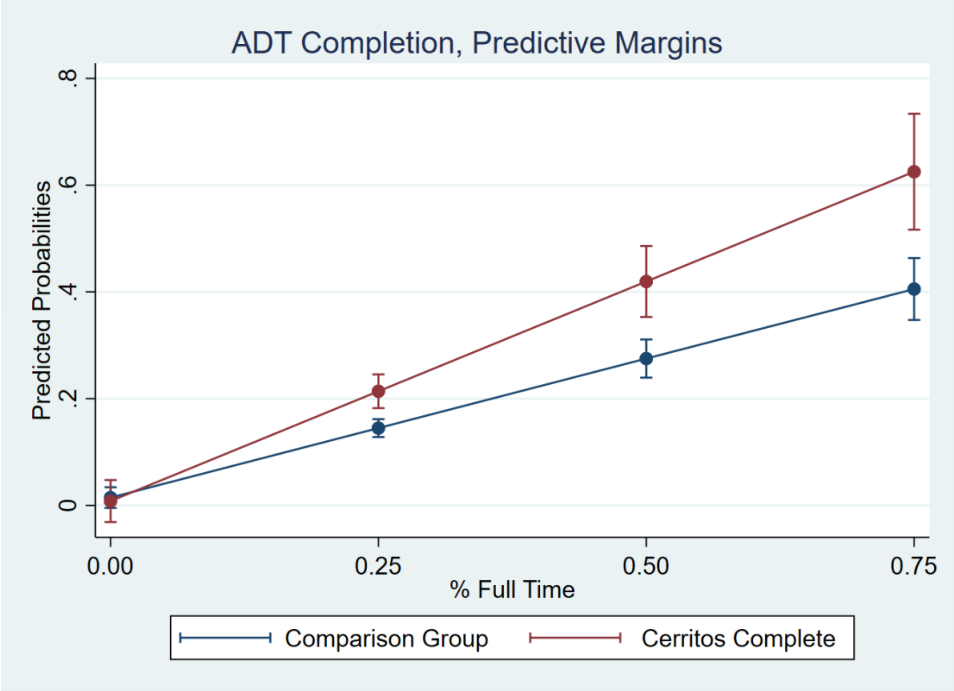
Note: Standard errors are in parentheses; missing values were estimated using multiple chained imputation, ***p<0.001, *p<0.05. Data Source: Office of Institutional Effectiveness, Research, Planning and Grants at Cerritos College

Table A5: Coarsened Exact Matching-weighted linear probability estimates of AA/AS, ADT, and Certificate Completion, moderated by Cerritos Complete participation

	AA/AS Completion	ADT Completion	Certificate Completion
Cerritos Complete participant	0.01	-0.00	0.00
	(0.02)	(0.02)	(0.02)
Percent full-time	0.29***	0.54***	0.78***
	(0.07)	(0.08)	(0.09)
Cerritos Complete X percent full-time	0.07	0.38**	0.31*
	(0.13)	(0.15)	(0.15)
Female	0.01	0.01	0.04*
	(0.01)	(0.01)	(0.02)
Black	0.02	-0.02	-0.03
	(0.04)	(0.04)	(0.05)
Latinx	0.01	0.02	0.02
	(0.03)	(0.04)	(0.04)
Asian	0.02	0.04	-0.01
	(0.06)	(0.07)	(0.08)
Other	0.03	0.02	-0.02
	(0.05)	(0.06)	(0.07)
Planned to transfer/earn BA	-0.01	0.02	-0.02
	(0.03)	(0.03)	(0.03)
First-term GPA	0.03***	0.04***	0.06***
	(0.01)	(0.01)	(0.01)
Transfer-level English	0.02	-0.02	-0.00
	(0.01)	(0.02)	(0.02)
Transfer-level Math	0.03	0.03	0.03
	(0.04)	(0.04)	(0.04)
Fee waiver recipient	-0.04	-0.01	-0.02
	(0.03)	(0.03)	(0.03)
STEM major	0.02	-0.07**	-0.04
	(0.02)	(0.02)	(0.03)
Age at enrollment	-0.00	0.00	-0.01
	(0.01)	(0.01)	(0.01)
n	2,471	2,471	2,471

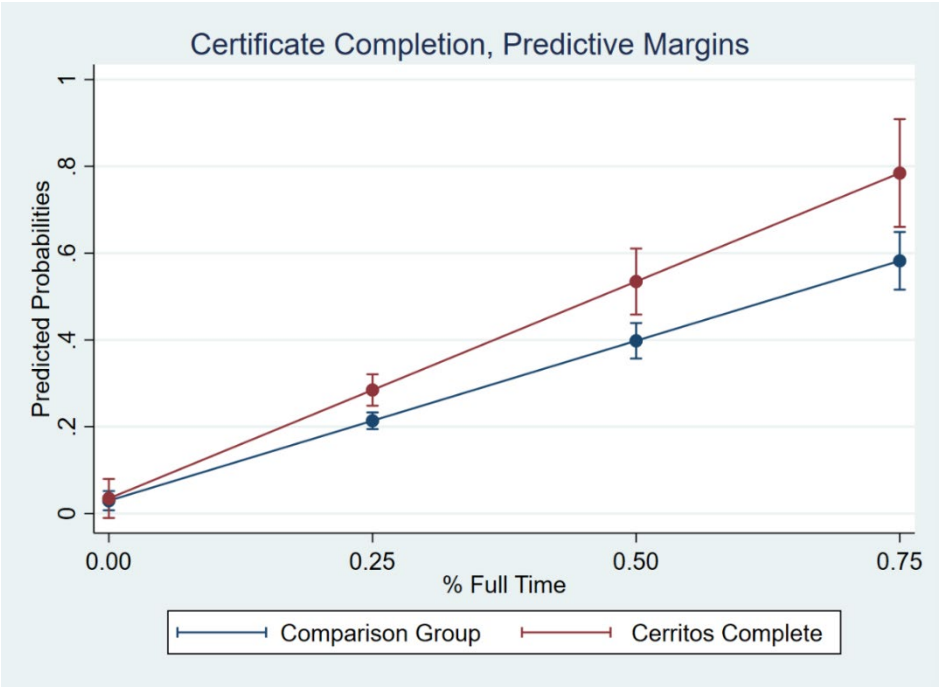
Note: Standard errors are in parentheses; missing values were estimated using multiple chained imputation, ***p<0.001, *p<0.05. Data Source: Office of Institutional Effectiveness, Research, Planning and Grants at Cerritos College

Figure A1
Predicted Probabilities of ADT Completion for Cerritos Complete and Comparison Group Students



Note: This figure illustrates that the relationship between percent full-time enrollment and ADT completion was moderated by Cerritos Completes participation. Estimates reported in Table A4, row 3, column 22.

Figure A2
Predicted Probabilities of Certificate Completion for Cerritos Complete and Comparison Group Students



Note: This figure illustrates that the relationship between percent full-time enrollment and certificate completion was moderated by Cerritos Completes participation. Estimates reported in Table A4, row 3, column 22.

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