Annenberg Institute
BROWN UNIVERSITY

EdWorkingPaper No. 26-1507

Boosting Dual Enrollment Participation by Simplifying Access for High School Students

Audrey Boochever
University of California, Davis

Despite the promise of dual enrollment to expand college access, racial disparities in participation persist, and limited research examines policies designed to reduce access barriers. Using statewide student-level data from 2013–14 to 2021–22 and difference-in-differences approaches, I estimate the causal impact of College and Career Access Pathways (CCAP) partnerships, which aimed to reduce barriers by offering college courses on high school campuses, during the school day, exclusively for high school students, and tuition-free (i.e., structured dual enrollment). CCAPs increased structured dual enrollment participation by 0.8 to 1.8 percentage points—a 42% to 95% increase over pre-policy levels—but did not affect independent dual enrollment (courses students enroll in individually). Effects were consistent across racial groups but not larger for underrepresented students.

VERSION: June 2026

Suggested citation: Boochever, Audrey. (2026). Boosting Dual Enrollment Participation by Simplifying Access for High School Students. (EdWorkingPaper: 26-1507). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/p2ty-w646

Boosting Dual Enrollment Participation by Simplifying Access for High School Students

Audrey Boochever
University of California, Davis

One Shields Ave,
Davis, CA 95616
audrey.boochever@gmail.com
(202) 365-0603

Abstract

Despite the promise of dual enrollment to expand college access, racial disparities in participation persist, and limited research examines policies designed to reduce access barriers. Using statewide student-level data from 2013–14 to 2021–22 and difference-in-differences approaches, I estimate the causal impact of College and Career Access Pathways (CCAP) partnerships, which aimed to reduce barriers by offering college courses on high school campuses, during the school day, exclusively for high school students, and tuition-free (i.e., structured dual enrollment). CCAPs increased structured dual enrollment participation by 0.8 to 1.8 percentage points—a 42% to 95% increase over pre-policy levels—but did not affect independent dual enrollment (courses students enroll in individually). Effects were consistent across racial groups but not larger for underrepresented students.

Introduction

Dual enrollment, in which students take college courses for college credit while in high school, has emerged as an important strategy for expanding college access, particularly for students historically underrepresented in higher education or not traditionally college-bound.[1] Dual enrollment is associated with a host of positive outcomes, including high school graduation, college degree attainment, and labor market outcomes (Allen & Dadgar, 2012; An & Taylor, 2019; Britton et al., 2019; Henneberger et al., 2020; Hughes et al., 2012). Yet, studies consistently show unequal access to dual enrollment opportunities, with persistent disparities by race (Anderson, 2024; Dykeman et al., 2024; Friedmann et al., 2024; Shivji & Wilson, 2019; Xu et al., 2021).

Several states have implemented policies aimed at increasing access and reducing barriers to dual enrollment participation. In California, Assembly Bill 288 (AB 288), enacted in 2016, authorized and promoted the formation of College and Career Access Pathways (CCAP) partnerships between K-12 and community college districts. CCAP partnerships allow colleges to offer courses on high school campuses during the regular school day composed entirely of high school students and offered without enrollment fees. These partnership-based dual enrollment offerings – referred to here as *structured dual enrollment* – stand in contrast to *independent dual enrollment*, in which students independently enroll in college courses outside of a formal coordinated partnership, often on college campuses and alongside college students.[2] An explicit purpose of AB 288 was to increase dual enrollment access for students from groups underrepresented in higher education and students who might not already be college-bound.

Although dual enrollment participation has increased over time, limited research exists on whether policies like CCAP effectively reshape access and address structural barriers (Hemelt &

Swiderski, 2022; Miller et al., 2018). Additionally, no studies, to my knowledge, have explored the causal impact of policies that provide for structured dual enrollment classes composed solely of high school students, outside of Early and Middle College High Schools.

This study addresses these gaps in the literature by investigating the following research questions:

1. Does attending a high school in a district with a College and Career Access Pathways partnership (reducing the barriers to accessing dual enrollment by offering courses on a high school campus exclusively for high school students) increase the likelihood of dual enrollment participation?
2. Does having a CCAP partnership increase dual enrollment participation for underrepresented students in higher education—Black, Latine, Native, and Pacific Islander—thereby meeting one of the key objectives of AB 288?[3]
3. Which types of dual enrollment courses (i.e., career-focused versus academic-focused) and subjects (e.g., Biological sciences, Education, Health) have had the most prominent change during this time period?[4]

To answer the first research question, I leverage the staggered implementation of these CCAP agreements across California and employ a difference-in-differences (DiD) approach with three specifications. First, I apply a *two-way fixed-effects* (TWFE) difference-in-differences model with district and time fixed effects to estimate the overall (pooled) impact of CCAPs. Next, I use an *event study* design with district and year fixed effects, which differs from TWFE in that it provides dynamic estimates of CCAP impacts for each year post-implementation, rather than a single pooled estimate. Finally, to address potential biases of the TWFE and event study estimates that can arise with staggered treatment timing and heterogeneous treatment effects

(Callaway & Sant'Anna, 2021; Goodman-Bacon, 2021; Sun & Abraham, 2021), I employ the Callaway and Sant'Anna (2021) DiD estimator. To answer the second research question, I estimate the models for each ethnoracial group separately using all three specifications.[5] For the third research question, I compare participation by dual enrollment type (i.e., academic vs. CTE) and field of study before and after the enactment of AB 288. I address each of these questions separately for both structured and independent dual enrollment participation.

This study finds that attending a school with a CCAP partnership increases the likelihood that a student participates in structured dual enrollment by 0.8 to 1.8 percentage points, representing a 42% to 95% increase relative to the pre-AB 288 structured dual enrollment rate of 1.9%. In contrast, independent dual enrollment showed no growth as a result of CCAPs. While students of all ethnoracial groups experienced an increase in the likelihood of structured dual enrollment participation due to CCAPs, the policy did not disproportionately benefit underrepresented students within districts, thus maintaining existing within-district participation gaps. However, because CCAP districts served a disproportionately Latine student population relative to non-CCAP districts, the policy's aggregate gains reached more Latine students in absolute numbers compared to Asian and White students due to the type of districts where they were adopted. These findings are noteworthy given AB 288's explicit emphasis on increasing dual enrollment participation for underrepresented students. The policy also shaped enrollment patterns across subject areas, with career-focused dual enrollment participation growing more than academic-focused dual enrollment participation. The fields of *Humanities* and *Social Sciences* saw the largest growth in enrollments in both structured and independent dual enrollment. *Health* also saw the third largest total growth in enrollments in structured dual enrollment subjects, whereas *Mathematics* showed the third greatest growth in independent dual enrollment.

This paper makes an essential contribution to the growing body of literature on dual enrollment as well as research on racial and socioeconomic equity in college access. Specifically, this study offers the opportunity to evaluate how formal college district-K-12 district partnerships can expand and reduce barriers to access to dual enrollment—particularly valuable given the well-documented benefits of participation and the need for evidence on scalable approaches to increasing participation.

Prior Literature

Benefits of Dual Enrollment Participation

Dual enrollment has consistently shown positive impacts across multiple student outcomes. For example, studies have documented that dual enrollment participation is associated with increased high school graduation rates (Karp et al., 2007; Lee et al., 2022). Additionally, dual enrollment has been shown to increase college enrollment, though findings are mixed regarding effects on two-year versus four-year attendance. Henneberger et al. (2020) found that dual enrollment increased two-year college enrollment by 20 percentage points immediately after high school but had no effect on four-year enrollment in that first year. Conversely, Lee et al. (2022) found that dual enrollment students were more likely to choose four-year institutions over two-year institutions by 5.6 percentage points. These varying findings may reflect differences in program implementation, regional contexts, or student populations studied. Additionally, dual enrollment has been shown to be associated with better academic performance in college (Kirby et al., 2023), greater college persistence (Lee et al., 2022), shorter time to degree completion (Allen & Dadgar, 2012), higher degree attainment rates (An, 2013), and improved labor market outcomes (Henneberger et al., 2020). Particularly noteworthy are findings that dual enrollment can have especially strong positive effects for historically underrepresented students, with Lee et al. (2022) documenting particularly strong graduation rate improvements for Black, Asian, and Latine students, and An (2013) highlighting greater benefits for low-income students in college degree attainment. While these benefits are well-established, less is known about how policy interventions affect dual enrollment participation patterns, particularly for historically underrepresented students.

Dual Enrollment Course Structure and Educational Outcomes

Importantly for this study, which focuses on a dual enrollment expansion policy for structured dual enrollment, Ryu et al. (2024) examined dual enrollment features that predict greater postsecondary outcomes. They found that courses offered on high school campuses were associated with higher pass rates and course grades compared to those offered on college campuses. Specifically, college-campus courses resulted in a 1.1 percentage point decrease in course grade and a 0.9 percentage point decrease in the likelihood of passing for academic dual enrollment courses. For career and technical education (CTE) courses, location on a college campus led to a 5.5 percentage point decrease in course grade. Additionally, Ryu et al. (2024) found that dual enrollment students had lower course grades and were less likely to pass courses that included both high school and college students, compared to classes composed exclusively of high school students. Beyond location and class composition, course content also matters: Giani et al. (2014) further noted that dual enrollment in core academic subjects was more predictive of positive postsecondary outcomes than dual enrollment in electives, suggesting that both course content and delivery format influence effectiveness.

Administrative Burden Theory and Dual Enrollment Access

While the benefits of dual enrollment are well-documented, understanding why some students participate while others do not requires examining barriers to access. *Administrative Burden Theory* provides a useful conceptual lens for understanding these barriers, identifying three types of costs that can impede participation: learning costs (time and effort required to learn about a program), compliance costs (time, effort, and resources required to participate), and psychological costs (stress and stigma associated with navigating bureaucratic systems) (Moynihan et al., 2015). This framework helps motivate why policy features such as free courses, school-day course offerings, and high school campus location – features expanded under CCAP – may plausibly reduce participation barriers that disproportionately affect students of color (Ray et al., 2023). Accordingly, the estimates in this study should be interpreted as the total effect of CCAP implementation on participation rather than evidence about which specific administrative burdens were reduced.

Barriers to Equitable Dual Enrollment Participation

Despite growth in dual enrollment participation nationally, access and participation vary significantly across student subgroups. According to the High School Longitudinal Study of 2009, White and Asian students had higher participation rates (both at 38%) compared to Black (27%) and Latine students (30%) (NCES, 2019). Xu, Solanki, and Fink (2021) found that districts with larger populations of Black and Latine students demonstrated greater inequalities in dual enrollment access, though these racial gaps were smaller than those in Advanced Placement enrollment.

The greatest barrier to dual enrollment participation is whether a school offers any dual enrollment courses at all (Spencer & Maldonado, 2021), and schools with higher proportions of

White students are more likely to offer dual enrollment opportunities, as observed in Tennessee's Statewide Dual-Credit program (Hemelt & Swiderski, 2022). Additionally, districts with higher proportions of Black students show larger participation gaps between White students and students of color (Xu et al., 2021). This uneven distribution of dual enrollment opportunities means that students' access to structured dual enrollment depends, in large part, on the racial composition of their school and district, reflecting systemic inequalities in educational opportunities.

Even when dual enrollment is available, institutional requirements for participation may further exacerbate these inequities. Marken et al. (2013) found that nationwide, 60% of programs require a minimum GPA, 45% require passing a college placement test, 43% require a minimum score on a standardized test, and 41% require a letter of recommendation. While these requirements aim to maintain academic rigor, they may inadvertently restrict access for students who would benefit most from college exposure.

Research suggests that disparities may also stem from additional factors beyond program availability and formal requirements. Anderson (2023) finds suggestive evidence that explicit racial bias—as measured by two questions in the Race Implicit Association Test (IAT)—can explain some of the disparities in dual enrollment participation between White and Black students. These multiple, intersecting barriers—from basic program availability to institutional requirements to potential bias—create significant administrative burdens that disproportionately affect students of color.

Policy Approaches to Reducing Dual Enrollment Barriers

Research on policies that have reduced dual enrollment access barriers in other states provides insights into how California's CCAP partnerships might also have impacted dual enrollment patterns. In Texas, House Bill 505 eliminated limits on the number of dual enrollment courses students could take and allowed 9th and 10th graders to participate. Miller et al. (2018) found moderate increases in participation following implementation, with the proportion of students in 9th grade who participated in dual enrollment doubling from 1.0% to 2.1% and the proportion of 10th grade students participating in dual enrollment increasing from 2.7% to 4.3%. Tennessee's Statewide Dual Credit program similarly reduced barriers by offering college-level courses in high schools that were free to students and had no GPA requirements. Hemelt and Swiderski (2022) found that this program increased the proportion of students enrolling in dual enrollment courses across all academic achievement levels, with career and technical education courses experiencing the largest growth in enrollments. In Ohio, the Innovative Program (IP) policy sought to increase dual enrollment participation for underrepresented students by allowing high school-college partnerships the ability to waive math, reading, and writing placement testing requirements for students underrepresented in dual enrollment. Using a similar analytical approach to this study, Sparks et al. (2025) found that the IP policy led to a 1 to 2 percentage point increase in the proportion of Black and Hispanic students participating in dual enrollment, although these findings were not statistically significant. Notably, the authors were unable to distinguish between formalized and independent dual enrollment participation, which may have attenuated the estimated effects.

Financial barriers also appear to be a factor in participation. Xu et al. (2021) found that dual enrollment participation disparities between White and Black students were lower (by four percentage points) in states that require tuition-free or reduced-tuition dual enrollment. Additionally, when Washington made dual enrollment courses free for students through its

College in High School program, participation increased by approximately 10,000 students (Deng, 2024).

California Policy Context

Access and Participation in Dual Enrollment in California

As of 2022, 22% of California high school graduates participated in dual enrollment (Dykeman et al., 2024). Participation rates reflected national patterns of inequity: Asian students had the highest participation rate (31%), followed by White (26%), Latine (19%), and Black students (17%) (Dykeman et al., 2024).

Despite the widespread presence of structured dual enrollment programs in California – approximately 70% of schools offered structured opportunities (Kurlaender et al., 2021) – equitable access remained a challenge. Roughly 74% of high school graduates attended schools where only five percent of the student body took dual enrollment courses, and 22% attended schools with no structured dual enrollment offerings at all (Kurlaender et al., 2021). Schools with the highest dual enrollment participation rates tended to have significantly smaller student populations (70 students per cohort) compared to the average school (252 students per cohort) (Mathias, 2022).

Historically, most students in California accessed dual enrollment courses through independent enrollment (75% in the 2020 cohort) rather than structured program enrollment (Kurlaender et al., 2021; Rodriguez et al., 2023). Kurlaender et al. (2021) reported that 12% of dual enrollment participants from the 2016 high school graduation class took courses composed solely of high school students, and Rodriguez et al. (2023) found that by 2019-20, 24% of dual enrollment participants participated in dual enrollment through CCAP programs. Both independent and structured dual enrollment rates increased over this period, with structured/CCAP participation growing at a faster rate (Kurlaender et al., 2021; Rodriguez et al., 2023). Whether this growth can be attributed to AB 288 is a key motivation for the present study.

Research indicated smaller racial participation gaps in structured programs compared to independently sought dual enrollment (Kurlaender et al., 2021). Rodriguez et al. (2023) found that participants in structured dual enrollment more closely resembled the general student population than those in independent programs. While CCAP participants had better academic outcomes in college than non-dual enrollment students, they generally had lower academic outcomes than other dual enrollment students (Rodriguez et al., 2023), likely reflecting differences in self-selection.

Assembly Bill 288: College and Career Access Pathways Act

Prior to AB 288, dual enrollment in California was primarily accessed through independent enrollment, in which students navigated the community college enrollment process on their own, taking courses on college campuses alongside traditional college students. Some districts did have locally developed structured dual enrollment arrangements, including district-specific partnerships like the Long Beach College Promise Partnership (SB 650) and the Oakland Unified School District–Peralta Community College District partnership.[6] There were additional structured dual enrollment programs supported through the California Career Pathways Trust and Gateway to College models. These partnerships were unevenly distributed across districts and operated without a consistent statewide policy framework.

Acknowledging both the benefits of dual enrollment and the fact that it had historically been primarily accessed by higher-achieving students, and modeling after and citing the success of the 2011 Long Beach College Promise Partnership Act, the California Legislature passed AB 288 in 2015, authorizing and promoting the formation of College and Career Access Pathways

(CCAP) partnerships between community college districts and K-12 school districts in 2016. These partnerships were aimed to develop "seamless pathways from high school to community college for career and technical education or preparation for transfer, improving high school graduation rates, or helping high school pupils achieve college and career readiness" (AB 288: CCAP Partnerships, 2015, Section 2). Importantly, the resulting statute specifies that CCAP partnerships are intended to expand dual enrollment opportunities "for pupils who may not already be college bound or who are underrepresented in higher education" (California Education Code § 76004).

The implementation of CCAP partnership agreements changed several features of the dual enrollment experience relative to independent dual enrollment. CCAPs meant that dual enrollment could be offered on high school campuses during the regular school day, composed entirely of high school students, and taught either by community college faculty or by high school teachers who meet community college instructor qualification requirements. In either instructor model, high school staff are available to provide student support in ways that college faculty cannot. For instance, high school staff have access to student information systems and established relationships with students' families, which can mean stronger partnerships and community with the families throughout the course, especially if students struggle and need support. High school staff can also advocate for students and help them navigate community college services and accommodations, which is particularly valuable for students with disabilities and English Learners, who would otherwise need to navigate and advocate for these services on their own in an unfamiliar college environment (correspondence with the Post-Secondary Pathways Program Manager for a California School District, 2026). This is a significant shift from independent dual enrollment, in which students take courses on college campuses, often outside the school day, alongside traditional college students, without this additional layer of support from high school teachers and staff. In addition to changing where and how courses are offered, CCAP agreements also eliminated enrollment fees, removing a financial barrier that disproportionately affects lower-income students.

Through these design features, CCAP partnerships plausibly could reduce several of the administrative burdens associated with dual enrollment participation. This includes compliance costs related to scheduling, as misaligned schedules between high schools and community colleges have been identified as a meaningful barrier, with more than half of dual enrollment survey respondents in California citing this as an obstacle (Engage R+D and the Career Ladders Project, 2023), and psychological costs associated with navigating unfamiliar college environments. Whether these administrative burden mechanisms drive any increases in participation observed in this study is an empirical question this study is not designed to answer; the estimates reflect the total effect of CCAP implementation on participation.

Data and Methods

Data

To address this study's research questions, I use student-level administrative data on the census of California's 11th- and 12th-graders between the 2013–14 and 2021–22 school years. The analytic sample includes students from all California traditional public school districts (i.e., Local Education Agencies [LEAs]) that operate high schools. I exclude charter schools because they function as independent LEAs and have separate CCAP agreements from the districts in which they receive their charters. I focus on 11th- and 12th-grade students because these are the grades in which dual enrollment participation is most common (Friedmann et al., 2024). This approach is consistent with other studies that limit their samples to 11th- and 12th-grade students

(Edmunds et al., 2024) or to 12th-grade only (Henneberger et al., 2020). Individual student-level data come from a restricted administrative dataset provided by the California Department of Education (CDE), which includes information on race, gender, socioeconomic status, and school, and the California Community Colleges Chancellor's Office (CCCCO), which contains course subject, course type, and grade received.

Because California lacks a unique statewide student identifier to link K–12 and community college records, I rely on a crosswalk used in prior work (e.g., Dykeman et al., 2024; Boochever et al., 2025). This method matches students across the CDE and CCCCO datasets using a combination of last name, first name, date of birth, high school, and gender. The process incorporates both deterministic and fuzzy matching techniques to account for inconsistencies in how names are recorded. Students who appear in both datasets in a given year – meaning they were enrolled in both systems concurrently – are considered dual enrollment students for that year.

To obtain the year of implementation for each district's CCAP agreement, information from all CCAP agreements that I received from the CDE and was able to open was hand-coded. I supplemented this dataset with publicly available information about each high school, including its locale and enrollment size. As of the 2021–22 school year, 247 of the 502 (49%) non-elementary school districts had a CCAP agreement in place, and 571,553 11th- and 12th-grade students (69%) were enrolled in a school within a district with a CCAP agreement. Table 1 shows the distribution of the year each district first implemented a CCAP agreement and the corresponding student enrollment in those districts. The data begins in the 2015–16 school year, which was the first year such agreements were formally authorized under California state law (AB 288). While some districts may have offered formal dual enrollment opportunities before this law, 2015–16 marks the beginning of the formal CCAP policy framework.

<Insert Table 1>

Table 2 presents the sample of schools included in this analysis, comparing those in districts that have ever had a CCAP to those that have not. While difference-in-differences analyses do not require these groups to be demographically similar, understanding their differences may provide insight into the generalizability of CCAP's potential impact if non-CCAP districts were to adopt a CCAP.

<Insert Table 2>

The proportion of students participating in dual enrollment (both structured and independent) increased steadily from 2013–14 to 2021–22, although independent dual enrollment growth has leveled off in recent years. Structured dual enrollment (blue line) started lower – at 1.5% in 2013–14 – but reached 7.2% by 2021–22, while independent dual enrollment (orange line) grew from 3.0% to 6.7% over the same period. Structured dual enrollment saw a dip in participation in 2020–21, when most California public high school students were learning remotely due to the COVID-19 pandemic; interestingly, independent dual enrollment did not experience a similar decline. Overall, structured dual enrollment nearly quintupled during the study period.

<Insert Figure 1>

Additional descriptive analyses suggest that CCAP implementation may have contributed to this growth. Prior to a district adopting a CCAP, only 30% of schools had more than 0.5% of students participating in structured dual enrollment. After adoption, that share doubled to 60%. Among schools with any structured dual enrollment participation post-CCAP, an average of 11.4% of students are enrolled in structured dual enrollment.

Measures

This study leverages a policy change, AB 288, which allowed K-12 school districts and community college districts to enter into CCAP partnerships to offer dual enrollment courses on high school campuses for high school students. I examine the impact of these CCAP partnerships on student participation in dual enrollment. In an ideal world, I would be able to examine the impact of CCAP dual enrollment, but based on data limitations, I am not able to observe at the course-level whether a course is a CCAP course. So, I focus on structured dual enrollment since that is the direct target of AB 288 and a proxy for CCAP dual enrollment, since CCAP dual enrollment is the largest and most comprehensive example of structured dual enrollment in California. Importantly, it is also possible that CCAPs had indirect effects on independent dual enrollment. For example, students exposed to structured dual enrollment through CCAPs may have been inspired to seek out additional college courses on their own. Additionally, peer effects may play a role. Students may have learned about dual enrollment opportunities from classmates participating in structured dual enrollment programs and be further encouraged to participate independently. As a result, I also estimate separate models for independent dual enrollment.

For structured dual enrollment participation, I create a variable where participation equals "1" if the student took at least one dual enrollment course section in which 95% or more of enrolled students are high school students that year, and "0" otherwise. For independent dual enrollment participation, I create a variable where participation equals "1" if the student took at least one dual enrollment course section in which fewer than 95% of enrolled students are high school students that year, and "0" otherwise. Because these are defined at the course level, a student may take both a structured and an independent dual enrollment course within the same academic year and receive a "1" for both outcome variables.[7] While these courses are defined based on high school student composition, it is important to note that there are other facets of dual enrollment program design not captured in the conceptualization of structured and independent dual enrollment. For instance, as discussed in the California Policy Context section, some are taught by high school teachers, some by college instructors, some are offered on the high school campus, and some are on the college campus. Unfortunately, the data do not allow us to analyze these courses by those features.

To examine how dual enrollment changed across course types and subjects, I define course types as either CTE or academic, which I determine by using a CCCCO indicator that identifies if a course was a vocational course. In defining course subjects, I use the two-digit discipline code that the CCCCO uses to categorize dual enrollment courses.[8] There are 24 disciplines (indicated by the first two digits), which I refer to as dual enrollment “subjects". Although additional discipline code digits identify 270 sub-disciplines, I do not use these in my study (CCCCO, 2023).

Analytic Approach

My goal is to estimate the causal effect of districts adopting CCAP partnerships on dual enrollment participation—overall and by student race/ethnicity. But potential selection issues exist, where some districts might choose to enter into a CCAP for some confounding reason that also increases dual enrollment participation but is not due to the CCAP agreement itself. Additionally, other concurrent policies and events like the COVID-19 pandemic could affect dual enrollment participation, potentially confounding estimates of CCAP's impact. I attend to these through multiple identification strategies.

Difference-in-Differences Two-Way Fixed Effects Model

The TWFE model for the impact of CCAP partnership on dual enrollment participation, which I estimate separately for structured and independent dual enrollment using ordinary least squares, takes the form:

$$Y_{isdt} = \beta_0 + \beta_1 CCAP_{isdt} + \theta SchoolChar_{sd} + \eta StuChar_{isd} + \delta_d + \gamma_t + \varepsilon_{isdt} \qquad (1)$$

Where Y_{isdt} is a binary variable indicating whether or not student *i* in school *s* in district *d* participated in dual enrollment in year *t*. The treatment variable $CCAP_{isdt}$ indicates whether or not the student was enrolled in a school in a district that had a CCAP agreement in place that year, taking a value of 1 if there was a CCAP agreement in place for that district *d* in year *t* and 0 if not. This means that β_1, the coefficient of interest, captures the increased likelihood of participating in dual enrollment (measured in percentage points), as a result of attending a school in a district with a CCAP agreement. I include fixed effects for year γ_t and district δ_d to control for any variations across time or across districts that may affect dual enrollment participation.

In DiD models, the underpinning assumption is that there would be parallel trends in dual enrollment participation in the treatment (schools in districts with CCAPs) and control groups (schools in districts without CCAPs). This means that the different baseline values of dual enrollment participation do not matter in this method, and generally speaking, adding covariates is not necessary. However, it is becoming increasingly common to include controls while using this method to mitigate bias from confounding variables that may influence the outcome (dual enrollment participation) or be correlated with treatment assignment. If adding covariates changes the DiD estimate for having a CCAP, this suggests that the controls were correlated with CCAP adoption and that observed characteristics were differentially changing between groups. This, in turn, raises the possibility that unobserved characteristics may also be evolving differently over time, potentially violating the parallel trends assumption. In this case, adding covariates does not substantially change the DiD estimate. Adding controls can also improve the precision of this study's estimates. To avoid including controls that might be affected by the variable of interest (CCAP), and to ensure the covariates are predetermined and fixed, all school-level and district-level controls are from the period before CCAPs came into existence (2014-15).

$SchoolChar_s$ represents the controls for school characteristics (log of school size, average number of Advanced Placement (AP) courses per student, percent of the school that is socioeconomically disadvantaged (SED), percent of the school that is Black, and percent of the school that is Latine). The log of school size controls for differences in dual enrollment opportunities that may vary by school size, while school-level average number of Advanced Placement (AP) courses per student accounts for a potential substitution effect by students enrolling in AP versus dual enrollment college courses. Controls for school composition include the proportion that is socioeconomically disadvantaged, the proportion who are Black, and the proportion who are Latine, given the research on the relationship between school composition and dual enrollment participation (Xu et al., 2021).

$StudentChar_i$ represents the controls for student characteristics: socioeconomic disadvantaged status (SED) and dummy variables for each ethnoracial group, where not-SED and White are the omitted variables. I include these student-level controls given the research on differences in dual enrollment participation by socioeconomic status and ethnoracial group. The estimates of the control coefficients are represented by θ for school-level controls and η for student-level controls. Under the parallel trends assumption, the controls and fixed effects allow β_1 to be interpreted as the causal effect of CCAP partnerships.

Event Study Model

The event study model takes the form:

$$Y_{isdt} = \beta_0 + \sum_{k=-4}^{-2} \mu_k (Lead\ k)_{isdt} + \sum_{j=0}^{4} \rho_j (Lag\ j)_{isdt} + \theta SchoolChar_{sd} + \eta StuChar_{isd} + \delta_d + \gamma_t + \varepsilon_{isdt} \quad (2)$$

where Y_{idt} represents whether student *i* participated in dual enrollment at school *s*, in district *d*, during time *t*. The key variables of interest are the lead and lag indicators, which capture the number of years until or since CCAP implementation. The year before CCAP implementation (*t* - 1) serves as the reference year and is omitted. The lead terms (*k*) include the 4, 3, and 2 years before CCAP implementation, where each *Lead k* is an indicator variable equal to 1 if district *d* is *k* years before CCAP implementation in year *t*, and 0 otherwise. Each μ_k coefficient represents the difference in dual enrollment participation between districts adopting CCAP in year 0 and never- or later-treated districts in that pre-treatment year, relative to the difference in the reference year (the years before CCAP implementation). The lag terms (*j*) include the year of

CCAP implementation (year 0) and 1, 2, and 3 years after implementation. Each ρ_j represents the estimated effect of CCAPs in that post-treatment year relative to the reference year. School characteristics ($SchoolChar_{sd}$), student characteristics ($StuChar_{isd}$), district fixed effects (δ_d), and time fixed effects (γ_t) are included as described above.

This model allows us to test the parallel trends assumption by examining whether the gap in dual enrollment participation between districts that adopt a CCAP and those that do not or have not yet adopted is stable in the years prior to CCAP implementation (Clarke & Tapia-Schythe, 2021). Specifically, whether pre-treatment differences between treated and not-yet-treated districts differ significantly from the reference year. Significant lead coefficients would suggest that participation was already trending differently across groups, raising concerns about whether observed increases can be causally attributed to CCAP adoption. The parallel trends assumption appears to hold for independent dual enrollment outcomes; pre-treatment patterns for structured dual enrollment are more nuanced, however, and discussed in the findings section.

Difference-in-Differences Callaway & Sant'Anna (2021) Estimator

Recent developments in econometrics offer alternatives to TWFE models, particularly when treatment effects have the potential to be heterogeneous (Callaway & Sant'Anna, 2021; Goodman-Bacon, 2021; Sun & Abraham, 2021). Specifically, the Callaway and Sant'Anna (2021) (CS) estimator is a version of DiD that is robust to biases that can arise with staggered implementation designs when there are heterogeneous treatment effects. This estimator calculates the "group-time average treatment effect" (Callaway & Sant'Anna, 2021) and improves upon traditional DiD estimators by incorporating propensity score weights based on the likelihood of treatment at a given time, conditional on pre-treatment covariates. These weights are applied to both treated groups and comparison groups that are untreated in a given period—whether because they will be treated later or never treated at all. The CS estimator relies on conditional parallel trends assumptions, where the control/comparison groups are selected based on whether they are likely to satisfy the parallel trends assumption. Unlike the TWFE or event study models, which rely on direct control variables, CS uses these variables to generate propensity score weights. Because the CS estimator operates at the district level, I use district-level covariates to generate propensity score weights rather than the full set of school-level controls used in the TWFE and event study specifications. Specifically, I use the proportion of Black students, the proportion of Latine students, and the proportion of SED students with a weight for district size. CS avoids the issue of negative weighting that can arise in the TWFE model due to the issue of "forbidden comparisons" (i.e., comparing treated districts with previously treated districts rather than only untreated districts).[9]

I implement the CS estimator with the *csdid* package in Stata (Rios-Avila et al., 2021). The estimator's algorithm conducts the analysis at the unit of treatment level (i.e., the district level). This means that instead of modeling the individual likelihood of participating in dual enrollment, the outcome measures the proportion of students within a district who participated in structured or independent dual enrollment as a result of CCAPs.

Heterogeneous Effects of CCAP Partnerships

To assess whether CCAPs had a greater effect on increasing dual enrollment participation for students underrepresented in higher education, I estimate each model – TWFE, event study, CS – separately for each ethnoracial group. The results are consistent across models, so I use the TWFE model for the subgroup analysis. I include the CS and event study estimates in Appendix

B. I then conduct a t-test between the *CCAP* coefficients in each separate model by ethnoracial group in both the structured and independent dual enrollment models to examine if there is statistically significant heterogeneity in the impact of CCAPs across races.

Change in Course Types and Subject Offerings

To analyze the change in course offerings over this period, I calculate the absolute and percent change in the number of enrollments in academic- and CTE-dual enrollment courses between the 2014 graduating cohort (pre-AB 288) and the 2022 graduating cohort (post-AB 288). I conduct this analysis separately for structured and independent dual enrollment participation.

I apply a similar approach to examine the shift in subject areas, calculating the absolute and percent change in enrollment across each of the 24 subject areas before and after AB 288. I conduct this analysis separately by structured and independent dual enrollment. By measuring percent change, I not only capture the absolute growth in course enrollments, but also the relative expansion of specific subject areas.

To assess the validity of the identifying assumption, in Appendix A, I examine whether observable student characteristics – specifically race and socioeconomic disadvantage (SED) status – change with the onset of CCAP implementation. I do this by regressing each time-varying characteristic on the CCAP indicator, controlling for year and district fixed effects, and clustering standard errors at the district level. I find no statistically significant changes in student composition following CCAP adoption, which supports the assumption that treated and untreated districts followed similar trends in observables. However, this analysis does not rule out the possibility that unobserved characteristics were also changing in ways that could bias the estimated treatment effect.

Findings

Dual Enrollment Participation

Turning to the first research question on the effects of CCAPs on dual enrollment participation, Table 3 presents the regression results for structured dual enrollment (Panel A) and independent dual enrollment (Panel B). Each panel includes four sets of estimates: the TWFE estimates (column 1) can be compared to the pooled CS estimates (column 2), while the event study estimates (column 3) can be compared to the year-by-year CS estimates (column 4). The table only includes the parameters of interest—the impact of CCAP (TWFE and Pooled CS), and the association between lag/lead years and dual enrollment participation (event study and year-by-year CS). The full tables with the covariates are provided in Appendix C.

<Insert Table 3>

For structured dual enrollment (Panel A), all four models indicate a positive and statistically significant impact of CCAPs on participation. The TWFE model reveals that having a CCAP leads to a 1.8 percentage point increase in the likelihood of participating in a structured dual enrollment course in 11th and 12th grade. Given that the pre-CCAP level of structured dual enrollment was 1.9%, this represents a roughly 95% increase in participation. To further interpret the magnitude of the estimated 1.8 percentage points, if districts without a CCAP agreement made a CCAP agreement, we might expect to see an increase in structured dual enrollment participation of approximately 8,113 students (0.018 multiplied by the 450,726 11th- and 12th-grade students in districts without a CCAP partnership as of 2022).[10] The CS estimator corroborates the positive and statistically significant TWFE results, with a smaller coefficient of

0.8 percentage points. Since these findings are at the district level, the interpretation is that a district entering a CCAP agreement yields a 0.8 percentage point increase in the proportion of students taking a structured dual enrollment course.

The structured dual enrollment event study model (column 3) shows a 1.0 percentage point increase in the likelihood of structured dual enrollment participation in the year of CCAP implementation, followed by a 1.4 percentage point increase in the following year. The CS estimates, while similar to the event study, yield slightly attenuated effects of 0.4 and 0.6 percentage points, respectively. Figure 2 visualizes the year-by-year impact of CCAP implementation relative to the year before a district adopted a CCAP agreement, comparing estimates from both the event study and the year-by-year CS model. Both graphs in Figure 2 demonstrate a positive impact of CCAP implementation on structured dual enrollment participation, as indicated by the bars consistently falling above zero on the y-axis in post-implementation years (Time 0 onwards). The participation rate increases the longer a district has a CCAP in place. The confidence intervals widen over time due to fewer observations in later years, reflecting the limited number of post-CCAP implementation years available for analysis; however, the estimates remain statistically significant throughout the post-implementation period.

<Insert Figure 2>

The pre-treatment estimates for structured dual enrollment present a mixed picture. On one hand, the overall pattern does not follow a clear upward trend. For instance, in the event study, the pre-period coefficients form a slight U-shape (as shown in Figure 2), the CS pre-period estimates are relatively flat, and confidence intervals across all pre-treatment periods overlap substantially, and the Lead 4 estimates in both models are not statistically significant. Also, the pre-period coefficients are not statistically significant (less than zero at a significance level of 5%, although they are at a significance level of 10%).

On the other hand, the Lead 2 and Lead 3 estimates are statistically significant and negative in both the event study and year-by-year CS models, (although Lead 3 in the event study is only marginally significant, $p < 0.10$). Because t-1 is the omitted reference category and normalized to zero by construction, these negative coefficients indicate that the gap in structured dual enrollment participation between CCAP and non-CCAP districts was smaller in those pre-period years relative to the gap in t-1. That is, these trends suggest that structured dual enrollment participation might have already been growing in CCAP-adopting districts in the years leading up to CCAP implementation. Notably, as shown in Table 2, CCAP districts had slightly higher structured dual enrollment participation than non-CCAP districts prior to implementation (1.0% versus 0.7%), and this study finds that CCAPs produced statistically significant increases above those already-higher baseline levels. However, the pre-intervention overlapping confidence intervals without a clear upward trend and the averaged pre-period estimates falling just outside of the 5% significance level together suggest that the evidence is unclear in interpreting the post-implementation increases as simply a continuation of pre-existing trends. Regardless, the possibility that the pre-intervention estimates are significant means that the existence of structured dual enrollment growth unrelated to CCAP cannot be ruled out entirely. This represents a potential limitation of interpreting the CCAP estimates as causal in the observed growth of dual enrollment participation.

As expected, for independent dual enrollment, I find no evidence that CCAPs increased participation (Table 3, Panel B). Both the TWFE (column 1) and pooled CS (column 2) estimates show no significant effect (0.0, not statistically significant), and lag estimates in both the event study and year-by-year CS estimators are also not statistically significant. Notably – and somewhat counterintuitively – three years before CCAP implementation (Lead 3), the likelihood of independent dual enrollment participation is statistically significantly ($p < 0.1$) higher than in the reference year. However, given that all other estimates are not statistically significant, I interpret this result with caution. These findings are illustrated in Figure 3.

<Insert Figure 3>

Results were robust to alternative high school student threshold definitions for structured dual enrollment. Using a 90% high school student threshold in identifying structured dual enrollment course sections, in comparison to a 95% threshold used in the main specification, increased the share of California Community College course sections identified as structured dual enrollment from 1.61% to 1.74% of all course sections. The results for the impact of CCAPs on structured dual enrollment participation were substantively similar to the main specification, with consistently positive and statistically significant effects across all estimators. Fewer pre-trend estimates for structured dual enrollment were significant under the 90% threshold than in the main specification, with Lead 2 insignificant in both the event study and year-by-year CS models. For independent dual enrollment at the 90% threshold, there was no statistically significant impact across estimators, with the exception of Lag 1 ($p < 0.1$) in the event study estimator.

In the 100%-high school student threshold specification check, which is more restrictive and reduces the share of course sections identified as structured dual enrollment to 1.48%, the effects of CCAPs on structured dual enrollment participation remained positive and statistically significant across all four estimators, with pre-trend patterns similar to the main specification. Estimates were still statistically insignificant for the effects of CCAPs on independent dual enrollment at the 100% high school student structured dual enrollment threshold. This is overall consistent with the main specification, although Lead 3 in the event study and year-by-year CS models showed suggestive significance ($p < 0.10$). Consistent across all structured dual enrollment threshold specifications, these findings show that CCAPs had a statistically significant positive impact on structured dual enrollment participation and no impact on independent dual enrollment participation. The table of results for the 90% and 100% threshold specifications are reported in Appendix D.

Participation by Ethnoracial Group

Turning to research question 2 – *Does having a CCAP partnership increase dual enrollment participation for minoritized students in higher education, thereby meeting the intended goal of AB 288?* – I find that easing dual enrollment restrictions (i.e., CCAP) increases dual enrollment participation across students of all ethnoracial groups.

Table 4 shows the results from estimating the TWFE model (1) separately by race for the structured (panel A) and independent (panel B) dual enrollment outcome.[11] CCAPs increased the likelihood of structured dual enrollment participation across all ethnoracial groups by 0.7 percentage points (Native) to 2.9 percentage points (Pacific Islander). With the exception of Native students, all estimates are statistically significant. And of all ethnoracial groups in this study, all students except for Latine students had a greater than 2 percentage point increase in the likelihood of participating in structured dual enrollment as a result of CCAPs. Pacific Islander, Asian American, White, and Filipino students had the greatest increases in likelihood with a 2.9, 2.5, 2.4, and 2.5 percentage point increase in the likelihood of structured dual enrollment participation, respectively, as a result of attending a school with a CCAP. Latine students had a 1.3 percentage point increase in the likelihood of participation.[12] These findings are similar to the estimates from the CS estimator (Appendix B).

Table 5 shows results from a series of t-tests between each ethnoracial group's CCAP coefficient, which tells us if any of the ethnoracial groups had a statistically greater increase in the likelihood of structured dual enrollment (panel A) and independent (panel B) participation above other ethnoracial groups. Despite the slight range in CCAP estimates by ethnoracial group, with the exception of Native and Pacific Islander students, no ethnoracial group pairs were statistically significantly different from one another. When using the CS estimator (Appendix B), no ethnoracial group pairs – not even Native and Pacific Islander students – were statistically significantly different. This means that within districts, CCAPs did not disproportionately increase dual enrollment participation for students underrepresented in higher education.

Although CCAPs did not close within-district participation gaps between underrepresented and White students, the distribution of CCAP adoption has equity implications worth considering. As shown in Table 2, CCAP districts served a disproportionately Latine student population relative to non-CCAP districts – 53.1% versus 46.3% – while serving fewer white students – 23.7% versus 31.3%. As a result, even with a smaller point estimate for Latine students (1.3 percentage points) relative to White students (2.4 percentage points), the policy generated approximately 3,956 additional Latine dual enrollees compared to 3,259 additional White dual enrollees in CCAP districts. This suggests that while CCAPs did not reduce within-district racial participation gaps, the policy's aggregate gains reached more Latine students in absolute numbers due to where it was adopted. This between-district mechanism did not operate similarly for Black, Native, or Pacific Islander students, whose representation in CCAP and non-CCAP districts was nearly identical.

Table 4, panel B presents the analysis for estimating the impact of CCAPs on the independent dual enrollment outcome for each ethnoracial group. As discussed, our findings indicate that CCAPs did not significantly affect independent dual enrollment participation overall. Additionally, the table shows no meaningful variation in the impact of CCAPs across different ethnoracial groups.

<Insert Table 4>

<Insert Table 5>

Course types

During the period when CCAPs accelerated structured dual enrollment participation, both academic and CTE dual enrollment grew substantially. However, CTE dual enrollment outpaced academic dual enrollment in growth across both structured and independent dual enrollment. Table 6 shows the total number of enrollments and the percent change in both CTE and academic dual enrollment across structured and independent dual enrollment from 2013–14 (pre-AB 288) to 2021–22 (the most recent year of available post-AB 288 data).

<Insert Table 6>

The growth in dual enrollment participation varied significantly across subject areas. Table 7 highlights the change in subject-specific dual enrollment from 2013–14 to 2021–22 for structured and independent dual enrollment, respectively. Table 7, panel A reveals notable expansions in *Humanities*; *Health*; *Engineering & Industrial Technologies*; and *Education* —all of which saw substantial gains in both the number of enrollments and growth rates in structured dual enrollment. Although *Agriculture & Natural Resources* and *Environmental Sciences & Technologies* had smaller total enrollments in 2013–14 (with *Environmental Sciences & Technologies* having none), they showed some of the largest percentage increases, along with *Health*. In terms of total structured enrollment gains, *Humanities* added the most enrollments, followed by *Social Sciences* and *Health*.

In independent dual enrollment (Table 7, panel B), *Social Sciences*, *Information Technology, Psychology*, *Business and Management*, and *Physical Sciences* all ranked among the top 10 for both total enrollment growth and percent increase. This suggests that these subjects experienced both broad uptake as well as accelerating interest. *Social Sciences* and *Humanities* saw some of the largest gains in total enrollments, with *Mathematics* close behind. Meanwhile, *Environmental Sciences & Technologies*, *Information Technology*, and *Social Sciences* had the highest percentage increases, reflecting patterns seen in structured dual enrollment and pointing to rising student interest and demand in technology-related fields.

<Insert Table 7>

Discussion & Conclusion

California's College and Career Access Pathway (CCAP) partnerships highlight how structured policy interventions can meaningfully expand dual enrollment access–an increasingly important postsecondary pathway for educational attainment. This is one of the first studies (and the only in California) to analyze the causal impact of a statewide dual enrollment policy that creates formal opportunities for high school students to take community college courses entirely with their high school peers through College and Career Access Pathways (CCAP). Results suggest that CCAPs increased the likelihood of participating in structured dual enrollment by 0.8 to 1.8 percentage points, depending on the estimation strategy. This represents a 42% to 95% increase in pre-policy structured dual enrollment levels, which translates to an additional 3,606 to 8,113 students who could access important dual enrollment courses. Perhaps unsurprisingly, these results were not reflected in independent dual enrollment, meaning CCAPs did not lead to an increase in students seeking out dual enrollment opportunities on their own.

CCAPs led to an increase in structured dual enrollment participation overall and across all ethnoracial groups. Within districts, average participation increased by 2.9 percentage points for Pacific Islander students, 2.5 for Asian, 2.4 for White, 2.1 for Black, 1.3 for Latine, and 0.7 for Native students. This achieved the explicit legislative goal of increasing dual enrollment access for underrepresented students. However, because CCAPs did not produce larger within-district gains for underrepresented groups relative to White students, removing structural barriers alone appears insufficient for achieving equity in dual enrollment participation. The exception to this current study's findings that CCAPs did not close ethnic/racial gaps in dual enrollment participation pattern is for Latine students. Because CCAP adoption was disproportionately concentrated in districts with larger Latine student populations relative to districts that did not adopt CCAPs, the policy's aggregate gains reached more Latine than White students in absolute numbers, even with a smaller point estimate. This between-district mechanism did not operate similarly for Black, Native, or Pacific Islander students, whose representation in CCAP participating districts and non-CCAP participating districts prior to the policy was nearly the same.

These findings are consistent with Xu et al.'s (2021) findings that district-level policies designed to broaden dual enrollment access do not necessarily translate into reduced equity gaps. Importantly, Xu et al. (2021) also found that stronger financial incentives for dual enrollment participation, such as state mandates requiring local or state agencies to cover full or partial tuition costs, were associated with smaller racial enrollment gaps, with White-Black participation gaps nearly four percentage points smaller in states with strong financial incentives compared to those where students and families bear the full cost. This suggests that fee elimination under CCAP, while an important step, may need to be paired with additional incentives to increase course enrollments to meaningfully close within-district gaps.

Additionally, administrative burdens, even with CCAPs, exist. Engage R+D and the Career Ladders Project (2023) found that 20% of dual enrollment survey respondents in California reported not enrolling because their application was lost or because of the need to enter a Social Security number.[14] Community college applications can also trigger identity verification requirements that many students under 18 cannot easily satisfy; and undocumented students may be flagged as non-residents, creating additional eligibility complications (Correspondence with Post-Secondary Pathways Program Manager for a California School District, 2026). These “racialized administrative burdens” (Ray et al., 2023) can also exacerbate racial/ethnic gaps in dual enrollment participation, even under CCAP. As Xu et al. (2021) note, "a single policy or practice may be insufficient to eliminate or narrow the current racial gaps in AP and DE participation." The current study's findings reinforce this conclusion that removing structural access barriers are a necessary but not sufficient condition for achieving equity, and additional targeted support may be needed to ultimately close gaps in participation by race/ethnicity.

To benchmark the current study's findings against comparable policies: these estimates are slightly larger when compared to Sparks et al.'s (2025) finding that Ohio's Innovative Program (IP) increased dual enrollment participation by 1.5 percentage points for Black students and 0.6 percentage points for Hispanic students, but results were not statistically significant. One possible explanation is that Sparks et al. (2025) do not distinguish between impacts on structured versus independent dual enrollment. Consistent with this interpretation, when examining overall dual enrollment (structured and independent combined) in California, the estimated effects are similar to Ohio's. Specifically, Black student participation increased by 1.6 percentage points (statistically significant) and Latine by 0.9 percentage points (not statistically significant) [Citation to author’s working paper removed for anonymity. The cited analysis uses overall dual enrollment participation as an outcome]. The greater precision of the current study's estimates may also reflect California's larger population, with roughly 3.75 times as many high school students as Ohio. More broadly, the effect sizes in this study are consistent with the moderate participation increases documented following similar policy changes in Texas and Tennessee (Hemelt & Swiderski, 2022; Miller et al., 2018), suggesting that policies reducing structural barriers to dual enrollment can produce meaningful, albeit not dramatic, shifts in participation.

The large growth in career and technical education (CTE) dual enrollment, which increased 1,112% compared to 496% for academic courses in structured programs, signals an increase in career-focused educational opportunities. Digging into the fields that experienced growth, the substantial growth in *Health*, *Engineering & Industrial Technologies*, and *Education* fields reflects an alignment with high-demand, high-wage sectors in line with California's

Golden State Pathways initiative (California Education Code § 53021). This pattern aligns with Boochever et al.'s (2025) finding that dual enrollment is a key avenue for students accessing CTE, and suggests that dual enrollment can serve both college preparation and career readiness goals simultaneously. One additional explanation for the faster growth of CTE relative to academic dual enrollment is that high school instructors teaching structured dual enrollment courses in CTE fields face lower credentialing barriers – an instructor can be credentialed in a CTE dual enrollment course with a bachelor's degree or associate degree combined with professional experience, whereas an instructor for an academic field requires a master's degree (Rodriguez & Gao, 2021).

The estimated effects of CCAP, while statistically significant and meaningful in magnitude, likely reflect only a portion of the policy's potential impact. This is because structured dual enrollment participation declined during the COVID-19 pandemic, when schools shifted to remote learning. Independent dual enrollment did not decline, however, suggesting the pandemic specifically disrupted the in-person learning that structured dual enrollment depends on. Because 77% of initial CCAPs were implemented before the 2021–22 school year, many districts had limited post-CCAP years unaffected by the pandemic available for analysis. It is likely that estimates would be larger with additional post-pandemic implementation years of data.

An important consideration is whether the observed increase in structured dual enrollment participation under CCAP generalizes to other efforts to ease access to dual enrollment. Because policies like CCAP vary in their design and implementation, it remains unclear which specific features contributed to increased participation. Future research could investigate which components—such as offering courses on high school campuses, integration into the regular school day, cost-free access, the social environment of taking classes with high school peers, instruction by high school teachers, or a combination of these factors—were most influential. Moreover, while CCAPs increased participation among racially underrepresented students, it remains unclear whether they also increased participation among students who are not traditionally college-bound. Future studies could examine the relative impact of different CCAP features and explore whether these programs broaden participation among students who may not be considered "college-bound", for example, students with lower prior academic performance.

Assessing the full impact of expanding access to structured dual enrollment necessitates examining whether CCAPs led to broader postsecondary and workforce success – including enrollment in two- and four-year colleges, persistence, GPA, degree attainment, employment, and earnings. Understanding these long-term outcomes is essential for determining whether the observed increases in participation translate into the educational and economic benefits that motivate dual enrollment policy. Future research in this area would greatly contribute to the literature.

The momentum behind increasing access to dual enrollment in California is reflected in ongoing legislative activity. Further state legislation (AB 30) reduced administrative burdens by streamlining the guardian approval and principal recommendation processes. The introduction of two additional bills in 2025 demonstrate continued legislative interest in expanding access to dual enrollment, though neither advanced (i.e., SB 438, which would have reduced the minimum school day for CCAP-participating students from 240 to 180 minutes to address scheduling barriers; and AB 1122, which would have required all LEAs without a dual enrollment program to establish one by 2029–30). These legislative developments underscore the continued commitment to expanding dual enrollment access in California and emphasize the need for more research on what works, and for whom, as policymakers seek to scale dual enrollment equitably.

Endnotes

1. Dual enrollment is sometimes referred to as concurrent enrollment (where a student enrolls in college courses while in high school) to distinguish from dual credit dual enrollment, where a student receives high school credit for their college course. For the purposes of this study, I refer to any college course a student takes while still enrolled in a high school as a dual enrollment course, regardless of whether the student receives high school credit.
2. Structured dual enrollment is an emerging term, used by scholars such as Rodriguez et al. (2023). It has also been referred to as high school-only dual enrollment (Kurlaender et al., 2021) or formal dual enrollment (Rodriguez & Gao, 2021). CCAP dual enrollment is one such type of structured or formal program. Independent dual enrollment has also been referred to as the "à la carte" model of dual enrollment (Ryu et al., 2024).
3. There is no unified definition of underrepresented minority, but many universities include Black, Latine, and Native students (California State University Chico, 2019; Stanford University, n.d.), and some additionally include Pacific Islanders (Stanford University, n.d.). I use "Latine" as a gender-inclusive term for Latina/o students (Méndez, 2023). Individuals may self-identify — and studies may use — "Hispanic," "Latina/o," or "Latinx" to refer to this group. Where cited papers used a different term, I retained their original language.
4. Career-focused dual enrollment (also known as career and technical education-focused dual enrollment) are dual enrollment courses that are directly aligned to career industries (e.g., information technology, nursing, etc), whereas academic-dual enrollment courses are courses that are intended as college-preparatory courses. While oversimplifying

categorizations, career-focused dual enrollment is also academic and often requires college, this distinction exists in the data and in other studies (e.g., Hemelt & Swiderski, 2022; Ryu et al., 2024).

5. Since all estimators yield a similar pattern of results, I present the subgroup findings using the TWFE estimator for ease of interpretation, as it provides a single average treatment effect that is more straightforward to communicate. Subgroup results from the event study and Callaway and Sant'Anna (CS) models are available in Appendix B.
6. The Oakland Unified School District–Peralta Community College District partnership launched in Fall 2015, just a few months before AB 288 was enacted (January 1, 2016).
7. While structured dual enrollment courses are also typically distinguished by course location (high school campus) and instructor type (community college faculty or credentialed high school instructor), these variables are not available in the data used for this study. The 95% high school student enrollment threshold therefore serves as the primary operational definition of structured dual enrollment, consistent with the approach used in Kurlaender et al. (2021). Kurlaender et al. (2021) used 100% as their benchmark for the proportion of high school students enrolled in community college dual enrollment courses at their schools. I use 95%, rather than 100%, as the proportion of dually enrolled students who are high school students to allow for misidentification of a high school student. I examine sensitivity to alternative threshold definitions of 90% and 100% for classifying structured dual enrollment; results are reported in Appendix C.

8. The Taxonomy of Programs (TOP) codes are California-specific codes, similar to the national Integrated Postsecondary Education Data System's Classification of Instructional Programs (CIP) code.
9. "Forbidden comparisons" is a term coined by Borusyak et al. (2024) in an earlier working paper version of their paper.
10. This is a rough calculation and does not take into account that the baseline characteristics of CCAP and never-CCAP schools differ, as shown in Table 2.
11. As with Table 3, Table 4 only displays the results for the variable of interest. Full tables with covariates are available upon request.
12. I additionally examined whether CCAP differentially expanded CTE versus academic structured dual enrollment across ethnoracial groups. Results were consistent across course types and similar to the main findings in Table 4, with CCAP increasing participation in both CTE and academic structured dual enrollment across all ethnoracial groups and no striking differences in the pattern of effects. These additional results are available upon request.
13. The reluctance to provide a Social Security number may reflect concerns related to documentation status.

Acknowledgments

This research was conducted through partnership agreements between the California Education Lab at the University of California, Davis and the California Department of Education and California Community Colleges Chancellor's Office (Michal Kurlaender, principal investigator). Research activities were supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A210217 to the Regents of the University of California, as well as by the College Futures Foundation and the Stuart Foundation. I am grateful to my colleagues Michal Kurlaender, Paco Martorell, Heather Rose, Betsey Friedmann, and Sherrie Reed for their guidance and collaboration throughout this project. I also thank Jonathan Isler and Marvin Cao of the California Department of Education; Colby Franklin, formerly of the California Department of Education; John Hetts of the California Community Colleges Chancellor's Office; and Valerie Lundy-Wagner and Erik Cooper, formerly of the California Community Colleges Chancellor's Office, for their expertise, partnership, and support. The findings and conclusions presented here are those of the author and do not necessarily reflect the views of the funders, including the U.S. Department of Education, or the agencies that provided data for this study.

References

Allen, D., & Dadgar, M. (2012). Does dual enrollment increase students' success in college? Evidence from a quasi-experimental analysis of dual enrollment in New York City. *New Directions for Higher Education*, *2012*(158), 11–19. https://doi.org/10.1002/he.20010

An, B. P. (2013). The impact of dual enrollment on college degree attainment: Do low-SES students benefit? *Educational Evaluation and Policy Analysis*, *35*(1), 57–75.

Anderson, K. P. (2024). Biased Opportunities: The Role of Implicit and Explicit Bias in Advanced Placement and Dual Enrollment. *Educational Evaluation and Policy Analysis*, *46*(4), 735–763. https://doi.org/10.3102/01623737231192487

Boochever, A. V. (2025). *Expanding Access and Advancing Equity: Evidence From Dual Enrollment, Career and Technical Education, and Teacher-Student Ethnoracial Matching* (Order No. 32241021). Available from Dissertations & Theses @ University of California; ProQuest Dissertations & Theses A&I. (3263417106). https://www.proquest.com/dissertations-theses/expanding-access-advancing-equity-evidence-dual/docview/3263417106/se-2

Boochever, A., Reed, S., & Kurlaender, M. (2025). *Expanding access to Career and Technical Education through dual enrollment (Working paper)*. California Education Lab, University of California, Davis. https://education.ucdavis.edu/sites/main/files/expanding_access_to_career_and_technical_education_through_dual_enrollment_with_title_page.pdf

Borusyak, K., Jaravel, X., & Spiess, J. (2024). Revisiting event-study designs: Robust and efficient estimation. *The Review of Economic Studies*, *91*(6), 3253–3285. https://doi.org/10.1093/restud/rdae007

Britton, T. A., Chelliah, B., Symns, M., & Campbell, V. (2019). College now...or later: Measuring the effects of dual enrollment on postsecondary access and success. (EdWorkingPaper: 19-118). In *EdWorkingPapers.com*. Annenberg Institute at Brown University. https://www.edworkingpapers.com/ai19-118

California Code, Education Code - EDC 76004. https://codes.findlaw.com/ca/education-code/edc-sect-76004/#:~:text=(a)(1)%20The,may%20not%20already%20be%20college

California State University Chico. (2019, December). *Underrepresented minority (URM) and first generation defining terms*. Institutional Research And Strategic Analytics. https://www.csuchico.edu/ir/by-the-numbers/urm-first-generation-definitions.shtml

Clarke, D., & Tapia-Schythe, K. (2021). Implementing the panel event study. *The Stata Journal*, *21*(4), 853–884. https://doi.org/10.1177/1536867X211063144

Cohodes, S. R., Corcoran, S. P., Jennings, J. L., & Sattin-Bajaj, C. (2025). When do informational interventions work? Experimental evidence from New York City high school choice. *Educational Evaluation and Policy Analysis*, *47*(1), 208–236. https://doi.org/10.3102/01623737231203293

Deng, G. (2024, September 11). College credit program for WA high schoolers sees enrollment jump now that it's free. *Washington State Standard*. https://washingtonstatestandard.com/2024/09/11/college-credit-program-for-wa-high-schoolers-sees-enrollment-jump-now-that-its-free/

Edmunds, J. A., Unlu, F., Phillips, B., Mulhern, C., & Hutchins, B. C. (2024). CTE-focused dual enrollment: Participation and outcomes. *Education Finance and Policy*, *19*(4), 612–633. https://doi.org/10.1162/edfp_a_00414

Engage R + D, & Career Ladders Project. (2023). *A cumbersome enrollment process named the top challenge to dual enrollment in California*. https://careerladdersproject.org/wp-content/uploads/2023/03/A-Cumbersome-Enrollment-Process-Named-the-Top-Challenge-to-Dual-enrollment-in-California-03.13.23.pdf

Friedmann, E., Kurlaender, M., Li, A., & Rumberger, R. (2020). *A leg up on college: The scale and distribution of community college participation among California high school students*. Wheelhouse: The Center for Community College Leadership and Research. https://education.ucdavis.edu/sites/main/files/ucdavis_wheelhouse_research_brief_vol5no1_online.pdf

Friedmann, E. Z., Reed, S. B., Kurlaender, M., & Dykeman, K. A. (2024). *A strong start for college and career: Dual enrollment participation from 9th to 12th grade*. Policy Analysis for California Education. https://edpolicyinca.org/publications/strong-start-college-and-career

Giani, M., Alexander, C., & Reyes, P. (2014). Exploring Variation in the Impact of Dual-Credit Coursework on Postsecondary Outcomes: A Quasi-Experimental Analysis of Texas Students. *The High School Journal*, *97*(4), 200–218.

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, *225*(2), 254–277. https://doi.org/10.1016/j.jeconom.2021.03.014

Hemelt, S. W., & Swiderski, T. (2022). College comes to high school: Participation and performance in Tennessee’s innovative wave of dual-credit courses. *Educational Evaluation and Policy Analysis*, *44*(2), 313–341. https://doi.org/10.3102/01623737211052310

Henneberger, A. K., Witzen, H., & Preston, A. M. (2020). A longitudinal study examining dual enrollment as a strategy for easing the transition to college and career for emerging adults. *Emerging Adulthood*, *10*(1), 225–236. https://doi.org/10.1177/2167696820922052

Howard Terrell, J., Mathias, J., Roldan-Rueda, D., & Blanchard, A. (2026). *Making dual enrollment work: Solving the access-success paradox with OUSD's point person model*. WestEd. https://www.wested.org/resource/making-dual-enrollment-work-solving-the-access-success-paradox-with-ousds-point-person-model/

Hughes, K. L., Rodríguez, O., Edwards, L., & Belfield, C. (2012). *Broadening the benefits of dual enrollment: Reaching underachieving and underrepresented students with career-focused programs*. https://ccrc.tc.columbia.edu/publications/broadening-benefits-dual-enrollment.html

Jaeger, D. A., & Page, M. E. (1996). Degrees matter: New evidence on sheepskin effects in the returns to education. *The Review of Economics and Statistics*, *78*(4), 733–740. https://doi.org/10.2307/2109960

Karp, M. M., Calcagno, J. C., Hughes, K. L., Jeong, D. W., & Bailey, T. R. (2007). *The postsecondary achievement of participants in dual enrollment: An analysis of student outcomes in two states*. Community College Research Center, Teachers College, Columbia University. https://ccrc.tc.columbia.edu/media/k2/attachments/dual-enrollment-student-outcomes.pdf

Kirby, C., Misra, K., Bagchi Misra, A., & Cox, S. P. (2023). The effects of dual-enrollment programs on students' post-secondary academic performance. *CESifo Economic Studies*, ifad004. https://doi.org/10.1093/cesifo/ifad004

Kurlaender, M., Reed, S., Grosz, M., Mathias, J., & Hughes, K. (2021). *A foot in the door: Growth in Participation and Equity in Dual Enrollment in California* (No. Volume 6, Number 7; p. 18). UC Davis, Wheelhouse: The Center for Community College Leadership and Research. https://education.ucdavis.edu/sites/main/files/wheelhouse_research_brief_vol_6_no_7_final.pdf

Lee, J., Fernandez, F., Ro, H. K., & Suh, H. (2022). Does dual enrollment influence high school graduation, college enrollment, choice, and persistence? *Research in Higher Education*, *63*(5), 825–848. https://doi.org/10.1007/s11162-021-09667-3

Marken, S., Gray, L., & Lewis, L. (2013). *Dual enrollment programs and courses for high school students at postsecondary institutions: 2010–11*. National Center for Education Statistics. https://nces.ed.gov/pubs2013/2013002.pdf

Mathias, J. R. (2022). *Dual enrollment and Career and Technical Education in California: Participation, access, and college and career readiness under Common Core and multiple measures accountability (Doctoral dissertation, University of California, Davis)*. ProQuest Dissertations Publishing. https://www.proquest.com/dissertations-theses/dual-enrollment-career-technical-education/docview/2759965233/se-2?accountid=14505

Méndez, L. (2023, June 5). A brief explainer on Latine and Latinx. *Hispanic Executive*. https://hispanicexecutive.com/latinx-latine-explainer/

Miller, T., Kosiewicz, H., Tanenbaum, C., Atchison, D., Knight, D., Ratway, B., Delhommer, S., & Levin, J. (2018). *Dual-Credit education programs in Texas: Phase II*. American Institutes for Research.

https://www.air.org/sites/default/files/Dual-Credit-Education-Programs-in-Texas-Phase-II-July-2018.pdf

Moynihan, D., Herd, P., & Harvey, H. (2015). Administrative Burden: Learning, Psychological, and Compliance Costs in Citizen-State Interactions. *Journal of Public Administration Research and Theory*, *25*(1), 43–69. https://doi.org/10.1093/jopart/muu009

Public Schools: College and Career Access Pathways Partnerships, No. AB 288 (2015). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB288

Ray, V., Herd, P., & Moynihan, D. (2023). Racialized burdens: Applying racialized organization theory to the administrative state. *Journal of Public Administration Research and Theory*, *33*(1), 139–152. https://doi.org/10.1093/jopart/muac001

Rodriguez, O., & Gao, N. (2021). *Dual enrollment in California*. Public Policy Institute of California. https://www.ppic.org/publication/dual-enrollment-in-california/

Rodriguez, O., Payares-Montoya, D., Ugo, I., & Gao, N. (2023). *Improving college access and success through dual enrollment*. Public Policy Institute of California. https://www.ppic.org/publication/improving-college-access-and-success-through-dual-enrollment/

Roth, J., Sant'Anna, P. H. C., Bilinski, A., & Poe, J. (2023). What's trending in difference-in-differences? A synthesis of the recent econometrics literature. *Journal of Econometrics*, *235*(2), 2218–2244. https://doi.org/10.1016/j.jeconom.2023.03.008

Ryu, W., Schudde, L., & Pack-Cosme, K. (2024). Dually noted: Examining the implications of dual enrollment course structure for students' course and college enrollment outcomes. *American Educational Research Journal*, 00028312241257453. https://doi.org/10.3102/00028312241257453

Shivji, A., & Wilson, S. (2019). *Dual enrollment: Participation and characteristics* (NCES 2019-176, Data Point). National Center for Education Statistics. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019176

Sparks, D., Griffin, S., & Fink, J. (2025). "Waiving" goodbye to placement testing: Broadening the benefits of dual enrollment through statewide policy. *Journal of Research on Educational Effectiveness*, 1–25. https://doi.org/10.1080/19345747.2025.2520855

Stanford University. (n.d.). *Dashboard definitions*. Stanford IDEAL. https://ideal.stanford.edu/data-reports/ideal-dashboards/dashboard-definitions

Sun, L., & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, *225*(2), 175–199. https://doi.org/10.1016/j.jeconom.2020.09.006

Velasco, T., Fink, J., Bedoya, M., & Jenkins, D. (2024). *The postsecondary outcomes of high school dual enrollment students a national and state-by-state analysis*. Community College Research Center, Teachers College at Columbia. https://ccrc.tc.columbia.edu/media/k2/attachments/postsecondary-outcomes-dual-enrollment-national-state.pdf

Xu, D., Solanki, S., & Fink, J. (2021). College acceleration for all? Mapping racial gaps in advanced placement and dual enrollment participation. *American Educational Research Journal*, *58*(5), 954–992. https://doi.org/10.3102/0002831221991138

Tables

Table 1

Initial CCAP Implementation and District Enrollment

The year CCAP was signed into effect	Number of First CCAPs signed that year	Enrollment in districts adopting CCAPs	Share of students in districts adopting CCAPs (%)
2015-16	6	15,152	0.9
2016-17	39	319,476	19.0
2017-18	31	137,689	8.2
2018-19	62	362,326	21.6
2019-20	54	191,194	11.3
2020-21	41	104,744	6.2
2021-22	14	37,387	2.2
Total	247		

Note. Charter school CCAPs are excluded from this table, as I excluded them from this study. The number of first CCAPs signed that year represent "unique" CCAP agreements; these are all the first agreements between a particular community college district and a K-12 school district (i.e., this table does not include renewal agreements). Enrollment in districts adopting CCAPs represents the number of students enrolled in districts during the year their district first adopted a CCAP. Share of students in districts adopting CCAPs represents the proportion of students enrolled in districts that adopted CCAPs that year.

Table 2

Comparison of CCAP and Non-CCAP Districts' Demographics in 2014–15

	Non-CCAP	CCAP
Average number of schools per district	3.3	5.5
Average number of students per district	1,070	2,377
Structured dual enrollment participation (%)	0.7	1.0
Independent dual enrollment participation (%)	4.8	5.6
Socioeconomically disadvantaged students (%)	47.3	51.5
Black (%)	6.1	5.8
Latine (%)	46.3	53.1
White (%)	31.3	23.7
Asian American (%)	8.7	10.2
Pacific Islander (%)	0.6	0.6
Filipino (%)	2.6	3.5
Native (%)	0.7	0.5
11th grade ELA proficiency (%)	57.2	56.3
College-going rate (%)	56.4	64.3
Total number of districts	233	241
Total number of students	249,221	572,937

Note. Table 2 compares 2014–15 demographic characteristics between districts that implemented a CCAP agreement at any point between 2016 and 2022 and those that never implemented a CCAP. The average number of schools includes any school serving 11th and 12th graders, and the average number of students refers specifically to 11th- and 12th-grade enrollment. Consistent with the sample used in this study, charter schools are excluded from this table. ELA proficiency is defined as scoring Met or Exceeded Standards on the 11th-grade SBAC assessment. The college-going rate measures the proportion of public high school completers who enrolled in postsecondary institutions within 12 months of high school completion.

Table 3

Effects of CCAP on Dual Enrollment Participation

Panel A: Structured Dual Enrollment				
	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.018*** (0.005)	0.008*** (0.002)		
Lag 0			0.010*** (0.003)	0.004*** (0.001)
Lag 1			0.014*** (0.004)	0.006*** (0.002)
Lag 2			0.023*** (0.006)	0.010*** (0.003)
Lag 3			0.024*** (0.008)	0.012*** (0.004)
Lead 4			-0.002 (0.006)	-0.003 (0.002)
Lead 3			-0.007* (0.004)	-0.004** (0.002)
Lead 2			-0.005** (0.003)	-0.002** (0.001)
Observations	7,244,509	4,249	7,244,509	4,249

Panel B: Independent Dual Enrollment				
	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.000 (0.002)	0.000 (0.002)		
Lag 0			0.001 (0.002)	0.001 (0.001)
Lag 1			0.003 (0.002)	0.001 (0.001)
Lag 2			0.001 (0.003)	-0.001 (0.002)
Lag 3			0.001 (0.006)	0.000 (0.003)
Lead 4			0.000 (0.006)	0.002 (0.002)
Lead 3			0.004*** (0.002)	0.002* (0.001)
Lead 2			0.002 (0.002)	0.001 (0.001)
Observations	7,244,509	4,249	7,244,509	4,249

Note. Standard errors in parentheses, clustered at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TWFE shows estimates from the two-way fixed effects difference-in-differences (DiD) estimator; CS shows estimates from the Callaway and Sant'Anna (2021) estimator; and Event Study shows estimates from an event study specification. The CS estimate for *Has CCAP* reflects the average group-time treatment effect (ATT) across post-treatment periods and is comparable to the *Has CCAP* estimate from the TWFE model. Lag and Lead coefficients from CS can also be interpreted similarly to those in the event study model.

Table 4

TWFE of the Effect of CCAP on Structured Dual Enrollment Participation, by Ethnoracial Group

Panel A: Structured Dual Enrollment

	Black	Latine	Asian	Filipino	Pacific Islander	White	Native
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Has CCAP	0.021*** (0.005)	0.013** (0.006)	0.025*** (0.007)	0.025* (0.013)	0.029*** (0.007)	0.024*** (0.007)	0.007 (0.007)
Observations	381,287	3,810,840	732,821	228,219	37,181	1,741,361	35,234

Panel B: Independent Dual Enrollment

	Black	Latine	Asian	Filipino	Pacific Islander	White	Native
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Has CCAP	-0.003 (0.004)	-0.003 (0.002)	0.008 (0.005)	-0.006 (0.006)	-0.003 (0.004)	0.006 (0.004)	-0.004 (0.006)
Observations	381,287	3,810,840	732,821	228,219	37,181	1,741,361	35,234

Note. Each column represents a separate regression model in which the outcome is independent dual enrollment participation for the ethnoracial group specified in the column header. Covariates are included but not shown; estimates available upon request. Standard errors in parentheses, clustered at the district level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5

Significance Test Between Structured Dual Enrollment CCAP Estimates Across Ethnoracial Groups

Panel A: Structured Dual Enrollment

	Latine	Asian	Filipino	Pacific Islander	White	Native
Black	1.02	-0.46	-0.29	-0.93	-0.35	1.63
Latine		-1.30	-0.84	-1.74	-1.19	0.65
Asian			0.00	-0.40	0.10	1.82
Filipino				-0.27	0.07	1.22
Pacific Islander					0.51	2.22**
White						1.72

Panel B: Independent Dual Enrollment

	Latine	Asian	Filipino	Pacific Islander	White	Native
Black	0.00	-1.72	0.42	0.18	-1.59	0.14
Latine		-2.04**	0.47	0.22	-2.01**	0.16
Asian			1.79	1.87	0.31	1.54
Filipino				-0.28	-1.66	-0.24
Pacific Islander					-1.77	0.00
White						1.39

Note. ** $p < 0.05$. The number in each cell represents the t-statistic of the significance between the two races' estimates. At a significance level of 0.05, any absolute value greater than 1.96 would be considered significant.

Table 6

Change in Structured and Independent Dual Enrollment by Type, 2013-14 to 2021-22

	Structured			Independent		
	2013-14	2021-22	Percent change	2013-14	2021-22	Percent change
Academic	11,699	69,679	496%	38,174	97,612	156%
CTE	2,990	36,233	1,112%	8,343	22,035	164%

Note. Table shows the number of dual enrollment course enrollments across structured and independent dual enrollment in 2013–14 and 2021–22 and the percent change between these years. Enrollments are at the course level; individual students may be counted more than once if they enrolled in multiple dual enrollment courses.

Table 7

Change in Dual Enrollments by Course Subject, 2013-14 to 2021-22

Panel A: Structured Dual Enrollment

Subject	Course Type Composition	2013-14	2021-22	Enrollment Change	Percent Change
Environmental Sciences and Technologies	Mixed	0	465	465	*
Agriculture and Natural Resources	CTE	58	3,609	3,551	6,122%
Health	CTE	300	6,265	5,965	1,988%
Foreign Language	Academic	211	3,481	3,270	1,550%
Humanities (Letters)	Academic	1,122	18,182	17,060	1,520%
Biological Sciences	Academic	161	2,302	2,141	1,330%
Engineering and Industrial Technologies	Mixed	329	4,049	3,720	1,131%
Education	Mixed	334	3,991	3,657	1,095%
Information Technology	CTE	207	2,329	2,122	1,025%
Family and Consumer Sciences	CTE	415	4,518	4,103	989%
Media and Communications	CTE	230	2,441	2,211	961%
Business and Management	CTE	578	5,274	4,696	812%
Physical Sciences	Academic	156	1,405	1,249	801%
Psychology	Academic	621	4,010	3,389	546%
Social Sciences	Academic	2,682	17,104	14,422	538%
Public and Protective Services	CTE	747	4,052	3,305	442%
Mathematics	Academic	1,322	6,998	5,676	429%
Fine and Applied Arts	Mixed	1,697	6,550	4,853	286%
Architecture and Related Technologies	CTE	90	233	143	159%
Interdisciplinary Studies	Academic	3,391	8,558	5,167	152%

Panel B: Independent Dual Enrollment

Subject	Course Type Composition	2013-14	2021-22	Enrollment Change	Percent Change
Environmental Sciences and Technologies	Mixed	90	414	324	360%
Information Technology	CTE	1,045	4,698	3,653	350%
Social Sciences	Academic	6,320	23,709	17,389	275%
Media and Communications	CTE	771	2,857	2,086	271%
Health	CTE	736	2,545	1,809	246%
Biological Sciences	Academic	995	3,222	2,227	224%
Psychology	Academic	2,458	7,510	5,052	206%
Law	Academic	48	146	98	204%
Business and Management	CTE	1,600	4,527	2,927	183%
Physical Sciences	Academic	1,667	4,644	2,977	179%
Architecture and Related Technologies	CTE	53	144	91	172%
Humanities (Letters)	Academic	5,994	16,182	10,188	170%
Library Science	Academic	118	308	190	161%
Mathematics	Academic	5,130	12,979	7,849	153%
Foreign Language	Academic	2,730	6,210	3,480	127%
Family and Consumer Sciences	CTE	1,352	2,816	1,464	108%
Agriculture and Natural Resources	CTE	185	379	194	105%
Fine and Applied Arts	Mixed	4,954	9,930	4,976	100%
Engineering and Industrial Technologies	Mixed	1,219	2,075	856	70%
Education	Mixed	4,595	7,709	3,114	68%
Public and Protective Services	CTE	1,463	2,229	766	52%
Interdisciplinary Studies	Academic	2,931	4,374	1,443	49%

Note. This excludes any subject with 50 or fewer students participating in 2021-22. Course type composition reflects whether a subject's enrollments are predominantly CTE, predominantly academic, or a mix of both. Subjects in which all or all but one course section are of the same type are classified as CTE or Academic; subjects with a more of a mix of course types are classified as Mixed.

Figure Captions

Figure 1

Independent and structured dual enrollment participation, 2013-14 – 2021-22

Note. Figure shows the percentage of 11th- and 12th-grade students participating in dual enrollment over time. The blue line for structured dual enrollment refers to students participating in dual enrollment through formal CCAP agreements between K-12 districts and community college districts. The orange line for independent dual enrollment refers to students enrolled in community college courses outside of formal partnership agreements.

Figure 2

Effect of Dual Enrollment Expansion on Structured Dual Enrollment Participation

Note. Time 0 is the year the CCAP was implemented. Time -1 is the comparison year.

Figure 3

Effect of Dual Enrollment Expansion on Independent Dual Enrollment Participation

Note. Time 0 is the year the CCAP was implemented. Time -1 is the comparison year.

Figures

Figure 1

Independent and structured dual enrollment participation, 2013-14 – 2021-22

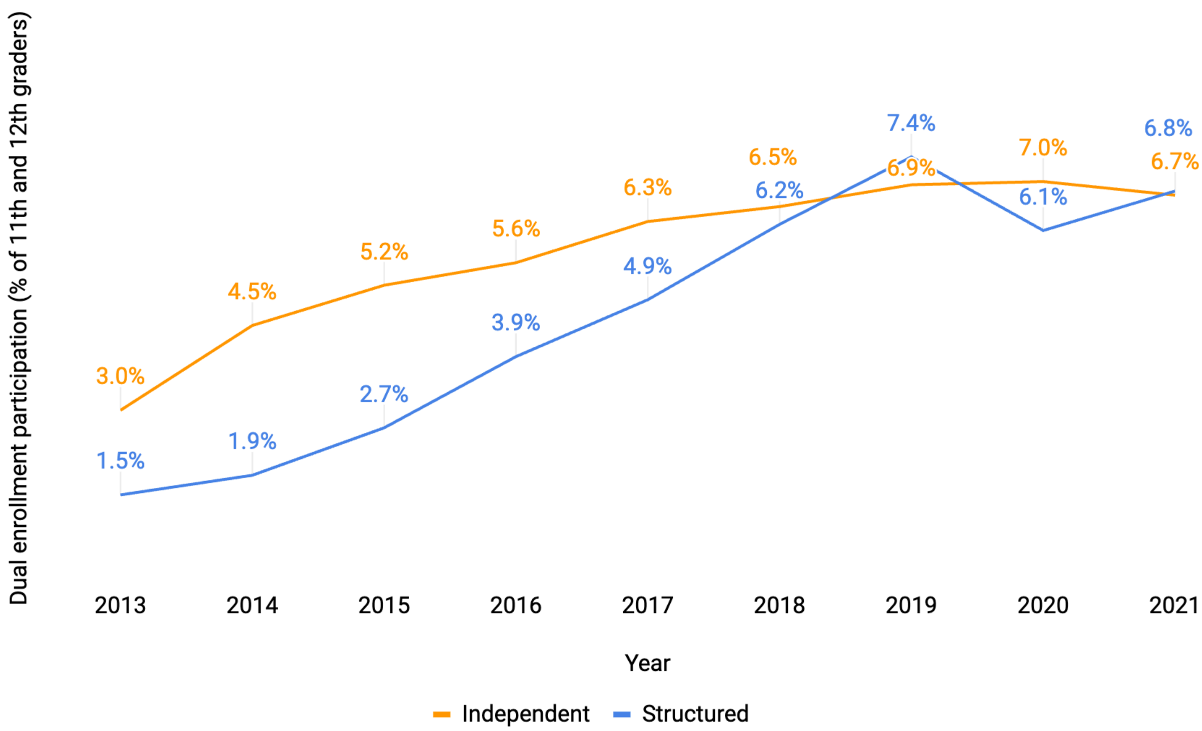


Figure 2

Effect of Dual Enrollment Expansion on Structured Dual Enrollment Participation

(A) Event Study (B) Callaway & Sant'Anna (2021)

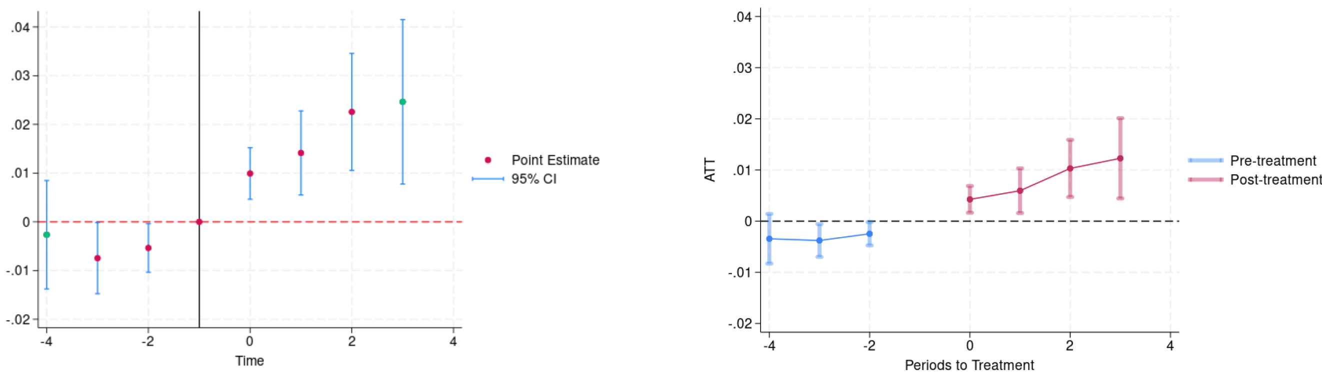
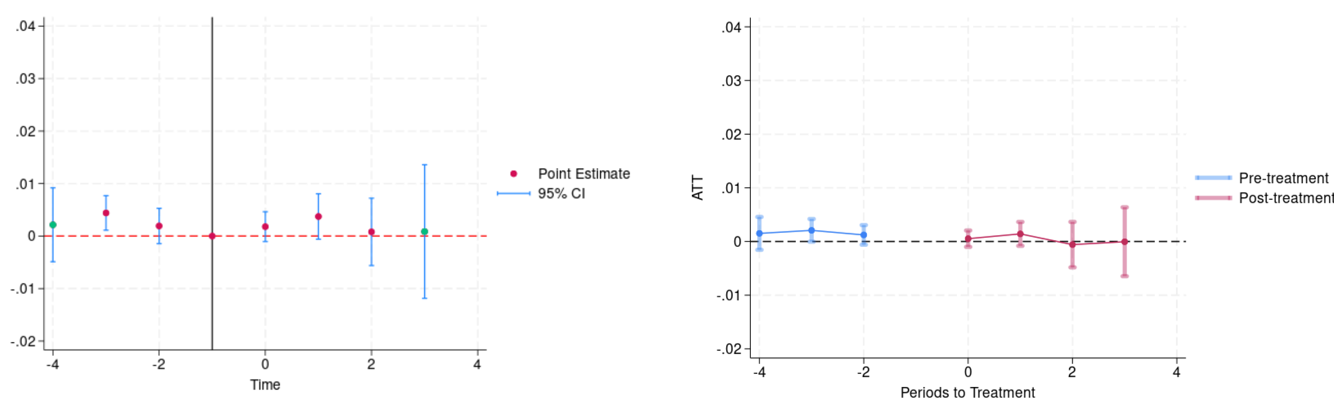


Figure 3

Effect of Dual Enrollment Expansion on Independent Dual Enrollment Participation

(A) Event Study (B) Callaway & Sant'Anna (2021)



Appendix A

Identifying Assumption Test

Table A1

Regression of Ethnoracial Group and SED on Policy Variable

	Black	Native	Asian	Filipino	Pacific Islander	White	Latine	Multiracial	SED
Has CCAP	0.001	0.000	-0.002	-0.001	0.000	0.004	-0.003	0.000	0.000
	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)	(0.003)	(0.003)	(0.001)	(0.005)
Constant	0.052***	0.005***	0.102***	0.032***	0.005***	0.239***	0.527***	0.030***	0.487***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.002)
Observations	7,244,496	7,244,496	7,244,496	7,244,496	7,244,496	7,244,496	7,244,496	7,244,496	7,244,496
R^2	0.055	0.046	0.171	0.038	0.005	0.201	0.223	0.019	0.188

Note. This table presents results from regressions of student demographic characteristics on the CCAP indicator to test for changes in observable characteristics following CCAP implementation. Each column represents a separate regression with the specified demographic variable as the dependent variable. All regressions include year and district fixed effects. Standard errors are clustered at the district level and shown in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

Appendix B

Effects of CCAP on Structured Dual Enrollment Participation by Ethnoracial Group Using Event Study and Callaway & Sant'Anna Estimators

Table B1

Effects of CCAP on Structured Dual Enrollment Participation by Ethnoracial Group using Event Study

	Black (1)	Latine (2)	Asian (3)	Filipino (4)	Pacific Islander (5)	White (6)	Native (7)
lag0	0.012*** (0.003)	0.008** (0.003)	0.019*** (0.004)	0.014** (0.006)	0.011 (0.008)	0.011*** (0.004)	0.00 (0.009)
lag1	0.018** (0.007)	0.010* (0.005)	0.029*** (0.006)	0.023** (0.011)	0.032*** (0.009)	0.020*** (0.006)	0.003 (0.009)
lag2	0.020*** (0.007)	0.011 (0.007)	0.041*** (0.009)	0.030* (0.016)	0.038** (0.016)	0.031*** (0.008)	0.014 (0.012)
lag3	0.011 (0.009)	0.006 (0.012)	0.050*** (0.009)	0.028 (0.022)	0.039** (0.017)	0.040*** (0.011)	0.006 (0.015)
Observations	381,301	3,813,910	732,825	228,215	37,197	1,741,381	35,255

Note. This table presents results from separate regressions by ethnoracial group examining the effects of CCAP on structured dual enrollment participation using an event study methodology. Each column represents results for the specified ethnoracial group. Standard errors are clustered at the district level and shown in parentheses. All regressions include year and district fixed effects and the full set of covariates shown in Table C1. * p < 0.10, ** p < 0.05, *** p < 0.01

Table B2

Effects of CCAP on Structured Dual Enrollment Participation by Ethnoracial Group using Callaway & Sant'Anna Estimator

	Black (1)	Latine (2)	Asian (3)	Filipino (4)	Pacific Islander (5)	White (6)	Native (7)
Has CCAP	0.019*** (0.005)	0.016*** (0.005)	0.016*** (0.007)	0.018* (0.010)	0.009 (0.012)	0.014*** (0.005)	0.007 (0.011)
Observations	4,249	4,249	4,249	4,249	4,249	4,249	4,249

Note. This table presents results from separate regressions by ethnoracial group examining the effects of CCAP on structured dual enrollment participation using Callaway & Sant'Anna estimator methodology. Each column represents results for the specified ethnoracial group. Standard errors are clustered at the district level and shown in parentheses.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table B3

Effects of CCAP on Independent Dual Enrollment Participation by Ethnoracial Group using Event Study

	Black (1)	Latine (2)	Asian (3)	Filipino (4)	Pacific Islander (5)	White (6)	Native (7)
lag0	0.001	0.001	0.006*	0.000	-0.007	0.002	-0.006
	(0.003)	(0.001)	(0.003)	(0.004)	(0.005)	(0.003)	(0.007)
lag1	0.002	0.001	0.009*	0.003	0.003	0.008**	-0.006
	(0.006)	(0.002)	(0.004)	(0.008)	(0.007)	(0.004)	(0.008)
lag2	-0.006	-0.005	0.013**	-0.003	-0.005	0.009**	0.001
	(0.005)	(0.003)	(0.006)	(0.006)	(0.007)	(0.004)	(0.010)
lag3	-0.010*	-0.007	0.022**	-0.004	-0.004	0.014**	-0.003
	(0.005)	(0.006)	(0.009)	(0.007)	(0.009)	(0.007)	(0.012)
Observations	381,294	3,810,841	732,834	228,227	37,197	1,741,361	35,248

Note. This table presents results from separate regressions by ethnoracial group examining the effects of CCAP on independent dual enrollment participation using event study estimator methodology. Each column represents results for the specified ethnoracial group. Standard errors are clustered at the district level and shown in parentheses. All regressions include year and district fixed effects and the full set of covariates shown in Table C1. * p < 0.10, ** p < 0.05, *** p < 0.01

Table B4

Effects of CCAP on Independent Dual Enrollment Participation by Ethnoracial Group using Callaway & Sant'Anna Estimator

	Black (1)	Latine (2)	Asian (3)	Filipino (4)	Pacific Islander (5)	White (6)	Native (7)
Has CCAP	0.003	-0.002	0.002	0.001	-0.002	0.002	-0.012
	(0.004)	(0.003)	(0.006)	(0.006)	(0.010)	(0.006)	(0.012)
Observations	4,249	4,249	4,249	4,249	4,249	4,249	4,249

Note: This table presents results from separate regressions by ethnoracial group examining the effects of CCAP on independent dual enrollment participation using the Callaway & Sant'Anna estimator methodology. Each column represents results for the specified ethnoracial group. Standard errors are clustered at the district level and shown in parentheses.
* p < 0.10, ** p < 0.05, *** p < 0.01

Appendix C

Table C1

Effects of CCAP on Dual Enrollment Participation (All Covariates Included)

Panel A: Structured Dual Enrollment				
	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.018*** (0.005)	0.008*** (0.003)		
Lag 0			0.010*** (0.003)	0.004*** (0.001)
Lag 1			0.014*** (0.004)	0.006*** (0.002)
Lag 2			0.023*** (0.006)	0.010*** (0.003)
Lag 3			0.025*** (0.009)	0.012*** (0.004)
Lead 4			-0.003 (0.006)	-0.004 (0.003)
Lead 3			-0.007** (0.004)	-0.004** (0.002)
Lead 2			-0.005** (0.003)	-0.002** (0.001)
School size (log)	0.012*** (0.002)		0.012*** (0.002)	
Avg. # of APs	0.000*** (0.000)		0.000*** (0.000)	
% SED	0.001 (0.014)		0.000 (0.014)	
%Latine	-0.007 (0.018)		-0.007 (0.018)	
%Black	-0.099*** (0.029)		-0.099*** (0.029)	
Student SED	-0.004*** (0.001)		-0.004*** (0.001)	
Black	-0.005*** (0.002)		-0.005*** (0.002)	
Latine	-0.002 (0.002)		-0.002 (0.002)	
Filipino	0.007*** (0.002)		0.007*** (0.002)	
Pacific Islander	-0.004** (0.002)		-0.004** (0.002)	
Multiracial	-0.002 (0.001)		-0.002 (0.001)	
Native	-0.008*** (0.002)		-0.008*** (0.002)	
Asian	0.008*** (0.002)		0.008*** (0.002)	
Constant	-0.022 (0.014)		-0.021 (0.023)	
Observations	7,239,799	4,249	7,239,799	4,249

	Panel B: Independent Dual Enrollment			
	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.000 (0.002)	0.000 (0.002)		
Lag 0			0.002 (0.001)	0.000 (0.000)
Lag 1			0.004* (0.002)	0.001 (0.001)
Lag 2			0.001 (0.003)	-0.001 (0.002)
Lag 3			0.001 (0.006)	-0.000 (0.003)
Lead 4			0.002 (0.004)	0.002 (0.002)
Lead 3			0.004*** (0.002)	0.002* (0.001)
Lead 2			0.002 (0.002)	0.001 (0.001)
School size (log)	0.007*** (0.003)		0.007*** (0.003)	
Avg. # of APs	-0.001*** (0.000)		-0.001*** (0.000)	
% SED	-0.038 (0.030)		-0.038 (0.030)	
%Latine	-0.076* (0.046)		-0.076* (0.046)	
%Black	-0.102*** (0.028)		-0.102*** (0.029)	
Student SED	-0.013*** (0.001)		-0.013*** (0.001)	
Black	-0.010*** (0.002)		-0.010*** (0.002	
Latine	-0.013*** (0.002)		-0.013*** (0.002)	
Filipino	-0.004 (0.003)		-0.004 (0.003)	
Pacific Islander	-0.009*** (0.003)		-0.009*** (0.003)	
Multiracial	0.00 (0.002)		0.000 (0.002)	
Native	-0.013*** (0.003)		-0.013*** (0.003)	
Asian	0.045*** (0.005)		0.045*** (0.005)	
Constant	0.110*** (0.015)		0.097*** (0.018)	
Observations	7,239,799	4,249	7,239,799	4,249

Note. This table displays the full regression results, including all covariates used in the model specification for both structured dual enrollment (Panel A) and independent dual enrollment (Panel B). TWFE and event study models include district and year fixed effects (not shown). Standard errors are clustered at the district level and shown in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix D

Using Alternative Thresholds to Classify Structured Dual Enrollment

Table D1

Effects of CCAP on Dual Enrollment Participation (90% High School Student Threshold)

Panel A: Structured Dual Enrollment				
	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.018*** (0.005)	0.008*** (0.003)		
Lag 0			0.011*** (0.003)	0.004*** (0.001)
Lag 1			0.015*** (0.004)	0.006*** (0.002)
Lag 2			0.023*** (0.006)	0.010*** (0.003)
Lag 3			0.024** (0.009)	0.012*** (0.004)
Lead 4			0.003 (0.006)	-0.003 (0.002)
Lead 3			-0.007* (0.004)	-0.004** (0.002)
Lead 2			0.004 (0.002)	-0.002 (0.001)
Observations	7,244,509	4,249	7,244,509	4,249

Panel B: Independent Dual Enrollment				
	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.000 (0.002)	0.000 (0.002)		
Lag 0			0.002 (0.001)	0.001 (0.001)
Lag 1			0.004* (0.002)	0.001 (0.001)
Lag 2			0.001 (0.003)	0.000 (0.002)
Lag 3			0.001 (0.006)	0.000 (0.003)
Lead 4			0.003 (0.004)	0.001 (0.001)
Lead 3			0.001 (0.002)	0.002** (0.001)
Lead 2			0.001 (0.001)	0.001 (0.001)
Observations	7,244,509	4,249	7,244,509	4,249

Note. Standard errors in parentheses, clustered at the district level. * p < 0.10, ** p < 0.05, *** p < 0.01

Table D2

Effects of CCAP on Dual Enrollment Participation (100% High School Student Threshold)

Panel A: Structured Dual Enrollment

	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.016*** (0.005)	0.007*** (0.002)		
Lag 0			0.009*** (0.003)	0.002*** (0.001)
Lag 1			0.012*** (0.004)	0.002** (0.001)
Lag 2			0.021*** (0.004)	0.004*** (0.002)
Lag 3			0.024*** (0.008)	0.003 (0.002)
Lead 4			0.001 (0.005)	-0.003 (0.002)
Lead 3			-0.007** (0.003)	-0.004** (0.002)
Lead 2			-0.005** (0.003)	-0.001** (0.000)
Observations	7,244,509	4,249	7,244,509	4,249

Panel B: Independent Dual Enrollment

	TWFE	Pooled CS	Event Study	Year-by-Year CS
Independent Variable	(1)	(2)	(3)	(4)
Has CCAP	0.002 (0.003)	0.001 (0.002)		
Lag 0			0.003 (0.002)	0.001 (0.001)
Lag 1			0.002 (0.002)	0.003* (0.001)
Lag 2			0.004 (0.004)	0.001 (0.003)
Lag 3			0.002 (0.008)	0.001 (0.004)
Lead 4			0.002 (0.004)	0.001 (0.002)
Lead 3			0.004* (0.002)	0.002* (0.001)
Lead 2			0.002 (0.002)	0.001 (0.001)
Observations	7,244,509	4,249	7,244,509	4,249

Note. Standard errors in parentheses, clustered at the district level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$