CCRC COMMUNITY COLLEGE RESEARCH CENTER
Teachers College, Columbia University

The Link Between Dual Enrollment Partnership Characteristics and Outcomes: Findings From Texas

Kimberly Pack-Cosme
Wonsun Ryu
Lauren Schudde
University of Texas at Austin

June 2025

CCRC Working Paper No. 138

Address correspondence to:

Lauren Schudde
Associate Professor, Educational Leadership and Policy
University of Texas at Austin
George I. Sanchez Building
1912 Speedway D5400
Austin, TX 78712
(512) 471-1623
Email: schudde@austin.utexas.edu

Authors are listed in alphabetical order; they contributed equally to this work.

The research reported here was supported by a grant to the Community College Research Center from the Gates Foundation and by the Eunice Kennedy Shriver National Institute of Child Health and Human Development through Grant P2CHD042849 awarded to the Population Research Center at the University of Texas at Austin. The opinions expressed are those of the authors and do not represent views of the foundation or the National Institutes of Health.

Abstract

Dual enrollment (DE) offers students the opportunity to earn college credits while in high school. Although variation in partnership contexts likely contributes to differences in DE access, structures, and outcomes, the extent of variation across DE partnerships is unclear. To build an understanding of variation in key DE structures and outcomes across partnerships, we examine DE partnerships between high schools and community colleges in Texas, where DE students account for one fifth of all community college enrollees. We use statewide administrative data from Texas to identify all DE course enrollments across three cohorts of high school students, constructing partnership-level measures and outcomes for each unique high school–college pairing. Through descriptive and regression analyses, we describe DE partnerships and estimate which DE structures and contexts predict aggregate DE course completion, college enrollment, and degree attainment. This study illuminates considerable variation in DE course structures and student composition across partnerships. Our regression results indicate that DE course structures (e.g., course subject, location, instructor type) are less practically meaningful in predicting a partnership's aggregate outcomes compared with contextual measures such as geographic locale (i.e., rural or urban) or use of an early college high school (ECHS) model. Future research should examine how to meet the needs of DE students within their geographic contexts and whether (and which) practices from ECHS models are effective for students taking DE courses outside of the ECHS model.

Table of Contents

1. Introduction

Dual enrollment (DE)—also known as concurrent enrollment or dual credit—offers high school students the opportunity to earn college credits. DE spans all 50 states, and nearly 2.5 million students participate each year (Fink, 2024; Taie & Lewis, 2020). DE programs can help students build early academic momentum toward college credentials (Giani et al., 2014; Karp et al., 2007; Wang et al., 2015). Compared with nonparticipants, DE students generally experience higher rates of high school graduation and college enrollment and, among those who go to college, improved persistence and degree completion (An & Taylor, 2019; Lee et al., 2022).

To facilitate high school students earning college credit, actors across partnering institutions collaboratively make decisions about DE course offerings, resource allocation, and staffing (Fink et al., 2023). DE constitutes an interorganizational field in which partner high schools and colleges draw on the same "suppliers" (instructors) and "clients" (students) (Levi Martin, 2000; Ryu et al., 2024). Maintaining cross-sector partnerships requires institutional buy-in, dedicated resources, clear communication of goals and outcomes, and continual maintenance (Amey, 2010). High schools and colleges have considerable autonomy over how to structure their DE partnership and course offerings. Their decisions may shape student success in DE, with implications for long-term educational attainment. Understanding variation in DE outcomes across interorganizational—i.e., partnership-level—characteristics could help high schools and colleges improve program structures to promote DE and postsecondary success.

Although some students engage in DE through structured early college high school (ECHS) programming, most students enroll in what we refer to as á la carte DE, whereby discrete DE courses are made available through a partnership between students' local public high school and community college (Mehl et al., 2020). Partnerships between high schools and colleges are complex, in part because they rely on numerous institutional actors with their own interests. Such partnerships require considerable intentionality from the actors involved (Amey, 2010). In Texas, state policy mandates that students be afforded the opportunity to enroll in college acceleration options such as DE or Advanced Placement (AP) courses, but individual institutions and districts can decide whom to partner with and how these partnerships operate.

Despite the proliferation of research demonstrating that DE boosts individual student outcomes, including college enrollment and credential attainment (see An & Taylor, 2019), there is little information on DE high school–college partnerships and which partnership characteristics predict partnership outcomes. Aggregate metrics such as rates of college matriculation and attainment are important indicators of student success for high schools and colleges, respectively, where predictors of those outcome metrics may inform decision-making and priorities among high school–college partners. In this paper, we use statewide administrative data from Texas to identify all DE course enrollments across three cohorts of high school students, constructing partnership-level outcome metrics for each unique high school–college pairing. Through descriptive and regression analyses, we provide insights about the structure of DE partnerships and the extent to which DE structures and contexts predict aggregate DE student outcomes, such as the proportion of the DE partnership's students that subsequently enter college or attain a postsecondary credential.

1.1 Dual Enrollment as an Interorganizational Field: Variation in Partnerships

Although research evidence consistently demonstrates that there are, on average, benefits from DE participation, DE course offerings and course structures vary greatly across—and within—partnerships (Fink et al., 2017; Villarreal, 2018). How DE is implemented—including the subject offered, course location and modality, and instructor assigned— likely shapes student experiences and, we argue, outcomes. We build a conceptual framework to understand variation across DE partnerships, anticipating that some partnerships have stronger outcomes than others and that partnership characteristics may predict aggregate outcomes (Mehl et al., 2020). DE partnerships vary in terms of the students who gain access to them, contexts of partner institutions (including resources, geographic location, and student composition), and course availability and structures (e.g., DE course type, course location, modality, instructor, and subject).

1.2 Dual Enrollment Access Across Partnerships: Who Participates?

DE may increase college access, credit accrual, and attainment for underserved students when such programming is made accessible to them (Education Commission of the States [ECS], 2022; Mehl et al., 2020). However, on average, White students and

affluent students are more likely to enroll in DE programs than Black and Hispanic students and students from low-income households (Hemelt & Swiderski, 2022; Miller et al., 2017; Xu et al., 2021). At the same time, racial gaps in DE participation are smaller than in AP or International Baccalaureate (IB) participation, which represent more costly alternatives to earning college credit for students in states or districts with subsidized DE, though populations of students taking AP, IB, and DE coursework often overlap (Ryu et al., 2024; Xu et al., 2021).

In many states, students must meet specific academic eligibility criteria based on standardized test scores, high school GPA, and/or teacher recommendations (ECS, 2022; Xu et al., 2021) in order to participate in DE. Given academic eligibility standards, students with lower academic preparedness and performance levels are less likely to enroll in DE or in other college acceleration programs such as AP or IB. Research on the characteristics of DE students suggests that those who participate in DE have higher test scores and GPAs and are more likely also to participate in other forms of college acceleration compared with nonparticipants (An, 2013; Kevelson et al., 2023; Ryu et al., 2024). Understanding variation in DE partnership outcomes requires information on which students gained access under each partnership, given variation across racial, socioeconomic, and academic backgrounds.

1.3 Dual Enrollment Partnership Contexts

The contexts and constraints of partnering institutions are informed by resources, as both partner institutions must make investments of financial and human capital (Belfield et al., 2023), and by geographic locale, where rural institutions may struggle to offer face-to-face coursework and support services because of the distance between high schools and their college partners. The challenge of resource allocation speaks to the need for strong, collaborative high school–college partnerships to help facilitate DE courses. The financial context of each institution informs the success of DE partnerships, as leaders at both institutions must carefully consider financial disincentives and potential revenue sources (Mehl et al., 2020); pooled financial resources in a high school–college partnership appear particularly important for sustaining, rather than starting, the partnership (Mokher & Jacobson, 2021). Partnership resources for DE may also be shaped by how many partnerships each institution participates in, which may correlate

with what resources those institutions are able to allocate toward supporting DE students (e.g., the provision of counselors at both the high school and college). Variation in the number of DE students enrolled within that partnership may also inform partnership-level characteristics such as average class size.

Dual enrollment partnerships employ various program designs, from ECHSs to more prevalent à la carte models. ECHS partnerships typically target students underrepresented in higher education (namely, Black, Hispanic, and low-income students), provide a clear sequence of DE coursework, and offer academic supports such as tutoring (Griffin et al, 2024). Qualitative research suggests that the immersive ECHS environment socializes students for college while providing academic support they would not receive through taking college courses on their own (Duncheon, 2020). Because many ECHSs are oversubscribed, the ECHS model has been the focus of some of the most rigorous evaluations of DE; evidence from admission lotteries links ECHS participation to higher rates of college matriculation, persistence, and degree attainment (Edmunds et al., 2020; Song et al., 2024). There is minimal research comparing outcomes for ECHS and non-ECHS DE partnerships.

The institutional context of each organization also shapes access to DE: Participation varies across schools' racial and socioeconomic compositions and geographies (Harmon & Johnson, 2023; Spencer & Maldonado, 2021). The demographics of the school and college may inform how partners design DE coursework and prioritize specific success outcomes. For example, high school leaders may set success metrics according to the composition and perceived goals of their students, ranging from short-term college credential attainment to credit accrual toward a bachelor's degree (Fink et al., 2023).

Geographic locale, which includes the distance between high school and college, can create additional complications for DE partners as they design and staff coursework. Although geographic locale is a predictor of DE program availability, it is less clear how it predicts success among DE participants. Spencer and Maldonado (2021) used nationally representative data to illustrate that, relative to suburban schools, those in rural and town locations were each 5–10 percentage points more likely to offer DE, but those in urban locales were 2 percentage points less likely to do so. However, this does not

illuminate how common DE participation was in those locales or how locale may differentially shape the way students experience DE (e.g., through course modality and location). At rural colleges and high schools, online DE courses are easier to schedule and staff than in-person courses, since the latter requires transporting students to the college or identifying qualified instructors at the high school (Fink et al., 2023). When rural DE partnerships rely on online DE courses, they often make other investments to improve student engagement with course content, including in technology classrooms and course facilitators (Fink et al., 2023; Mehl et al., 2020).

1.4 Dual Enrollment Course Structures

Organizational contexts of schooling, including how classes are structured, have been linked to student outcomes for decades (Barr & Dreeben, 1983; Dallavis & Berends, 2023). In DE partnerships, high schools and colleges leverage their resources to determine which courses to offer and how to structure and staff them. Prior research on DE course structures suggests differences in student outcomes across DE course type and subject, location, modality, and composition, as well as instructor affiliation.

Course type and subject. DE partnerships may construct various DE curricular pathways, diverging by DE course type (academic DE or career-technical education [CTE] DE) and whether they offer gateway college courses or more advanced offerings. Although half of public high schools in the country offer CTE DE courses (Thomas et al., 2013), most DE course enrollments are in academic DE courses (Ryu et al., 2024). CTE DE courses tend to have smaller class sizes—which may require more resources—than academic DE courses, likely because they are hands-on in nature and require specific facilities and tools to teach technical skills (Ryu et al., 2024). Decisions over which type of DE course to offer can affect student outcomes, as students in CTE DE are less likely to attend college after high school compared with peers in academic DE courses (Ryu et al., 2024). Recent evidence from Tennessee suggests that expanding CTE DE rather than academic DE has increased DE participation among underserved student populations but has not led to increases in DE course completion (Hemelt & Swiderski, 2022). Given variation in student backgrounds, course structures, and outcomes across academic and CTE DE courses, research on DE should differentiate between course types (Blankenberger et al., 2017; Ryu et al., 2024).

More so than electives, DE courses taken in core academic subjects—especially in math and science—positively predict students' postsecondary outcomes (Giani et al., 2014). Growing evidence suggests that DE college algebra, a common gateway math course that serves as a prerequisite for STEM coursework, improves college success (Heavin, 2020; Hemelt et al., 2020; Minaya, 2021; Speroni, 2011). Most students in Texas who enroll in DE take academic general education courses required for transfer to public institutions after high school (Miller et al., 2017), but there is likely considerable variation across DE partnerships in the breadth and number of their DE course offerings. The success of DE partnerships in improving student outcomes likely depends on how many courses they can offer and how those course offerings align with subsequent educational and workforce pathways.

Course location, modality, and composition. Taking classes on college campuses can help students understand what it means to be a college student and envision themselves as one (Edwards et al., 2011; Witkowsky & Clayton, 2020). DE taken at the college positively predicts enrollment at a community college after high school but is also associated with lower grades and passing in the course (Ryu et al., 2024), with some evidence that affluent students benefit more from taking courses on campus than their lower income peers (Hu & Chan, 2021). In terms of feasibility of offering DE coursework on college campuses, the college's proximity to the partner high school can minimize costly transportation between campus locations (An & Taylor, 2019; Edwards et al., 2011). Providing online DE coursework is another means of increasing access to DE taught by college-affiliated instructors; online DE coursework, compared with face-to-face, is negatively associated with course performance and positively associated with college enrollment (Ryu et al., 2024).

In implementing DE coursework, actors in a DE partnership must decide whether to include both DE and college-only students in the same course; this decision may be linked to other factors such as location, instructor affiliation, and preferred class size. Such decisions are often shaped by less mutable factors such as funding, instructor availability, and geography, but they have important implications for student experiences. Mixing DE and college students can enhance DE's authenticity as a college experience, exposing students to college and potentially increasing their college aspirations (Edwards

et al., 2011). As in other DE structures that better approximate college courses, mixed-composition academic DE sections—compared with DE-student-only sections—are negatively correlated with passing the course but positively correlated with college matriculation (Ryu et al., 2024).

Course staffing. Funding and finding qualified teachers to teach DE courses pose a challenge for institutional partners (Hornbeck & Malin, 2019). As a result, instructor assignments are sometimes shaped by instructor availability—along with accreditation requirements—rather than student needs or alignment with high-demand pathways (Fink et al., 2022). Both across and within states, some community colleges rely primarily on their own faculty to teach DE, while others rely on qualified high school teachers (Mehl et al., 2020). Forty-one percent of DE courses taken by 2015 Texas public high school graduates were taught by a high school teacher (Miller et al., 2017), but CTE DE courses appear more likely to be taught by a high school instructor than academic DE courses (Ryu et al., 2024). Qualitative research on DE course instruction describes how high school instructors prioritize rules and classroom management, whereas college instructors tend to offer students more independence and control over their learning (Duncheon, 2020; Duncheon & Relles, 2020; Edwards et al., 2011). Given those findings, it is unsurprising that, compared with their peers in DE courses with college instructors, students who take DE courses with high school instructors are more likely to pass and receive higher grades but less likely to attend college after high school (Ryu et al., 2024).

2. Research Questions

To build an understanding of DE interorganizational fields and variation across partnerships, we examine DE partnerships between traditional Texas public high schools and public two-year colleges, which account for 95% of all dual enrollments in the state. We ask the following research questions (RQs):

1. What do DE partnerships look like on average? Do partnership characteristics differ based on rurality and socioeconomic composition of high schools?

2. Which DE partnership characteristics are associated with postsecondary success among DE participants?

After describing DE partnership characteristics throughout Texas, we examine how DE partnership characteristics predict aggregate measures of DE course completion, subsequent college enrollment, and postsecondary degree attainment.

3. Study Context

Texas has a high rate of DE participation; in fall 2021, Texans comprised 16% of all DE students in the U.S. but just 10% of all K-12 and college students (De Brey et al., 2021). All school districts in Texas are mandated to offer students the opportunity to earn a minimum of 12 college credits through AP, IB, or DE (Texas Education Code Sec. 28.009, 2015). To be eligible for academic DE coursework, students must meet college-readiness requirements by achieving minimum proficiency scores on the Texas Success Initiative (TSI) assessment, high school state assessments (e.g., algebra and English II STAAR end-of-course tests), or the SAT or ACT (Texas Higher Education Coordinating Board [THECB], 2016). For entry-level CTE DE courses specific to short-term certificates, students do not need to demonstrate college readiness; however, they must meet college-readiness standards for required CTE courses toward higher credentials (THECB, 2016).

DE course design and partnerships are largely free from government oversight; per state law, school districts and partnering colleges must define how they will administer DE instruction and support services—including course location, class composition, faculty assignments and evaluation, and funding—and often do so through Memoranda of Understanding between institutional partners (THECB, 2016). Although colleges must offer approved general education (i.e., "core") college-level coursework, DE partners can determine which DE courses they offer and how they are structured (Miller et al., 2017). State policy dictates that colleges can receive state subsidies for students earning college credit in core-curriculum, CTE, and foreign-language DE

courses but leaves it to local control to determine how to cover the costs to students (THECB, 2016). Colleges are allowed—but not required—to waive some or all tuition and fees for DE. Recent state legislation serves to expand access to dual credit for low-income students by subsidizing their DE coursework via the Financial Aid for Swift Transfer (FAST) scholarship program, which may further shift student and institutional incentives for DE (THECB, 2023).

In Texas, all DE instructors teaching academic courses must hold a bachelor's degree plus 18 hours of graduate credits in the discipline of the subject they teach (Southern Association of Colleges and Schools Commission on Colleges [SACSCOC], 2018). For CTE DE, colleges can substitute instructors' relevant work experience for years of education, but they are responsible for justifying, documenting, and evaluating whether DE instructors meet their instructional standards (SACSCOC, 2018).

4. Methods

To answer the research questions, we use statewide administrative data provided through a restricted-use agreement with the Texas Education Research Center (ERC), a research center and data clearinghouse at the University of Texas at Austin. We first identify DE students as those enrolled in DE while attending a Texas public high school. Given that community and technical colleges enroll over 96% of all DE students in the state (Miller et al., 2017), we focus on students enrolled in DE coursework at public two-year colleges. Once we identify a student as a DE participant, we determine which high school they attended and at which college they took DE, defining a within-semester high school–college pair as a DE partnership. We descriptively examine the characteristics of the partnerships and the institutions involved in each partnership. We then perform multiple linear regression analyses to examine how partnership characteristics predict partnership-level student success rates.

4.1 Data

The ERC data is from a state longitudinal data system that contains K-12 school- and student-level data from the Texas Education Agency (TEA), alongside college- and student-level data from the Texas Higher Education Coordinating Board (THECB). The

data includes demographic, enrollment, transcript, and graduation data for all students in Texas. To create the analytic sample, we first use high school enrollment and demographic data from the TEA to identify students who enrolled in the 9th grade for the first time in 2012, 2013, and 2014 (student n = 975,712). We focus on students who attended traditional high schools and ECHSs, excluding those who attended charter schools or other nontraditional schools. Using TEA attendance files, we identify the high school students attended each semester; we select the record with the highest attendance for students with multiple schools. We also restrict the analytic sample to students who did not have high school enrollments in semesters after their posted high school graduation date. Combined, these steps leave us with 891,162 students in traditional or ECHS public schools in Texas.

We structure our analytic dataset at the partnership level by identifying public high school students who took at least one DE course at a Texas community college during their high school enrollment period (student n = 158,013). To create the partnership sample, we define a partnership as the high school a student was attending at the time of the DE course enrollment and the college where the student enrolled in the course (unique partnership n = 3,228; total partnership observations across all years = 8,537). We further restrict the analytic sample to partnerships with complete college and high school data, resulting in 1,820 unique partnerships and 6,557 partnership observations across all years. Not all partnerships have observations each year; we omit partnerships in a given year if no students were enrolled in that partnership.

4.2 Variables

Following the framework outlined in section 1.1, we examine DE partnership characteristics that fall within the following broad categories: (1) student access across demographics and academic achievement, (2) partnership contexts, and (3) DE course structures, as implemented on average in the partnership. Below, we briefly describe the variables included in each category. Appendix Table A1 provides the full list of explanatory variables from our regressions and their data sources.

For our main independent variables of interest, we first create measures to capture which students gain access to DE in each unique partnership. For example, we capture the proportion of DE students in each partnership that was identified as low income (we

multiply the percentage by .1, so 1 represents 10% and 10 represents 100%). We include differences in average English I and Algebra I state test scores for DE students and their entire high school as proxies for how selective DE courses are within their school.

We also create contextual measures to understand the size, classification, and geographic locale of partnerships. First, we identify whether the partner high school was classified as an ECHS using both school name and whether the majority of students enrolled in the school were flagged in the transcript data as participating in an ECHS program. We create a measure capturing the number of high schools paired with the DE host college, as well as the average number of students enrolled in DE and a categorical measure of DE student size. We are able to capture partnership geographic locale type using information from TEA, which classifies the partner high school as located in a rural, town, suburban, or urban area. We also measure the proportion of students who failed or withdrew from DE courses in each partnership as a proxy for academic support within partnerships, anticipating that partnerships with high-touch advising and tutoring services may have lower rates of failure or withdrawal.

We capture characteristics of DE courses offered in a partnership, such as the proportion of CTE course sections, gateway (introductory) course sections in math or English, and online course sections among DE courses offered within the partnership. We also capture the rates of course sections comprised of a mix of high school and college students, taught by high school instructors, and offered at college campuses. As with other measures, we use a decile scale for the variables capturing proportions, wherein each unit represents a 10% increment. To descriptively examine partnerships (RQ1), we also construct a host of college-level (e.g., student demographics, instructor characteristics, financial resources) and high school (e.g., student demographics, teacher description, school contexts) measures used in our descriptive tables.

Our outcomes include aggregate measures—at the partnership level—of students' college entrance and degree completion captured between 8 and 11 years after high school entry. We measure college enrollment outcomes within 4 years of on-time high school graduation and longer term outcomes such as credential attainment and transfer within 7 years of on-time graduation. For each partnership, we capture the rates of DE students' post-high-school (1) enrollment in any Texas postsecondary institution,

including private colleges; (2) enrollment in a Texas public two-year college; and (3) enrollment in a Texas public four-year university. To measure subsequent success in college, we capture the rates of completing certificates, associate degrees, and bachelor's degrees. Finally, we capture the rate of transfer to a Texas public university among those who entered college through a community college.

4.3 Analytic Strategy

To understand what DE partnerships in Texas look like (RQ1), we first leverage descriptive statistics. We describe the characteristics of DE partnerships and the characteristics of high schools and colleges involved in those partnerships. To examine how partnership characteristics predict partnership outcomes (RQ2), we perform a series of multivariate linear regressions for our partnership-level outcomes. As shown in Appendix B, we also run separate regression models for four subsamples distinguished by rurality and Title I status of the partner high school, but the results are not sufficiently different from the main analyses, so we provide them as supplemental results for interested readers.

We use the following equation with partnership *i*, high school *j*, college *k*, year *t*:

$$Yjkt = \beta 0 + \beta 1X1jkt + \beta 2X2jkt + \ldots + \beta nXnjkt + \xi j + \theta k + \lambda t + ujkt \quad (1)$$

where *Yjkt* is the predicted outcome and $\beta 0$ is the intercept. *X1–Xn* represent the regression coefficients for the independent variables, $\beta 1–\beta n$. ξj, θk, and λt represent high school, college, and year fixed effects, respectively, and *ujkt* represents the error term. We also assign greater weight to a partnership with a larger number of DE students by using DE student size as an analytic weight to avoid overrepresenting small partnerships in the results; our regressions on rural contexts then allow us to see how results differ for some of the smaller partnerships, which tend to be in rural areas. Independent variables include partnership-level characteristics discussed in the previous section, though we do not include high school and college characteristics because we use institutional fixed effects. Additionally, because some variables capturing partnership characteristics are highly correlated, we cannot include all of those listed in Table 1 in section 5.1 in our regression models. For example, variables capturing the proportion of racially minoritized students and low-income students in partnerships are highly correlated;

therefore, the regressions only include the proportion of low-income students. Similarly, the percentage of low-income students in DE is correlated with whether the partnership included a Title I high school, so we only include the percentage of low-income students in the regression model.

4.4 Limitations and Robustness Checks

The dataset includes partnerships between high schools and colleges, where approximately 68% of partnerships in the full sample consist of only one college and one high school as partners. Despite this, the high school–college partnership network is well connected, as most colleges are partnered with multiple high schools. This network structure allows for sufficient comparison across partnerships to identify both high school (ξj) and college (θk) fixed effects. High school fixed effects and college fixed effects are identified by comparing outcomes across partnerships involving the same high school but different colleges and vice versa. In cases where a high school or college has only one partnership, the relationship is indirectly identified through the broader network of partnerships. Thus, no observations are excluded due to single partnerships, and the fixed-effects models remain robust in this context. To ensure that single partnerships do not disproportionately influence the results, we conduct a robustness check by excluding high schools or colleges with only one partner. The results remain consistent, suggesting that the model's findings are not driven by these cases.

Because we rely on regression, our results do not represent causal relationships. However, given the observational nature of our data, a regression with rich covariates is our strongest analytic strategy for examining which partnership characteristics predict aggregate student success. We include a variety of statistical controls, including high school and college fixed effects (important given the wide variation in high school and college characteristics across partnerships), to capture features that may predict aggregate student outcomes. The R-squared values across our regression models indicate that our preferred models are able to explain over 90% of the variation in the outcomes, which is very high (see Table 2 in section 5.1). In supplemental analyses (see Appendix Table A3), we show that the high school—and, to a lesser extent, college—fixed effects explain a large proportion of this variation in outcomes.

Although our models capture several features of DE partnership design and implementation, including variables capturing DE access, contexts, and course structures, we still anticipate that the estimated relationships can be partially explained by unobserved factors. There are other features of DE partnerships not observable in administrative data (or harder to quantify), such as strength of partner relationship and commitment; practices related to DE outreach, funding, and transportation (which may inform student selection); alignment between DE course offerings and post-high-school pathways; DE advising and academic supports; and instructional quality. Despite limitations, the results stand to inform the literature on DE implementation and the state of knowledge about DE partnerships more generally.

5. Results

5.1 Descriptive Results: Dual Enrollment Partnerships and Variation Across Contexts

Table 1 presents descriptive statistics illustrating the average outcomes and characteristics of DE partnerships, including characteristics of their component organizations (i.e., high schools and colleges). Column 1 shows the means and standard deviations for all DE partnerships in Texas, followed by the means for subsamples across DE contexts, where we present descriptives by geographic locale (rural, urban, suburban, or town) and Title I status of the high school. There are 1,820 DE partnerships—comprised of combinations of 1,282 unique high schools and 80 unique college campuses (note that some college districts report data for their branch campuses separately, inflating the number observed)—in our full analytic sample, with some variation in which partnerships were observed in each year of the data. The average DE partnership in the state has a college enrollment rate of 82% and certificate and associate degree attainment rates of 6% and 19% within four years of high school completion (see the top of Table 1 for partnership outcomes), where only 1% and 2%, respectively, of those credentials were awarded prior to high school graduation (authors' calculations, not in table). On average, the bachelor's degree attainment rate is 35%. In the following

sections, we describe partnership characteristics, including measures of access, contexts, and course structures, including variation across geographic locale and Title I status.

Table 1. Description of Partnerships and Partner Organizations by Partnership Context

			A. Geographic Locale			B. Title I Status		
	Full Sample		Rural	Urban	Suburban	Town	Title I	Not Title I
Variable	*%* or *M*	(*SD*)	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*
Partnership outcomes								
Any college enrollment	81.5%	(14.3)	81.5%	79.2%	82.5%	80.5%	80.5%	82.6%
Public 2-year enrollment	36.5%	(16.3)	38.3%	35.2%	36.1%	35.8%	36.5%	36.5%
Public 4-year enrollment	40.6%	(18.4)	38.4%	39.6%	42.3%	40.0%	40.2%	41.0%
Certificate attainment	5.8%	(9.3)	6.0%	7.0%	5.5%	5.8%	6.7%	4.9%
Associate degree attainment	19.2%	(16.8)	17.6%	20.7%	20.5%	17.5%	20.2%	18.1%
Bachelor's degree attainment	34.5%	(18.1)	32.7%	27.5%	37.1%	34.9%	31.3%	38.0%
Vertical transfer (among 2-year college entrants only)	24.0%	(18.6)	21.6%	19.7%	25.5%	25.7%	21.1%	27.1%
Partnership characteristics								
DE access								
Count DE students	37.9	(57.1)	12.5	39.3	52.7	35.9	31.6	44.7
% Black or Hispanic students	45.2%	(36.4)	27.6%	80.2%	50.8%	36.8%	55.0%	34.7%
% Low-income students	36.9%	(31.3)	33.5%	57.3%	36.6%	31.3%	48.0%	24.9%
Count low-income students	13.4	(28.7)	3.8	17.8	18.8	11.2	17.1	9.4
Count DE courses taken	1.7	(0.6)	1.7	1.7	1.7	1.7	1.7	1.7
Count AP/IB courses taken	1.0	(1.2)	0.2	1.8	1.4	0.8	0.9	1.2
Algebra I scaled score	4,172.7	(196.3)	4,143.8	4,135.4	4,200.1	4,167.0	4,127.7	4,221.4
Difference: DE & HS Algebra I scores	223.0	(148.0)	268.1	226.8	190.4	237.3	252.2	191.4
English I scaled score	3,687.4	(398.3)	3,633.5	3,678.8	3,737.9	3,647.4	3,653.6	3,724.1
Difference: DE & HS English I scores	311.7	(155.9)	271.7	318.3	321.1	337.0	321.1	301.6
Partnership contexts								
ECHS	5.7%	(23.3)	2.0%	10.3%	8.0%	3.1%	7.9%	3.4%
Distance from HS to college	28.0	(32.7)	42.4	9.6	19.4	32.4	28.7	27.1
Partnership size (count students)								
Very small	22.8%	(42.0)	22.9%	27.6%	24.2%	17.1%	21.9%	23.8%
Small	23.5%	(42.4)	42.6%	22.0%	15.9%	17.7%	28.6%	18.1%
Medium	26.8%	(44.3)	32.1%	21.6%	20.6%	36.2%	28.6%	24.8%
Large	26.9%	(44.3)	2.4%	28.9%	39.2%	28.9%	20.9%	33.3%

	Full Sample		A. Geographic Locale			B. Title I Status		
			Rural	Urban	Suburban	Town	Title I	Not Title I
Variable	*%* or *M*	(*SD*)	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*
Geographic locale								
Urban	10.4%	(30.5)	0%	100%	0%	0%	14.0%	6.5%
Suburb	44.5%	(49.7)	0%	0%	100%	0%	30.0%	60.2%
Town	20.2%	(40.2)	0%	0%	0%	100%	20.8%	19.6%
Rural	24.9%	(43.3)	100%	0%	0%	0%	35.3%	13.7%
Title I school status	52.0%	(50.0)	73.6%	69.9%	35.0%	53.4%	100%	0%
Count HS partners of DE college	27.6	(15.8)	28.1	34.5	26.3	26.2	28.7	26.4
Average class size	21.2	(5.8)	17.9	23.9	23.1	19.7	20.3	22.2
Students failed/withdrew from DE	15.2%	(21.5)	13.5%	20.6%	15.2%	14.4%	15.9%	14.3%
DE course structures								
Unique courses	10.7	(11.9)	7.3	10.7	12.4	11.0	10.8	10.6
Sections: CTE	19.2%	(32.1)	13.9%	30.1%	19.0%	20.6%	21.2%	17.1%
Sections: Gateway math/English	14.5%	(17.1)	18.4%	10.4%	13.2%	14.8%	14.9%	14.1%
Sections: Online	40.2%	(38.8)	70.8%	12.0%	27.2%	45.6%	43.2%	37.0%
Sections: On college campus	37.1%	(40.9)	24.2%	45.4%	44.6%	32.1%	37.2%	36.9%
Sections: Mixed composition	48.1%	(39.8)	42.6%	40.0%	53.5%	47.2%	43.2%	53.4%
Sections: HS instructor	25.5%	(30.9)	22.1%	27.9%	25.9%	27.4%	28.4%	22.3%
Academic discipline								
Arts and design	5.7%	(14.4)	5.1%	4.9%	5.9%	6.4%	6.0%	5.3%
Business	1.8%	(8.0)	1.2%	2.6%	1.8%	2.0%	2.0%	1.5%
Computer science/IT	3.9%	(14.6)	1.5%	8.9%	4.6%	3.1%	4.4%	3.5%
Construction/manufacturing	5.0%	(15.5)	6.4%	4.8%	3.6%	6.7%	5.8%	4.3%
Education	1.5%	(7.9)	0.6%	3.5%	1.6%	1.2%	1.8%	1.2%
Foreign languages	2.2%	(9.8)	1.3%	3.4%	2.8%	1.5%	2.1%	2.3%
Health	3.6%	(12.6)	3.5%	3.3%	3.5%	4.3%	4.3%	2.8%
Humanities	35.8%	(28.4)	42.7%	27.6%	33.9%	35.8%	35.4%	36.3%
Math	9.0%	(15.3)	10.5%	7.1%	8.4%	9.3%	9.1%	8.8%
Mechanics/transport/military sciences	3.2%	(14.9)	0.6%	8.5%	3.6%	2.7%	3.0%	3.4%
Psych/counseling/social work	4.3%	(10.0)	5.4%	2.9%	3.6%	4.9%	4.5%	4.0%
Natural and physical sciences	4.2%	(10.4)	3.4%	4.9%	4.4%	4.7%	4.0%	4.6%
Social sciences	17.3%	(21.0)	16.5%	12.6%	19.4%	15.9%	14.9%	19.7%
Other academic disciplines	1.9%	(9.1)	1.0%	3.8%	2.2%	1.3%	2.0%	1.7%
Number of unique partnerships	1,820	—	501	201	803	376	969	925
Number of partnership observations	6.557	—	1,634	682	2,916	1,325	3,410	3,147

			A. Geographic Locale			B. Title I Status		
	Full Sample		Rural	Urban	Suburban	Town	Title I	Not Title I
Variable	*%* or *M*	(*SD*)	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*
College characteristics								
Total undergraduate enrollment	17,016	(17,052)	13,663	33,834	18,905	13,713	16,801	16,716
DE of total enrollment	15.0%	(9.8)	19.5%	9.6%	14.5%	18.2%	15.5%	14.8%
Pell-eligible students	33.8%	(10.9)	34.7%	32.6%	33.5%	34.5%	34.4%	33.0%
Adjunct instructors	53.3%	(13.3)	50.8%	59.8%	52.4%	51.9%	52.7%	53.1%
Instructors, advanced degrees	12.1%	(5.6)	10.5%	13.6%	12.6%	10.9%	11.8%	12.0%
White instructors	68.5%	(19.3)	72.5%	55.1%	67.2%	72.3%	68.0%	70.5%
Net price	$6,513	(2,087)	$6,690	$5,628	$6,391	$6,689	$6,512	$6,641
Core expenditure	$11,779	(5,982)	$11,764	$10,318	$11,788	$12,020	$11,701	$11,888
Instruction expenditure	$5,291	(2,501)	$5,220	$4,881	$5,343	$5,338	$5,246	$5,354
Academic support expenditure	$1,033	(778)	$1,068	$822	$1,030	$1,090	$1,021	$1,050
Number of unique colleges	80	—	51	26	76	59	78	79
Number of college observations	443	—	228	106	386	277	386	399
High school characteristics								
Enrollment size	1,091	(980)	126	1,731	1,706	586	811	1,395
College DE partners	1.4	(0.7)	1.2	1.6	1.6	1.3	1.3	1.5
DE courses taken per student	3.0	(1.3)	3.1	2.9	3.0	3.1	3.1	3.0
Count AP/IB courses offered	11.4	(11.3)	0.9	19.9	17.9	5.5	8.0	15.0
Student descriptors								
Dual enrolled students at HS	13.1%	(13.2)	18.8%	8.9%	10.6%	14.0%	14.5%	11.7%
Students enrolled in AP/IB	17.5%	(15.2)	3.5%	30.4%	25.2%	11.0%	14.3%	21.0%
Black	9.7%	(13.2)	4.6%	16.1%	11.8%	8.1%	9.2%	10.3%
Hispanic	43.3%	(29.3)	30.7%	67.8%	46.4%	39.0%	52.8%	33.0%
Low-income	51.0%	(22.2)	50.1%	65.3%	48.3%	50.6%	62.5%	38.6%
Limited English proficiency	4.2%	(6.0)	1.8%	9.6%	4.9%	2.7%	5.7%	2.6%
Teacher descriptors								
Beginning teacher	62.0%	(15.7)	65.9%	54.4%	60.9%	63.8%	62.0%	62.1%
Teachers with advanced degrees	24.8%	(12.4)	18.6%	33.0%	27.6%	21.9%	23.2%	26.5%
Black instructors	6.9%	(11.6)	2.1%	18.0%	8.4%	3.6%	7.4%	6.2%
Hispanic instructors	20.3%	(25.6)	10.2%	35.1%	24.0%	16.6%	28.1%	11.8%
School contexts								
Student–teacher ratio	17.4	(13.4)	9.1	23.5	20.4	17.8	15.7	19.2

			A. Geographic Locale			B. Title I Status		
	Full Sample		Rural	Urban	Suburban	Town	Title I	Not Title I
Variable	*%* or *M*	(*SD*)	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*	*%* or *M*
High school region								
North	23.5%	(42.4)	24.0%	26.4%	25.5%	17.0%	17.6%	29.9%
East	26.0%	(43.9)	19.6%	16.8%	30.8%	28.0%	24.8%	27.4%
South	20.1%	(40.1)	9.9%	32.0%	20.8%	24.8%	26.2%	13.5%
West	11.9%	(32.4)	21.0%	17.0%	6.4%	10.3%	16.5%	6.8%
Central	18.5%	(38.9)	25.5%	7.8%	16.5%	20.0%	14.9%	22.5%
Expenditure per student	$16,814	(17,715)	$28,319	$14,588	$12,110	$14,295	$20,115	$13,240
Number of unique high schools	1,282	—	410	128	507	294	739	604
Number of observations	5,385	—	1,462	525	2,252	1,146	2,909	2,476

Note. The table describes analytic variables and presents means for continuous variables and percentage for categorical variables for DE partnership observations in the analytic sample and subsamples broken down by (a) high school's geographic locale and (b) high school's socioeconomic composition (as captured by Title I status). College enrollment and degree completion outcomes are captured up to 8 and 11 years after high school entry, respectively, while vertical transfer is tracked up to 4 years after entry into a two-year college.

Access. Partnerships can vary in terms of how accessible they are for students from different demographic and academic backgrounds. The average number of students served by a partnership in our study is 38, but this is considerably smaller in rural partnerships—where only 13 students were served on average—and larger among non-Title I partnerships (those where low-income students did not make up a substantial proportion of the high school student body), which served an average of 45 students. Within the full sample, 45% of the students in the partnerships, on average, identify as Black or Hispanic (combined under "racially minoritized" to overcome issues with low cell size, which means we cannot release the *n*s for Black students due to Texas's restricted-data rules). Racial diversity looks dramatically different across partnership contexts, ranging from 28% racially minoritized students in rural partnerships to 80% in urban partnerships, with wide variation across Title I status as well (35% for non-Title I compared with 55% for Title I). We see similar patterns for the percentage of low-income participating DE students. In the average partnership in the state, 37% of students are low income, but these students appear underrepresented in both rural and non-Title I partnerships and overrepresented in urban and Title I partnerships.

The academic backgrounds of students also vary across partnerships. Among the full set of DE partnerships, the average number of DE courses taken by students is 1.7. On average, DE students also take one AP/IB course, but this number is considerably higher for urban partnerships (1.8) and considerably lower for rural partnerships (0.2). We also examine the differences between the average scores for the partner high school overall and the DE participants at that high school; this serves as a proxy for the extent of academic stratification that might take place in DE (i.e., how different academically students in DE are compared with those overall). The difference between the DE partnership students and the high school average for the Algebra I STAAR exam is 223 units, with a considerably higher difference in rural partnerships (268) and in Title I partnerships (252) and a considerably lower difference for non-Title I schools (191), which may indicate scarcity of DE opportunity and higher selectivity in the rural and Title I contexts (i.e., fewer spots for DE math courses). For the English STAAR test, we observe slightly different patterns: While the average difference for partnerships is 312

units, rural and non-Title I partnerships have lower differences, and urban and Title I partnerships have slightly higher differences.

Contexts. We examine variation in contexts across the other characteristics but also note additional distinctions between geographic locale and socioeconomic composition of schools here. Approximately 6% of the partnerships in the full sample include an ECHS, with notable variation by geographic locale—2% in rural partnerships and 10% in urban partnerships. Non-Title I partnerships have more than twice the percentage of ECHS partners compared to Title I partnerships. About 45% of the DE partnerships in the full sample include a suburban high school, with rural high schools serving as the second most common (25%), followed by town (20%) and urban (10%). As anticipated, the average distance between the partner high school and college is substantially larger for rural partnerships (42 miles) compared with urban partnerships (10 miles), both of which are quite different from the average of 28 miles for the full sample of partnerships. About 52% of the full sample of partnerships include a high school with Title I status, but there is considerable variation across geographic locale. Seventy-four percent and 70% of rural and urban partnerships, respectively, include Title I schools, whereas only 35% of suburban and 53% of town partnerships do. Fifteen percent of DE students, on average, ever failed or withdrew from a DE course, which may serve as a proxy for the availability of academic support for students within DE partnerships. The proportion of students who failed or withdrew in urban contexts (21%) appears much higher than in other geographic locales (14–15% for rural, suburban, and town), which corresponds with differences in expenditures across college contexts.

It is also important to acknowledge the resources and contexts specific to the organizations that comprise DE partnerships (see "College characteristics" and "High school characteristics" in Table 1). Most notable among the college characteristics is that the average core, instructional, and academic expenditures at urban colleges appear much lower than those for the full set of DE partnerships or other subsamples (including the partnerships with Title I schools). Most notable among the high school characteristics is the dramatic differences in campus size and demographic makeup, particularly for rural high schools, which average only 126 students and are considerably less racially diverse in terms of students and teachers compared with the state average for DE partner high

schools (and especially urban high schools) yet have much higher per-student expenditures.

Course structures. The average DE partnership in Texas offers 10.7 unique DE courses, with rural partnerships offering fewer courses—only 7.3 on average—than partnerships in other locales. Partnerships offer a mix of CTE and academic DE courses through different modalities and locations. On average, 19% of DE course sections are CTE, but that proportion varies substantially across rural and urban partnerships, representing 14% and 30% of all DE sections, respectively. Rural partnerships are much more likely to rely on online modality for their DE courses, with 71% of DE course sections taught online, which is dramatically higher than the average of 40% for all partnerships (urban, suburban, and town partnerships, respectively, offer 12%, 27%, and 46% of their sections online). Similarly, although the average DE partnership in the state offers 37% of their sections on the college campus, this proportion is lowest for rural partnerships (24%) and highest for urban partnerships (45%). Approximately half of all DE course sections offered by DE partnerships are mixed composition—including DE students and college-only students—and a quarter of DE course sections are taught by a high school teacher.

5.2 Regression Results: Predictors of Partnership-Level Postsecondary Success

To address RQ2, we examine predictors of DE partnership outcomes through a series of regression models. Table 2 presents the estimated relationships between partnership characteristics and outcomes, including proportion of DE participants who enrolled in college and/or attained a credential. Due to small changes in aggregate outcomes, we scale all partnership characteristics measured as percentages to capture deciles (i.e., for each additional 10-percentage-point average change in the independent variable, there is a corresponding percentage-point change in the outcome).

Table 2. Results With Full Sample for Regression Models Predicting DE Partnerships' Postsecondary Success Outcomes

	College Enrollment Rate (%)			Degree Attainment Rate (%)			Vertical
	Any	Two-year TX public	Four-year TX public	Certificate	Associate degree	Bachelor's degree	Transfer Rate (%)
Independent Variable	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)
DE access							
DE courses taken	-0.201*	0.218*	-0.360***	0.308***	0.008	-0.401***	-0.360*
	(0.095)	(0.107)	(0.106)	(0.089)	(0.111)	(0.113)	(0.142)
AP/IB courses taken	0.146**	-0.232***	0.331***	-0.178**	-0.202***	0.248***	-0.076
	(0.057)	(0.064)	(0.067)	(0.056)	(0.053)	(0.065)	(0.090)
% Low-income students[a]	-0.172***	-0.060	-0.096*	-0.014	-0.027	-0.153**	-0.057
	(0.049)	(0.052)	(0.046)	(0.043)	(0.043)	(0.047)	(0.065)
Difference: DE & HS Algebra	0.014***	0.000	0.012**	-0.003	0.010**	0.016***	0.002
score	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)
Difference: DE & HS English I	0.033***	-0.027***	0.050***	-0.018***	0.007*	0.036***	0.028***
score	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.005)
DE partnership contexts							
ECHS	3.857	-6.385	19.662**	4.420	26.037***	-4.064	-15.451
	(8.365)	(7.561)	(7.626)	(5.309)	(6.005)	(8.413)	(10.557)
DE student size (ref. large)							
Very small	-0.521	0.163	-0.683	1.096**	1.382**	-0.150	-11.690***
	(0.505)	(0.585)	(0.568)	(0.373)	(0.502)	(0.572)	(0.822)
Small	-0.853**	-0.488	-0.372	1.264***	0.553*	-0.350	-2.455***
	(0.305)	(0.309)	(0.291)	(0.296)	(0.261)	(0.276)	(0.431)
Medium	0.015	0.016	-0.016	0.309**	0.210*	0.071	-0.165
	(0.120)	(0.123)	(0.115)	(0.113)	(0.104)	(0.115)	(0.173)
Geographic locale (ref. rural)							
Urban	1.248	-26.595*	30.320**	-4.164	37.311***	32.477***	16.435
	(4.855)	(10.979)	(9.407)	(4.306)	(8.343)	(7.773)	(11.391)
Suburban	-0.024	0.036	-0.039	-0.179	-0.025	-0.058	-0.443
	(0.335)	(0.214)	(0.382)	(0.211)	(0.277)	(0.470)	(0.494)
Town	0.161	-0.059	0.167	-0.167	0.161	0.302	0.184
	(0.252)	(0.141)	(0.193)	(0.111)	(0.184)	(0.238)	(0.344)
Count HS partners of DE college	-0.001	0.003	-0.005	0.005	-0.004	0.001	0.005
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.010)
Average class size	-0.001	0.002	-0.010	-0.006	-0.019*	-0.007	0.016
	(0.012)	(0.010)	(0.011)	(0.009)	(0.008)	(0.012)	(0.014)

	College Enrollment Rate (%)			Degree Attainment Rate (%)			Vertical
	Any	Two-year TX public	Four-year TX public	Certificate	Associate degree	Bachelor's degree	Transfer Rate (%)
Independent Variable	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)
Students failed/withdrew from DE course (%)[a]	0.027 (0.044)	0.013 (0.048)	0.030 (0.043)	-0.095** (0.033)	0.042 (0.044)	-0.060 (0.044)	-0.030 (0.067)
DE course structures							
% DE sections: CTE[a]	-0.243*** (0.051)	0.081 (0.050)	-0.337*** (0.053)	0.375*** (0.053)	-0.107** (0.035)	-0.355*** (0.061)	-0.264*** (0.064)
% DE sections: Gateway course[a]	0.059 (0.038)	0.017 (0.043)	0.035 (0.044)	0.008 (0.028)	-0.044 (0.034)	0.025 (0.046)	-0.045 (0.081)
% DE sections: Online[a]	0.086* (0.036)	-0.057 (0.035)	0.111** (0.035)	0.011 (0.025)	0.062* (0.029)	0.056 (0.038)	-0.035 (0.056)
% DE sections: Taught by HS instructors[a]	0.010 (0.029)	0.050 (0.029)	-0.042 (0.030)	-0.018 (0.022)	0.039 (0.026)	0.001 (0.030)	-0.019 (0.042)
% DE sections: On college campus[a]	0.022 (0.027)	0.132*** (0.031)	-0.059* (0.029)	0.110*** (0.026)	0.116*** (0.026)	-0.102*** (0.030)	-0.032 (0.037)
% DE sections: Mixed composition[a]	-0.027 (0.024)	-0.054* (0.023)	0.019 (0.022)	-0.007 (0.017)	-0.027 (0.019)	0.053* (0.023)	-0.038 (0.040)
Adjusted R-squared	0.934	0.945	0.963	0.915	0.979	0.963	0.916
Partnership *n*	6,557	6,557	6,557	6,557	6,557	6,557	6,377

Note. The table presents linear regression results, and each column represents a separate regression model. All models also include high school, college, and year fixed effects and use robust standard errors. The analysis for college enrollment and degree attainment rates includes the entire sample; the analysis on vertical transfer rate includes only students who started at two-year colleges for the first time. Means (*SD*s) for the outcomes of interest in each of the six regressions are as follows: any college enrollment rate: 81.5% (14.3); public two-year college enrollment rate: 36.5% (16.3); public four-year university enrollment rate: 40.6% (18.4); certificate attainment rate: 5.8% (9.3); associate degree attainment rate: 19.2% (16.8); bachelor's degree attainment rate: 34.5% (18.1); vertical transfer rate (among two-year college entrants): 24.0% (18.6).

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

[a] These partnership characteristics measured as percentages are scaled to capture deciles (i.e., to interpret coefficients, a one-unit change in the outcome rate corresponds to a 10-percentage-point change in that partnership characteristic).

College enrollment outcomes. Several DE access characteristics, including measures capturing which students gain access and how they participate (i.e., number of courses taken), are associated with college enrollment rates, as illustrated in Table 2, but the most sizeable relationships are between geographic locale and enrollment outcomes. To help improve the interpretability and practical significance of the results, it is important to consider that the proportion of DE students at partnerships who enrolled in college after high school is quite high. The full sample partnership mean for any college enrollment (including private institutions) is 81.5%, and the means for public university and public two-year college enrollment rates are 40.6% and 36.5%, respectively.

After accounting for partnership characteristics and institutional fixed effects (or time-invariant characteristics), the relationships between several DE access measures—including the average number of DE courses taken in the partnership—and aggregate college enrollment outcomes are statistically significant but very small in magnitude (all significant coefficients for DE access measures in Table 2 are below a tenth of a standard deviation unit in size). For example, for each additional DE course taken, on average, the partnership's two-year college enrollment rate increases by .218 percentage points, which is an approximately .013-standard-deviation-unit change in the outcome (B = .218, SE = .107, p = .042). However, average number of DE courses taken also has small negative correlations with overall college enrollment at any Texas college and with public university enrollment rates. The patterns are the opposite for number of AP/IB courses taken in the partnership. The socioeconomic composition of DE students in a partnership has a very small negative association with the partnerships' overall college enrollment rates and four-year university enrollment rates, whereas the difference between DE participants' scores and the average score for the entire high school—in both math and English tests—is positively related to the same outcomes. We observe a negative relationship between the English score difference and two-year college enrollment rate: Partnerships in which DE students outperform their peers have slightly lower rates of two-year college enrollment but slightly higher rates of four-year college enrollment than other partnerships.

The DE partnership contexts—particularly high school type, DE student size, and high school locale—are also associated with college enrollment rates. Some coefficients

are very modest in size (e.g., less than a tenth of a standard deviation unit). For example, partnerships with a small number of DE students—compared to those serving more DE students—experience lower rates of any college enrollment and two-year college enrollment. Compared to large partnerships (those with more than 48 DE students), small partnerships (5–16 DE students) are associated with a .853-percentage-point decrease in any college enrollment rates (B = -.853, SE = .305, p = .005).

High school type and geographic locale are two DE context measures that tell a very different story: Their relationships with outcomes are large enough to have practical implications. For example, holding all other variables constant, partnerships with an ECHS—compared with traditional high school—are associated with a 19.7-percentage-point increase in university enrollment rates (B = 19.662, SE = 7.626, p = .010). In the case of geographic locale, DE partnerships involved with urban high schools, compared to rural high schools, experience significantly higher rates of four-year university enrollment—with a 30.3-percentage-point increase in university enrollment—but lower rates of two-year college enrollment (a 26.6-percentage-point decrease) (B = 30.320, SE = 9.407, p = .001; B = -26.595, SE = 10.979, p = .015). These represent well over a one-standard-deviation change in each outcome for urban compared with rural DE partnerships.

The characteristics of DE courses offered in a partnership are also associated with the partnership's college enrollment outcomes, but the change associated with these characteristics is, practically speaking, very small (under a tenth of a standard deviation unit, in all cases). For example, each 10-percentage-point increase in a partnership's CTE DE course sections is associated with .24- and .34-percentage-point decreases in the rates of any college enrollment and four-year university enrollment, respectively (B = -.243, SE = .051, $p < .001$; B = -.337, SE = .053, $p < .001$). Conversely, the proportion of online DE course sections in a partnership is positively correlated with any college and four-year university enrollment rates. The proportion of DE course sections taught at college campuses also predicts college enrollment rates, though results are mixed across types of colleges at which students enrolled. Specifically, the proportion of DE course sections at college campuses positively predicts two-year college enrollment rates but negatively

predicts four-year university enrollment rates. The proportion of mixed composition negatively predicts the two-year college enrollment outcome.

College outcomes beyond enrollment. We also examine how DE partnership characteristics predict college outcomes beyond enrollment (see Table 2). The average certificate, associate degree, and bachelor's degree attainment rates (11 years after high school entrance, which provides 7 years of follow-up for on-time college entrants) in the full sample of partnerships are 5.8%, 19.2%, and 34.5%, respectively, and the average vertical transfer rate (among two-year college entrants from partnerships) is 24%. Compared with college entrance measures, the rates of success are lower for the degree attainment outcomes. Among DE access characteristics associated with college outcomes, all are small in size (relationships that represent less than a tenth of a standard-deviation-unit change in the outcome); the average number of DE courses taken in a partnership has a small positive correlation with certificate attainment rate but negative correlation with bachelor's degree attainment and vertical transfer rates. A one-unit increase in the average number of DE courses taken in the partnership is associated with a .308-percentage-point increase in certificate attainment rate—for the average partnership, that would shift certificate attainment from 5.8% to 6.1% (or .03 standard deviation units)—and .401- and .360-percentage-point decreases in bachelor's degree attainment and vertical transfer rates, respectively (B = .308, SE = .089, p < .001; B = -.401, SE = .113, p < .001; B = -.360, SE = .142, p = .011). The number of AP/IB courses taken by students in the partnership also has small negative associations with both certificate and associate degree attainment rates but a positive association with bachelor's degree attainment rate. The socioeconomic composition of DE students in a partnership has a small negative association with the partnership's bachelor's degree attainment rate. The difference between a partnership's score and the average score of all high schools in both math and English tests positively predicts the partnership's associate and bachelor's degree completion rates; however, the difference in English test scores is negatively associated with certificate completion rate. We also observe a small positive relationship between the English score difference and vertical transfer rate.

The DE partnership contexts also predict college outcomes beyond enrollment, primarily focusing on degree attainment rates. Partnerships involved with ECHSs are

positively associated with an increase in the probability of associate degree attainment rates, compared with partnerships involved with traditional high schools—with a 26-percentage-point increase in associate degree attainment ($B = 26.037$, $SE = 6.005$, $p < .001$). Partnerships with fewer DE students experienced higher two-year college credential completion rates compared with large partnerships (the reference group: partnerships with over 48 DE students). For example, having a very small (less than 5) number of DE students is associated with 1.1- and 1.4-percentage-point increases in certificate and associate degree attainment rates, respectively, compared with large partnerships ($B = 1.096$, $SE = .373$, $p = .003$; $B = 1.382$, $SE = .502$, $p = .006$).

We also observe negative relationships between DE student size and vertical transfer rate. As with college enrollment outcomes, the geographic locale coefficients suggest meaningful differences in attainment between rural and urban partnerships. Partnering with an urban high school, compared with a rural school, is associated with 37.3- and 32.5-percentage-point increases in the partnerships' associate degree attainment and bachelor's degree attainment rates, respectively, both of which represent a change of more than one standard deviation unit in the respective outcome ($B = 37.311$, $SE = 8.343$, $p < .001$; $B = 32.477$, $SE = 7.773$, $p < .001$). The proportion of students who ever failed or withdrew from DE courses in a partnership is associated with a decrease in certificate attainment rates, which suggests that course completion may be closely linked to certificate attainment. There is also a small negative correlation between average class size and a partnership's associate degree completion rate.

Several DE course characteristics in a partnership also predict subsequent college outcomes beyond enrollment, but in all cases these associations are very small (below a tenth of a standard-deviation-unit change in the outcome). The proportion of CTE DE course sections is correlated with degree completion, though patterns are mixed across degree types. A one-unit increase in the decile of CTE DE course sections in a partnership is associated with a .375-unit increase in the partnership's rate of certificate completion ($B = .375$, $SE = .053$, $p < .001$). However, it is also correlated with .107-, .355-, and .264-unit decreases in associate degree attainment, bachelor's degree attainment, and vertical transfer rates, respectively ($B = -.107$, $SE = .035$, $p = .002$; $B = -.355$, $SE = .061$, $p < .001$; $B = -.264$, $SE = .064$, $p < .001$). The proportion of online DE

course sections in a partnership is positively associated with the partnership's associate degree completion rate. The proportion of DE course sections taught at college campuses positively predicts both certificate and associate degree completion rates but negatively predicts bachelor's degree attainment rate. In contrast, the proportion of mixed composition is positively associated with a partnership's rate of bachelor's degree completion.

6. Discussion

In this paper, we use statewide administrative data from Texas to examine how interorganizational—i.e., partnership-level—characteristics predict aggregate DE student outcomes. Through descriptive and regression analyses, we illuminate variation in high school–college DE partnerships throughout the state and examine how partnership characteristics predict partnership outcomes, where partnership contexts—particularly geographic locale and partnering with an ECHS—are strong predictors of partnerships' rates of college enrollment and attainment.

Given the size and diversity of Texas, there is unsurprisingly a great deal of variation in DE partnerships, including in size, locale, and student composition. The average community college held partnerships with 28 high schools across all the years of the study, and the average DE partnership served 38 students spread across approximately 11 courses in that same timeframe. Although we find that most DE partnerships occur in suburban settings, we see that rural areas are the second most common geographic locale (comprising a quarter of partnerships in the state). Rural partnerships rely heavily on DE compared with offerings such as AP/IB. Urban partnerships are the least common—representing 12% of all partnerships—but disproportionately serve students from low-income families, which illustrates their importance for improving DE access and success, especially considering that DE offers an affordable on-ramp to a college credential.

Our descriptive patterns suggest that DE access varies dramatically across partnership contexts, including socioeconomic composition of the partnership high school, as indicated by the school's Title I status. Title I partnerships have much higher

DE enrollment among low-income and racially minoritized students than non-Title I partnerships. Title I partnerships appear to be much more restrictive in terms of access to DE coursework, based on the math and English state test score differentials. The difference between average math or English state assessment scores of a school's DE participants and the overall high school population appears larger at Title I schools than at non-Title I schools. At the same time, there appear to be fewer AP/IB offerings and smaller percentages of students taking AP/IB in Title I partnerships compared with non-Title I partnerships, which may lead to additional competition for DE courses. It is also notable that non-Title I partnerships are much more likely to overlap with suburban contexts (61% of non-Title I partnerships are in the suburbs).

Geographic locale also appears to be an important factor associated with DE access. Urban DE partnerships serve disproportionately high percentages of Black or Hispanic students and low-income students compared with partnerships in the other geographic locales. Although all DE partnership locales have similar mean average counts of DE courses taken (1.7), urban DE partnerships have the highest rates of AP/IB coursetaking (2.2 courses), followed by suburban partnerships (1.5). Suburban partnerships may offer some advantages to students in terms of DE accessibility, as the differentials between the average math state assessment scores of a school's DE participants and the overall high school population appear smaller than those of partnerships in other locales (likewise, the English score differential is the second smallest). The math score differential appears substantially larger at rural schools than in other geographic locales (and particularly larger than in suburban partnerships), suggesting that rural partnerships—like Title I partnerships, as noted above—are more restrictive in access to math courses (though they have a slightly lower score differential than urban partnerships on the English assessment). This may indicate scarcity of available seats in DE math at rural schools, though it is also important to note that the average test scores at rural schools are lower than in other geographic locales, which may also speak to the need for college-course preparation. The lower preparation for college-level courses could have implications for college outcomes among students in those partnerships, given growing evidence that access to gateway math courses through DE predicts collegiate success (Heavin, 2020; Hemelt et al., 2020; Minaya, 2021).

Differences across partnership contexts also appear to translate into wide variation in the offerings and structures across geographic locale. Compared with the average partnership in the state, rural partnerships appear much more likely than their peers to rely on online modality and on use of the high school campus—almost three out of four DE course sections, on average, in rural partnerships are online, and students take the course at the high school. This is likely due to sizable distances between rural high schools and their partner community colleges. Urban partnerships are more likely to offer CTE DE—over a quarter of all their DE sections are CTE—and much less likely to offer DE coursework online than the average partnership in Texas. The close proximity of the high school and college partners in urban settings likely contributes to substantially higher rates of in-person course offerings. Partnerships between community colleges and ECHSs appear most prevalent in urban settings, which is meaningful given their positive association with both associate degree attainment and university entrance. Sensitivity analyses (available upon request) in which we perform the regression without the ECHS measure illustrate that the positive link between urban partnerships and four-year college entrance is driven by ECHSs (when removed from the model, the relationship changes direction).

A number of characteristics predict small increases in college enrollment rates within a partnership, but these are much smaller than the more tangible differences we observe across geographic locale and ECHS partnerships. For example, the number of college acceleration courses taken on average by DE students in the partnership positively predicts college enrollment rates, where increasing the proportion of AP/IB courses is associated with public university enrollment and increasing the proportion of DE courses is associated with two-year college enrollment. Perhaps not surprisingly, higher standardized test scores among DE participants (compared with their high school's average) are associated with higher college enrollment rates, driven by public university enrollment. This is likely due to selection: Partnerships that are academically selective have a higher aggregate success rate of enrollment among DE students. However, the high schools also ultimately lower the proportion of students at their institution who gain access to college credits (and therefore may reduce college opportunities for students at the high school in general). Although these statistical relationships are statistically

significant, they are exceptionally small (many of these coefficients would be well below the .2 standard for a "small" effect size), which suggests that adjusting DE access and course structures is unlikely to dramatically shift a partnership's college outcomes.

It is important to note that high school fixed effects—which should absorb the relationships between characteristics and resources specific to the high school and the outcomes—appear to explain the majority of the variation in aggregate student outcomes (see Appendix Table A2). Given residential segregation and variation in student and community characteristics across schools, this is not surprising. High school practices and resources are essential for DE student success, but college partners also need to be aware of the constraints of their institutional partners. When possible, college partners may need to intervene to reduce barriers to student success by providing social and academic supports. DE collaborations require strong partnerships in addition to state and local investments (Steiger et al., 2024).

One of the biggest takeaways from our regression on the full analytic sample is the high correlation between geographic locale and the partnership's rate of college enrollment, type of college attended, and credential attainment. The coefficients for urban partnerships, compared to rural, are the most substantively meaningful coefficients in our models. We find that, after adjusting for other partnership characteristics, partnering with an urban high school—compared with a rural one—is associated with a decrease in two-year college enrollment rate and an increase in four-year enrollment rate, which illustrates that urban DE partnerships can boost aggregate student outcomes. Urban partnerships also experience higher rates of associate and bachelor's degree attainment compared with their rural counterparts after covariate adjustment. This suggests that their lower observed rates of college enrollment in the descriptive statistics (Table 1) are likely explained by school-level characteristics captured in our school fixed effects and by factors such as higher representation of ECHS partnerships, which appears to contribute to aggregate success rates. There are dramatic descriptive differences between urban and rural DE partnerships that drive systematic differences in outcomes between the two; for example, rural partnerships are considerably better resourced and serve fewer students than their peers.

Another important insight is the positive association between ECHS partnerships and associate degree attainment and university matriculation. Although much of the extant DE literature emphasizes the positive outcomes of DE through ECHS models (Edmunds et al., 2020; Song et al., 2024), that literature compares students admitted to ECHSs with non-admitted peers. Our results suggest positive aggregate student outcomes for ECHS partnerships compared with other DE partnerships, holding other observable partnership characteristics constant. Given that ECHS models tend to focus outreach efforts on Black, Hispanic, and low-income students, they are highly concentrated in urban areas. Although more research is necessary to compare the outcomes of ECHS students with those of their à la carte DE peers, our results offer some evidence that ECHSs may further improve aggregate educational attainment, which could boost attainment in the regions where they are prevalent. It is also important to focus on how specific features of the ECHS model predict student success and whether those features can be adopted in the more prevalent á la carte model of DE.

Considering the small relationships between many partnership characteristics and aggregate student outcomes, simple malleable shifts in the number or type of DE course offerings are unlikely to move the needle for partnership outcomes. Rather, addressing disparities related to geographic locale and access to ECHS opportunities may be more consequential. This requires digging into practices implemented in different contexts to better understand what drives differences in outcomes and to improve practice for students in specific contexts.

Our results indicate variation in needs across partnership contexts, where partnerships in different geographic locales likely require different supports. States should help partnerships implement best practices to improve access and outcomes within their local constraints. For example, our results illustrate that urban partnerships have fewer resources per student than other partnerships but serve disproportionately more racially minoritized students and students from low-income families. They face the largest proportion of DE course failure or withdrawal among any partnership context we examined. To improve racial and socioeconomic gaps in DE access and college attainment, the state could make investments to offset resource constraints and fund additional student support structures, such as tutoring and academic advising in urban

settings. Further investments in supports for effectively facilitating online DE, on the other hand, would likely boost outcomes in rural settings, which rely more heavily on online coursework known for lower student engagement (Fink et al., 2023).

Our findings related to indicators of access within DE partnerships suggest that increasing access—becoming less restrictive in terms of test score differentials between DE students and the general high school population and increasing representation of low-income and racialized minority students in the partnership—would be unlikely to diminish the college enrollment or attainment outcomes of a partnership. This can be taken as evidence that partners face little risk in terms of long-term aggregate student success when eliminating some barriers to DE. In fact, given the sizable individual benefits to DE participation (An & Taylor, 2019), our results suggest that the negligible decrease in college enrollment that DE partnerships experience when increasing access to DE is likely offset by improvements in individual students' probability of postsecondary attainment.

7. Conclusion

This study shows that there is considerable variation in DE course structures and student composition across partnerships in the state of Texas. The differences in partnership characteristics are particularly striking across geographic locales, where rural partnerships rely heavily on teaching DE at the high school and through online course offerings compared with urban partnerships, which disproportionately offer CTE DE and are more likely to offer instruction at college campuses. Our regression results indicate that the mix of DE course structures in a given partnership (e.g., subjects offered, course locations, instructor type) are much less practically meaningful in predicting subsequent aggregate college outcomes for DE students compared with the partnership's geographic locale or organization as an ECHS model. Future research should examine how to better meet the needs of DE students within their geographic contexts as well as how to expand what works well in ECHSs to students taking DE courses outside of the ECHS model.

References

Amey, M. J. (2010). Leading partnerships: Competencies for collaboration. *New Directions for Community Colleges*, *149*, 13–23. https://doi.org/10.1002/cc.391

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. https://doi.org/10.3102/0162373712461933

An, B.P., & Taylor, J. L. (2019). A review of empirical studies on dual enrollment: Assessing educational outcomes. In M. B. Paulsen & L. W. Perna (Eds.), *Higher education: Handbook of theory and research* (vol. 34). Springer. https://doi.org/10.1007/978-3-030-03457-3_3

Barr, R., & Dreeben, R. (1983). *How schools work*. The University of Chicago Press.

Belfield, C., Jenkins, D., & Fink, J. (2023). *How can community colleges afford to offer dual enrollment college courses to high school students at a discount?* (CCRC Working Paper No. 130). Columbia University, Teachers College, Community College Research Center. https://ccrc.tc.columbia.edu/publications/community-colleges-afford-dual-enrollment-discount.html

Blankenberger, B., Lichtenberger, E., & Witt, M. A. (2017). Dual credit, college type, and enhanced degree attainment. *Educational Researcher*, *46*(5), 259–263. https://doi.org/10.3102/0013189X17718796

Dallavis, J. W., & Berends, M. (2023). Charter schools after three decades: Reviewing the research on school organizational and instructional conditions. *Education Policy Analysis Archives*, *31*. https://doi.org/10.14507/epaa.31.7364

De Brey, C., Snyder, T. D., Zhang, A., & Dillow, S. A. (2021). *Digest of Education Statistics 2019 (NCES 2021-009)*. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. https://eric.ed.gov/?id=ED611019

Duncheon, J. C. (2020). "We are exposed to that college environment": Exploring the socialization of early college high school students. *Community College Review*, *48*(2), 173–194. https://doi.org/10.1177/0091552119898880

Duncheon, J. C., & Relles, S. R. (2020). "We're caught in between two systems": Exploring the complexity of dual credit implementation. *Review of Higher Education*, *43*(4), 989–1016. https://doi.org/10.1353/rhe.2020.0028

Education Commission of the States. (2022). *50-state comparison: Dual/concurrent enrollment policies*. https://www.ecs.org/50-state-comparison-dual-concurrent-enrollment-policies/

Edmunds, J. A., Unlu, F., Furey, J., Glennie, E., & Arshavsky, N. (2020). What happens when you combine high school and college? The impact of the early college model on postsecondary performance and completion. *Educational Evaluation and Policy Analysis*, *42*(2), 257–278. https://doi.org/10.3102/0162373720912249

Edwards, L., Hughes, K. L., & Weisberg, A. (2011). *Different approaches to dual enrollment: Understanding program features and their implications*. The James Irvine Foundation. https://ccrc.tc.columbia.edu/publications/different-approaches-to-dual-enrollment.html

Fink, J. (2024, August 26). How many students are taking dual enrollment courses in high school? New national, state, and college-level data. *The CCRC Mixed Methods Blog*. Columbia University, Teachers College, Community College Research Center. https://ccrc.tc.columbia.edu/easyblog/how-many-students-are-taking-dual-enrollment-courses-in-high-school-new-national-state-and-college-level-data.html

Fink, J., Fay, M., Gilliard, R., Griffin, S., Jenkins, D., & Schudde, L. (2022, April 4). From "random acts" and "programs of privilege" to dual enrollment equity pathways. *The CCRC Mixed Methods Blog*. Columbia University, Teachers College, Community College Research Center. https://ccrc.tc.columbia.edu/easyblog/introducing-dual-enrollment-equity-pathways.html

Fink, J., Griffin, S., Garcia Tulloch, A., Jenkins, D., Fay, M., Ramirez, C., Schudde, L., & Steiger, J. (2023). *DEEP insights: Redesigning dual enrollment as a purposeful pathway to college and career opportunity*. Columbia University, Teachers College, Community College Research Center. https://ccrc.tc.columbia.edu/publications/deep-insights-redesigning-dual-enrollment.html

Fink, J., Jenkins, D., & Yanagiura, T. (2017). *What happens to students who take community college "dual enrollment" courses in high school?* Community College Research Center and National Student Clearinghouse Research Center. https://ccrc.tc.columbia.edu/publications/what-happens-community-college-dual-enrollment-students.html

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. https://doi.org/10.1353/hsj.2014.0007

Griffin, S., Steiger, J., Garcia Tulloch, A., Fink, J., & Jenkins, D. (2024). Dual enrollment equity pathways: A research-based framework for expanding college and career opportunity for underserved students. *New Directions for Community Colleges*, *2024*(207), 47–60. https://doi.org/10.1002/cc.20637

Harmon, H., & Johnson, J. (2023). Dual enrollment equity in rural America's two-year public postsecondary institutions. *Community College Journal of Research and Practice*, *48*(9), 557–572. https://doi.org/10.1080/10668926.2023.2222702

Heavin, K. S. (2020). *Bridging the gap: Effects of dual credit college algebra on postsecondary education outcomes* [Doctoral dissertation, University of Kentucky]. UKnowledge. https://doi.org/10.13023/etd.2020.405

Hemelt, S. W., Schwartz, N. L., & Dynarski, S. M. (2020). Dual-credit courses and the road to college: Experimental evidence from Tennessee. *Journal of Policy Analysis and Management*, *39*(3), 686–719. http://doi.org/10.1002/pam.22180

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

Hornbeck, D., & Malin, J. R. (2019). Superintendents' perceptions of the influence of a statewide dual enrollment policy on local educational programming. *International Journal of Educational Reform*, *28*(3), 253–277. https://doi.org/10.1177/1056787919857255

Hu, X., & Chan, H.-Y. (2021). Does delivery location matter? A national study of the impact of dual enrollment on college readiness and early academic momentum. *Teachers College Record*, *123*(4), 1–32. https://doi.org/10.1177/016146812112300401

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*. Columbia University, Teachers College, Community College Research Center. https://ccrc.tc.columbia.edu/dual-enrollment-student-outcomes.html

Kevelson, M. J. C., Millett, C. M., Slutsky, C., & Saunders, S. R. (2023). Equity levers: What predicts enrollment in and number of college-level courses taken in high school? *ETC Research Report Series*, *2023*(1), 1–61. https://doi.org/10.1002/ets2.12368

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*, 825–848. https://doi.org/10.1007/s11162-021-09667-3

Levi Martin, J. (2000). What is field theory? *American Journal of Sociology*, *109*(1), 1–49. https://doi.org/10.1086/375201

Mehl, G., Wyner, J., Barnett, E. A., Fink, J., & Jenkins, D. (2020). *The dual enrollment playbook: A guide to equitable acceleration for students*. Aspen Institute and Community College Research Center. https://ccrc.tc.columbia.edu/publications/dual-enrollment-playbook-equitable-acceleration.html

Miller, T., Kosiewicz, H., Wang, E. L., Marwah, E. V. P., Delhommer, S., & Daugherty, L. (2017). *Dual credit education in Texas: Interim report*. RAND Corporation. https://www.rand.org/pubs/research_reports/RR2043.html

Minaya, V. (2021). *Can dual enrollment algebra reduce racial/ethnic gaps in early STEM outcomes? Evidence from Florida*. Columbia University, Teachers College, Community College Research Center. https://ccrc.tc.columbia.edu/publications/dual-enrollment-algebra-stem-outcomes.html

Mokher, C. G., & Jacobson, L. (2021). A partnership model approach to understanding challenges in collaboration around college readiness. *Educational Policy*, *35*(3), 450–480. https://doi.org/10.1177/0895904818823742

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*, *61*(4), 803–841. https://doi.org/10.3102/00028312241257453

Song, M., Neering, K., Zeiser, K. L., Schwarzhaupt, R., & Mitchell, S. (2024). Accelerated postsecondary pathways: The longer-term impact of the early college high school model on postsecondary degree attainment. *American Educational Research Journal*, *61*(6), 1272–1307. https://doi.org/10.3102/00028312241276855

Southern Association of Colleges and Schools Commission on Colleges. (2018). *Faculty credentials*. https://sacscoc.org/app/uploads/2019/07/faculty-credentials.pdf

Spencer, G., & Maldonado, M. (2021). Determinants of dual enrollment access: A national examination of institutional context and state policies. *AERA Open*, *7*. https://doi.org/10.1177/23328584211041628

Speroni, C. (2011). *Determinants of students' success: The role of advanced placement and dual enrollment programs*. National Center for Postsecondary Research. https://ccrc.tc.columbia.edu/publications/role-advanced-placement-dual-enrollment.html

Steiger, J., Fink, J., & Perry, A. (2024). *How states and systems can support practitioner efforts to strengthen dual enrollment*. Columbia University, Teachers College, Community College Research Center. https://ccrc.tc.columbia.edu/publications/states-systems-practitioner-efforts-dual-enrollment.html

Taie, S., & Lewis, L. (2020). *Dual or concurrent enrollment in public schools in the United States* (NCES 2020-125, Data Point). U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020125

Texas Education Code Sec. 28.009. (2015). *College credit program*. https://statutes.capitol.texas.gov/Docs/ED/htm/ED.28.htm#28.009

Texas Higher Education Coordinating Board (THECB). (2016). *Overview: Dual credit*. https://reportcenter.highered.texas.gov/reports/data/overview-dual-credit/

THECB. (2023). *Texas house bill 8 becomes law, paves way for innovative community college funding*. https://www.highered.texas.gov/texas-house-bill-8-becomes-law-paves-way-for-innovative-community-college-funding/

Thomas, N., Marken, S., Gray, L., & Lewis, L. (2013). *Dual credit and exam-based courses in U.S. public schools: 2010–11* (NCES 2013-001). U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2013001

Villarreal, M. U. (2018). *The impact of dual credit as a school district policy on secondary and postsecondary student outcomes*. The University of Texas at Austin, Ray Marshall Center for the Study of Human Resources. http://dx.doi.org/10.26153/tsw/1524

Wang, X., Chan, H., Phelps, L. A., & Washbon, J. I. (2015). Fuel for success: Academic momentum as a mediator between dual enrollment and educational outcomes of two-year technical college students. *Community College Review*, *43*(2), 165–190. https://doi.org/10.1177/0091552115569846

Witkowsky, P., & Clayton, G. (2020). What makes dual enrollment work? High school counselor perspectives. *Community College Journal of Research and Practice*, *44*(6). https://doi.org/10.1080/10668926.2019.1610676

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

Appendix A. Supplementary Tables

Table A1. Variable Descriptions and Descriptive Statistics for Analytic Sample

Variable	Variable Description	Mean (SD)
Partnership outcomes		
Any college enrollment rate	Percent of students in a partnership who enrolled in a Texas college within 8 years of high school entry (numerator) divided by the total number of students in the partnership; determined using THECB CBM 001 & TEA graduation data	81.516 (14.349)
Public 2-year college enrollment rate	Percent of students in a partnership who enrolled in a Texas public university within 8 years of high school entry (numerator) divided by the total number of students in the partnership; determined using THECB CBM 001 & TEA graduation data	36.512 (16.305)
Public university enrollment rate	Percent of students in a partnership who enrolled in a Texas community college within 8 years of high school entry (numerator) divided by the total number of students in the partnership; determined using THECB CBM 001 & TEA graduation data	40.565 (18.405)
Certificate attainment rate	Percent of students in a partnership who earned a certificate degree within 11 years of high school entry (numerator) divided by the total number of students in the partnership; determined using THECB CBM 009 & TEA graduation data	5.813 (9.317)
Associate degree attainment rate	Percent of students in a partnership who earned an associate degree within 11 years of high school entry (numerator) divided by the total number of students in the partnership; determined using THECB CBM 009 & TEA graduation data	19.193 (16.828)
Bachelor's degree attainment rate	Percent of students in a partnership who earned a bachelor's degree within 11 years of high school entry (numerator) divided by the total number of students in the partnership; determined using THECB CBM 009 & TEA graduation data	34.539 (18.087)
Vertical transfer rate	Percent of students in a partnership who transferred from a two-year Texas college to a four-year Texas college within 4 years of their first two-year college enrollment (numerator) divided by the total number of students in the partnership who attended a Texas two-year college; determined using THECB CBM001 files & TEA graduation data	23.974 (18.580)
Independent variables		
DE access		
DE student *n*	Number of DE students in a partnership; determined using THECB CBM00S and TEA enrollment data	37.906 (57.093)
Racially minoritized students	Percent of students in a partnership identified as Black or Hispanic; determined using THECB CBM00S and TEA enrollment data	0.452 (0.364)
Low-income students[a]	Proportion of students in a partnership identified as economically disadvantaged, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM00S and TEA enrollment data	3.693 (3.132)

Variable	Variable Description	Mean (SD)
DE courses taken[a]	Number of DE courses taken by students in a partnership; determined using THECB CBM00S and TEA enrollment data	1.697 (0.640)
AP/IB courses taken[a]	Number of AP and IB courses taken by students in a partnership; determined using EA enrollment data	1.043 (1.237)
DE partnership Algebra I scaled score	Scale score for partnership's Algebra I test results, obtained from TEA data	4,172.665 (196.338)
Difference: Algebra I avg. score for DE students and entire HS[a]	Difference between Algebra I test score averages for DE students in a partnership and in entire HSs	223.008 (148.019)
DE partnership English I scaled score	Scale score for partnership's English I test results, obtained from TEA data	3,687.440 (398.332)
Difference: English I avg. score for DE students and entire HS[a]	Difference between English I test score averages for DE students in a partnership and in entire HSs	311.730 (155.862)
DE partnership contexts		
ECHS	High school in a partnership classified as an ECHS, which integrates high school- and college-level courses throughout the course curriculum; determined using TEA enrollment and campus data	0.057 (0.233)
Distance from high school to college	Distance between a high school and its DE partnered college; measured in miles using the geosphere package in R.	27.989 (32.667)
Partnership size (*n* DE students)[a]	Number of DE students in a partnership, divided into four equal groups based on the distribution; determined using THECB CBM00S and TEA enrollment data	
Very small	Fewer than 5 DE students in a partnership	0.228 (0.420)
Small	5–16 DE students in a partnership	0.235 (0.424)
Medium	17–48 DE students in a partnership	0.268 (0.443)
Large	More than 48 DE students in a partnership	0.269 (0.443)
Geographic locale[a]	Classification of a high school's locale based on the district's geographic setting, categorized as urban, suburban, town, or rural; determined using TEA district classifications	
Urban	High school located in a district identified as "major urban"	0.104 (0.305)
Suburban	High school located in a district identified as "major suburban," "other central city," or "other central suburban"	0.445 (0.497)
Town	High school located in a district identified as "independent town," "non-metropolitan: fast growing," or "non-metropolitan: stable"	0.202 (0.402)
Rural	High school located in a district identified as "rural"	0.249 (0.433)

Variable	Variable Description	Mean (SD)
Title I school status	High school in a partnership classified as a Title I school, which qualifies for additional federal funding to support low-income students; determined using THECB CBM00S and TEA enrollment data	0.520 (0.500)
HS partners of DE college[a]	Number of high schools paired with the DE host college in a partnership; determined using THECB CBM00S and TEA enrollment data	27.569 (15.797)
Average class size[a]	Average number of students enrolled in a DE course within a partnership; determined using THECB CBM00S and TEA enrollment data	21.198 (5.752)
Students failed/withdrew from DE course[a]	Proportion of students in a partnership who ever failed or withdrew from a DE course (numerator) divided by the total number of students in the partnership, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM00S data	1.517 (2.147)
DE course structures		
CTE course sections[a]	Proportion of CTE DE course sections in a partnership, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM00S data	1.921 (3.214)
Gateway math or English DE course sections[a]	Proportion of DE course sections that are gateway math or English in a partnership, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM00S data	1.453 (1.710)
Course sections taught online[a]	Proportion of DE course sections taught online in a partnership, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM00S data	4.021 (3.883)
Course sections taught by HS instructors[a]	Proportion of DE course sections taught by high school instructors in a partnership, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM008 and TEA instructor files data	2.546 (3.086)
Course sections taught at college campus[a]	Proportion of DE course sections taught at college campuses in a partnership, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM00S data	3.709 (4.094)
Course sections with mixed composition[a]	Proportion of DE course sections with a mix of DE and college students in a partnership, measured on a decile scale, where 0 represents 0% and 10 represents 100%; determined using THECB CBM00S data	4.810 (3.981)
DE college characteristics		
Total undergraduate enrollment	Number of undergraduate students enrolled for credit during 12-month reporting period at a DE college; provided by IPEDS data	20,618.570 (20,660.57)
DE of total enrollment	Percent of DE students among all students enrolled at a DE college; determined using THECB CBM00S and IPEDS data	17.343 (9.632)
Pell-eligible students	Percent of undergraduate students awarded Pell Grants at a DE college; provided by IPEDS data	33.530 (10.583)
Adjunct faculty	Percent of faculty identified as adjunct at a DE college (numerator) divided by the total number of faculty members at the college; determined using THECB CBM008 data	52.758 (14.102)
Instructors with advanced degrees	Percent of faculty with master's degrees or higher degrees at a DE college (numerator) divided by the total number of faculty members at the college; determined using THECB CBM008 data	12.023 (5.984)

Variable	Variable Description	Mean (SD)
White faculty	Percent of faculty identified as White at a DE college (numerator) divided by the total number of faculty members at the college; determined using THECB CBM008 data	68.178 (20.942)
Net price	Average net price for full-time, first-time degree-/certificate-seeking undergraduates paying the in-state or in-district tuition rate who were awarded grant or scholarship aid from federal, state, or local governments or the institution. Other sources of grant aid are excluded. Aid awarded anytime during the full aid year is included; provided by IPEDS data	$6,506.781 ($2,247.515)
Total core expenditure	Average amount of core educational expenses spent per student at a DE college; provided by IPEDS data	$11,564.740 ($6.4323.550)
Total instruction expenditure	Average amount of money spent on instructional activities per student at a DE college; provided by IPEDS data	$5,186.157 ($2,697.976)
Total academic support expenditure	Average amount of money spent per student on services and resources that support academic achievement at a DE college; provided by IPEDS data	$1,022.977 ($765.582)
DE high school characteristics		
Enrollment size	Number of high school students enrolled; determined using TEA enrollment data	1,088.741 (980.033)
College DE partners	Number of DE host colleges paired with the high school in a partnership; determined using THECB CBM00S and TEA enrollment data	1.445 (0.741)
DE courses taken per student	Average number of DE courses taken per student in the high school; determined using THECB CBM00S and TEA enrollment data	3.040 (1.322)
Student descriptors		
Dual enrolled students	Percent of students who ever participated in DE at a DE high school partner (numerator) divided by the total number of students in the high school; determined using THECB CBM00S and TEA enrollment data	13.257 (13.403)
Black students	Percent of students identified as Black at a DE high school partner (numerator) divided by the total number of students in the high school; determined using TEA enrollment data	9.717 (13.184)
Hispanic students	Percent of students identified as Hispanic at a DE high school partner (numerator) divided by the total number of students in the high school; determined using TEA enrollment data	43.318 (29.302)
Low-income students	Percent of students identified as economically disadvantaged at a DE high school partner (numerator) divided by the total number of students in the high school; determined using TEA enrollment data	51.006 (22.219)
Limited English proficiency students	Percent of students identified as having limited English proficiency (LEP) at a high school divided by the total number of students in the high school; determined using TEA enrollment data	4.165 (5.969)
Enrolled in AP/IB students	Percent of students enrolled in AP or IB courses at a high school divided by the total number of students in the high school; determined using TEA course completion data	17.505 (15.260)
Count AP/IB courses offered	Number of AP or IB courses offered at a high school; determined using TEA course completion data	11.348 (11.299)

Variable	Variable Description	Mean (SD)
Teacher descriptors		
Beginning teachers	Percent of teachers identified as having 5 or fewer years of experience within a high school identified, restricted to full-time primary instructional teachers; determined using TEA employment data	62.045 (15.720)
Teachers with advanced degrees	Percent of teachers with master's degrees or higher degrees within a high school, restricted to full-time primary instructional teachers; determined using TEA employment data	24.799 (12.394)
Black teachers	Percent of teachers identified as Black within a high school, restricted to full-time primary instructional teachers; determined using TEA employment data	6.856 (11.585)
Hispanic teachers	Percent of teachers identified as Hispanic within a high school, restricted to full-time primary instructional teachers; determined using TEA employment data	20.263 (25.645)
School contexts		
Student–teacher ratio	Ratio of students to teachers at a high school; determined using TEA employment data	17.348 (13.392)
High school region	High school's geographic region; determined using the education service center (ESC) areas (1–20) where the high school is geographically located	
North	High school located in ESC 9 (Wichita Falls), 10 (Richardson), 11 (Fort Worth), or 14 (Abilene)	0.236 (0.425)
East	High school located in ESC 4 (Houston), 5 (Beaumont), 7 (Kilgore), or 8 (Mount Pleasant)	0.259 (0.438)
South	High school located in ESC 1 (Edinburg), 2 (Corpus Christi), 3 (Victoria), or 20 (San Antonio)	0.201 (0.401)
West	High school located in ESC 16 (Amarillo), 17 (Lubbock), 18 (Midland), or 19 (El Paso)	0.119 (0.324)
Central	High school located in ESC 6 (Huntsville), 12 (Waco), 13 (Austin), or 15 (San Angelo)	0.185 (0.388)
Expenditure per student	Percent of expenditures spent per student, calculated using total expenses divided by total student enrollment; determined using TEA enrollment data and audited financial information	$16,898.260 ($17,796.060)

Note. Total DE partnership observations: *n* = 6,557. Total unique DE partnerships, *n* = 1,820; total unique DE high schools, *n* = 1,282; total unique DE colleges, *n* = 80. The table describes analytic variables and presents means and standard deviations (SD) for all DE partnership observations in the analytic sample.

[a] These variables are included as independent variables in our regression models. The partnership characteristics measured as percentages are scaled to capture deciles (i.e., for independent variables, a one-unit change represents a 10-percentage-point change).

Table A2. Regression Results: Postsecondary Success Outcomes Using Restricted Sample of Partnerships Paired With Multiple Partners

	College Enrollment Rate (%)			Degree Attainment Rate (%)			Vertical
	Any	Two-year TX public	Four-year TX public	Certificate	Associate degree	Bachelor's degree	Transfer Rate (%)
Independent Variable	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)
DE access							
DE courses taken	-0.766*	0.816*	-1.307***	1.187***	-0.046	-1.519***	-1.415***
	(0.315)	(0.334)	(0.318)	(0.307)	(0.352)	(0.327)	(0.366)
AP/IB courses taken	0.414*	-0.721***	1.022***	-0.227	-0.675***	0.680**	0.213
	(0.197)	(0.218)	(0.228)	(0.169)	(0.179)	(0.214)	(0.266)
Low-income students (%)[a]	-0.459**	-0.038	-0.400**	-0.027	-0.052	-0.487***	-0.277
	(0.147)	(0.149)	(0.141)	(0.128)	(0.129)	(0.136)	(0.183)
Difference: DE & HS Algebra	0.016***	0.001	0.012**	-0.002	0.012**	0.017***	0.002
score	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)
Difference: DE & HS English I	0.027***	-0.023***	0.041***	-0.011***	0.009**	0.029***	0.020***
score	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.006)
DE partnership contexts							
ECHS	-4.498	-10.395	8.754	4.163	32.048***	-3.247	-8.786
	(8.995)	(8.061)	(6.904)	(7.417)	(6.720)	(8.088)	(10.368)
DE student size (ref. large)							
Very small	-1.480	0.029	-1.700	2.022**	2.497**	-0.682	-10.022***
	(0.971)	(1.048)	(1.062)	(0.759)	(0.948)	(1.057)	(1.397)
Small	-2.297**	-2.046*	-0.487	3.238***	1.637*	-0.572	-2.074*
	(0.891)	(0.880)	(0.827)	(0.846)	(0.754)	(0.770)	(1.047)
Medium	0.025	-0.249	0.185	0.719	0.559	0.368	-0.254
	(0.427)	(0.429)	(0.403)	(0.386)	(0.384)	(0.399)	(0.506)
Geographic locale (ref. rural)							
Urban	16.633**	-3.119	10.473	-12.711***	41.956***	13.430	-18.657
	(5.181)	(4.910)	(6.083)	(3.022)	(5.163)	(6.947)	(10.055)
Suburban	-18.456	-6.808	-11.864	-3.292	-19.543	-18.294	-41.529***
	(20.842)	(6.289)	(19.179)	(3.329)	(12.584)	(25.103)	(6.103)
Town	-1.692	-1.274	-0.987	2.080*	0.110	-1.761	-2.412
	(6.727)	(4.302)	(2.023)	(1.048)	(1.504)	(3.455)	(5.030)
Count HS partners of DE college	0.015	0.025	-0.008	0.013	0.003	0.036	0.001
	(0.036)	(0.036)	(0.034)	(0.024)	(0.030)	(0.036)	(0.046)
Average class size	-0.034	0.005	-0.059	-0.022	-0.060	-0.054	0.004
	(0.042)	(0.041)	(0.041)	(0.033)	(0.036)	(0.043)	(0.046)
Students failed/withdrew from	-0.004	0.116	-0.012	-0.175	0.052	-0.308*	-0.033
DE course (%)[a]	(0.129)	(0.138)	(0.121)	(0.095)	(0.125)	(0.128)	(0.167)

	College Enrollment Rate (%)			Degree Attainment Rate (%)			Vertical Transfer Rate (%)
Independent Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	*Coeff* (*SE*)
DE course structures							
% DE sections: CTE[a]	-0.656***	0.181	-0.854***	0.857***	-0.393***	-0.916***	-0.669***
	(0.137)	(0.134)	(0.133)	(0.133)	(0.100)	(0.150)	(0.163)
% DE sections: Gateway course[a]	0.060	0.100	0.000	0.139	-0.180	-0.068	-0.165
	(0.123)	(0.134)	(0.136)	(0.093)	(0.110)	(0.138)	(0.205)
% DE sections: Online[a]	0.337**	-0.219	0.473***	-0.015	0.163	0.231	-0.267
	(0.115)	(0.113)	(0.113)	(0.089)	(0.099)	(0.122)	(0.168)
% DE sections: Taught by HS instructors[a]	-0.027	0.120	-0.132	-0.051	0.015	0.026	-0.158
	(0.099)	(0.096)	(0.099)	(0.072)	(0.086)	(0.095)	(0.131)
% DE sections: On college campus[a]	0.230**	0.409***	-0.026	0.207*	0.375***	-0.162	-0.135
	(0.088)	(0.096)	(0.089)	(0.083)	(0.081)	(0.087)	(0.107)
% DE sections: Mixed composition[a]	-0.197*	-0.216**	-0.018	0.009	-0.098	0.075	-0.035
	(0.090)	(0.082)	(0.076)	(0.062)	(0.071)	(0.075)	(0.107)
Adjusted R-squared	0.827	0.837	0.896	0.791	0.919	0.915	0.846
Partnership *n*	2,114	2,114	2,114	2,114	2,114	2,114	1,986

Note. The table presents linear regression results, and each column represents a separate regression model. All models also include high school, college, and year fixed effects and use robust standard errors. The analysis for college enrollment and degree attainment rates includes the sample of partnerships with multiple partners; the analysis of vertical transfer rate includes only students who started at two-year colleges for the first time. Means (*SD*s) for the outcomes of interest in each of the six regressions are as follows: any college enrollment rate: 79.5% (19.1); public two-year college enrollment rate: 37.2% (19.5); public four-year university enrollment rate: 37.6% (22.9); certificate attainment rate: 7.8% (13.4); associate degree attainment rate: 20.7% (21.1); bachelor's degree attainment rate: 32.0% (22.7); vertical transfer rate (among two-year college entrants): 21.6% (22.2).

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

[a] These partnership characteristics measured as percentages are scaled to capture deciles (i.e., to interpret coefficients, a one-unit change in the outcome rate corresponds to a 10-percentage-point change in that partnership characteristic).

Table A3. Regression Results: Postsecondary Success Outcomes Without High School and College Fixed Effects

	College Enrollment Rate (%)			Degree Attainment Rate (%)			Vertical
	Any	Two-year TX public	Four-year TX public	Certificate	Associate degree	Bachelor's degree	Transfer Rate (%)
Independent Variable	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)
DE access							
DE courses taken	-1.769***	-2.017***	0.402	0.998***	8.294***	-0.597	-0.340
	(0310)	(0.391)	(0.447)	(0.234)	(0.509)	(0.394)	(0.426)
AP/IB courses taken	0.840***	-2.004***	2.614***	0.652***	-2.311***	2.446***	0.743**
	(0.180)	(0.206)	(0.232)	(0.150)	(0.225)	(0.201)	(0.230)
Low-income students (%)[a]	-0.349***	0.499***	-0.416***	0.529***	1.158***	-2.006***	-1.569***
	(0.068)	(0.098)	(0.117)	(0.072)	(0.098)	(0.090)	(0.096)
Difference: DE & HS Algebra	0.005**	0.004	0.002	0.004***	0.000	-0.003	-0.001
score	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Difference: DE & HS English I	0.013***	0.001	0.011***	-0.003*	-0.009***	0.004	-0.006**
score	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
DE partnership contexts							
ECHS	1.413	-9.237***	9.357***	-1.477*	16.904***	4.235***	-1.197
	(0.757)	(0.960)	(1.219)	(0.701)	(1.369)	(1.016)	(0.882)
DE student size (ref. large)							
Very small	0.959	0.111	0.410	-0.839	0.381	0.301	-10.012***
	(0.612)	(0.800)	(0.833)	(0.437)	(0.780)	(0.748)	(0.899)
Small	0.663	-0.472	0.725	-0.100	-0.148	-0.461	-3.154***
	(0.455)	(0.628)	(0.649)	(0.372)	(0.620)	(0.557)	(0.634)
Medium	0.794*	-0.317	0.767	-0.517*	-0.936*	-0.315	-0.913*
	(0.322)	(0.453)	(0.485)	(0.224)	(0.443)	(0.410)	(0.446)
Geographic locale (ref. rural)							
Urban	0.525	-7.992***	7.393***	-4.417***	4.900***	1.406	4.550***
	(0.748)	(0.913)	(1.083)	(0.439)	(0.970)	(0.964)	(1.155)
Suburban	0.607	-4.408***	4.762***	-1.078**	0.759	1.911**	2.369**
	(0.561)	(0.711)	(0.738)	(0.343)	(0.618)	(0.655)	(0.762)
Town	-1.849***	-3.203***	0.943	-1.356***	1.209*	0.063	2.124**
	(0.481)	(0.685)	(0.694)	(0.303)	(0.588)	(0.582)	(0.706)
Count HS partners of DE college	-0.048***	-0.174***	0.096***	-0.040***	-0.165***	0.082***	-0.009
	(0.008)	(0.012)	(0.014)	(0.007)	(0.011)	(0.011)	(0.012)
Average class size	0.049	0.341***	-0.211***	-0.088***	0.290***	-0.012	0.101*
	(0.037)	(0.047)	(0.046)	(0.021)	(0.040)	(0.044)	(0.044)

	College Enrollment Rate (%)			Degree Attainment Rate (%)			Vertical
	Any	Two-year TX public	Four-year TX public	Certificate	Associate degree	Bachelor's degree	Transfer Rate (%)
Independent Variable	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)	*Coeff* (*SE*)
Students failed/withdrew from DE course (%)[a]	-1.181*** (0.132)	0.863*** (0.166)	-1.870*** (0.192)	0.286** (0.101)	-0.849*** (0.187)	-2.238*** (0.166)	-1.847*** (0.177)
DE course structures							
% DE sections: CTE[a]	-1.818*** (0.096)	0.464*** (0.099)	-2.062*** (0.105)	1.123*** (0.068)	-1.218*** (0.101)	-2.079*** (0.100)	-1.738*** (0.104)
% DE sections: Gateway course[a]	0.604*** (0.122)	0.039 (0.173)	0.591** (0.192)	0.065 (0.086)	-0.946*** (0.181)	0.441** (0.169)	-0.113 (0.191)
% DE sections: Online[a]	0.118 (0.061)	-0.161 (0.085)	0.339*** (0.095)	0.154*** (0.040)	-0.084 (0.078)	-0.099 (0.078)	-0.089 (0.095)
% DE sections: Taught by HS instructors[a]	0.244*** (0.067)	0.575*** (0.078)	-0.092 (0.082)	0.116* (0.048)	0.018 (0.075)	-0.210** (0.071)	-0.081 (0.080)
% DE sections: On college campus[a]	0.395*** (0.052)	0.493*** (0.065)	0.046 (0.070)	0.399*** (0.036)	0.523*** (0.062)	0.008 (0.060)	-0.100 (0.062)
% DE sections: Mixed composition[a]	0.070 (0.047)	0.077 (0.068)	0.010 (0.075)	-0.223*** (0.033)	0.101 (0.067)	0.265*** (0.065)	0.042 (0.072)
Adjusted R-squared	0.389	0.233	0.335	0.372	0.604	0.535	0.375
Partnership *n*	6,557	6,557	6,557	6,557	6,557	6,557	6,377

Note. The table presents linear regression results, and each column represents a separate regression model. All models also include year fixed effects and use robust standard errors. The analysis for college enrollment and degree attainment rates includes the entire sample; the analysis of vertical transfer rate includes only students who started at two-year colleges for the first time. Means (*SD*s) for the outcomes of interest in each of the six regressions are as follows: any college enrollment rate: 81.5% (14.3); public two-year college enrollment rate: 36.5% (16.3); public four-year university enrollment rate: 40.6% (18.4); certificate attainment rate: 5.8% (9.3); associate degree attainment rate: 19.2% (16.8); bachelor's degree attainment rate: 34.5% (18.1); vertical transfer rate (among two-year college entrants): 24.0% (18.6).

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

[a] These partnership characteristics measured as percentages are scaled to capture deciles (i.e., to interpret coefficients, a one-unit change in the outcome rate corresponds to a 10-percentage-point change in that partnership characteristic).

Appendix B: Variation Across High School Locale and Socioeconomic Composition

We examine the extent to which the relationships between DE partnership characteristics and postsecondary success outcomes vary across high school rurality and socioeconomic composition. Ultimately, the patterns do not differ substantially from those in our main tables, where the most notable coefficients are those capturing these contexts (particularly geographic locale). Tables B1 and B2 present regression results for two distinct subsamples of DE partnerships in terms of geographic locale: those with rural high schools (Table B1) and those with urban high schools (Table B2). Tables B3 and B4 present regression results for two subsamples of DE partnerships based on the socioeconomic makeup of the high schools: partnerships with Title I high schools (Table B3) and partnerships with non-Title I high schools (Table B4).

B.1 Variation by Geographic Locale

Running separate regressions for the rural and urban partnerships helps us understand the differences in covariate-adjusted outcomes between two subsets of partnerships—rural and urban—that we observe in the full analytic sample. A small number of DE partnership characteristics appear to have similar associations with college enrollment rates across partnerships with rural and urban high schools (see Table B1 and B2). For example, in both rural and urban partnerships, the difference in average math test scores between a partnership and high schools is positively associated with four-year college enrollment rates but negatively correlated with two-year college enrollment rates.

However, many significant (but small) relationships between DE partnership characteristics and college enrollment outcomes appear in one subsample but not in the other. For example, the decile of CTE DE course sections offered in a rural partnership positively predicts two-year college enrollment rate—where a one-unit increase in the decile of CTE DE course sections in a rural partnership is associated with a .23-unit increase and a .31-unit decrease in the rural partnership's two-year college enrollment and four-year college enrollment rates, respectively (B = .230, SE = .099, p = .020; B = -.306, SE = .099, p = .002). These associations do not appear in urban partnerships. The number of AP/IB courses taken by students in urban DE partnerships is associated with

an increase in four-year university enrollment rates, but the association is not significant for rural DE partnerships. Notably, the results show a contrasting association: In rural partnerships, ECHS affiliation is negatively associated with university enrollment rate, whereas in urban partnerships, the relationship is positive.

When turning to degree attainment and transfer outcomes, we observe more significant relationships between DE partnership characteristics—especially in DE access—and outcomes for urban partnerships than for rural ones. For example, the average number of DE courses taken in urban partnerships positively predicts certificate attainment rates. Specifically, a one-unit increase in the number of DE courses taken in an urban partnership predicts a .49-percentage-point increase in the urban partnership's certificate completion rate (B = .494, SE = .184, p = .007). This association between the DE coursetaking measure and certificate completion rates is not significant for rural partnerships. Similarly, the number of AP/IB courses taken in urban partnerships is positively associated with bachelor's degree attainment rates, while no such relationship is observed in rural partnerships. In urban partnerships, the difference in average math test scores between DE students and the full high school population is significantly associated with all degree attainment and vertical transfer outcomes. Specifically, it negatively predicts credential completion and associate degree completion rates but positively predicts bachelor's degree completion and vertical transfer rates. These associations do not appear in rural partnerships.

We find a small number of relationships between DE partnership contexts and degree completion and vertical transfer outcomes across geographic locales. Compared with large DE partnerships, having a very small number of DE students negatively predicts vertical transfer rates in both rural and urban partnerships. However, in rural partnerships, having a small number of DE students (as opposed to a large number) is negatively associated with vertical transfer rates, while in urban partnerships, having a medium number of DE students negatively predicts certificate attainment rates. Additionally, in rural partnerships, the proportion of students who failed or withdrew from DE courses has a small negative correlation with certificate completion rate, but this association does not appear in urban partnerships.

The associations between DE course structures and degree attainment and vertical transfer rates also vary across high school locale. In both rural and urban partnerships, an increase in CTE course sections is negatively associated with bachelor's degree attainment. However, an increase in CTE course sections is positively associated with certificate attainment only in urban partnerships. In rural partnerships, the proportion of online DE course sections is negatively correlated with a partnership's certificate attainment rate but positively associated with its associate degree attainment rate. Specifically, a one-unit increase in the decile of online DE courses offered in a rural partnership is associated with a .105-unit decrease and a .155-unit increase in certificate completion and associate degree completion rates, respectively (B = -.105, SE = .031, p < .001; B = .155, SE = .047, p < .001). These relationships do not appear in urban partnerships.

The proportions of course sections held at college campuses, taught by high school instructors, and featuring mixed student composition also vary across high school locale. In urban partnerships, the proportion of course sections taught by high school teachers is negatively associated with both bachelor's degree attainment and vertical transfer rates. Additionally, the proportion of course sections held on college campuses is negatively associated with bachelor's degree attainment rates. However, these associations are not significant for rural partnerships, where the proportion of course sections with mixed composition is positively associated with certificate attainment rates. In contrast, no significant association between mixed-composition course sections and certificate attainment rates is observed in urban partnerships.

B.2 Variation by High School Title I Status

We also examine how the relationships between DE partnership characteristics and postsecondary access and success vary by Title I status of high school partners (see Tables B3 and B4). We find commonalities and differences in the relationships between DE partnership characteristics and college enrollment rates across the two subgroups of partnerships. The number of AP/IB courses taken positively predicts public university enrollment rates for both Title I and non-Title I partnerships. However, negative associations between the number of DE courses taken and any college enrollment and university enrollment rates are observed only in non-Title I partnerships. Only for Title I

partnerships is the percentage of low-income students associated with any college enrollment rates; specifically, a one-unit increase in a partnership's percentage of low-income students is associated with a .19-percentage-point decrease in its any college enrollment rate (B = -.191, SE = .049, $p < .001$). The difference in average English test scores between DE students and their high school significantly predicts increases in any college and university enrollment rates (and decreases in two-year college enrollment rate) for both Title I and non-Title I partnerships, but the positive relationships between difference in average math test scores and overall college enrollment and university enrollment rates are significant only for Title I partnerships. In Title I partnerships, the number of DE courses taken negatively predicts any college enrollment and university enrollment rates, whereas these associations are not significant for non-Title I partnerships.

For DE partnership contexts, the type and geographic locale of high school appear to be associated with college enrollment rates of non-Title I partnerships, but this is not the case in Title I partnerships, which is somewhat surprising given how large the coefficient is in the full analytic sample. In non-Title I partnerships, partnering with an ECHS positively predicts four-year college enrollment rates. This association does not appear in Title I partnerships. In non-Title I partnerships, partnering with urban high schools—compared with rural high schools—positively predicts any college and four-year university enrollment rates, reflecting an increase of 21 percentage points in a partnership's any college enrollment rate and 36 percentage points in its public university enrollment rate (B = 22.200, SE = 10.744, p = .039; B = 30.634, SE = 12.594, p = .015). In addition, partnerships with a small number of DE students—compared to those serving a large number of DE students—negatively predict any college and two-year college enrollment rates in non-Title I partnerships only.

We also find commonalities and differences in Title I and non-Title I partnerships in terms of the relationships between DE course structures and college enrollment rates. In both types of partnerships, the proportion of CTE DE course sections negatively predicts university enrollment rates, whereas the proportion of online DE course sections positively predicts university enrollment rates. In non-Title I partnerships, the proportions of DE course sections taught by high school instructors and those held at college

campuses are positively associated with two-year college enrollment rates. However, the proportion of sections at college campuses in non-Title I partnerships is negatively associated with public university enrollment rates. A one-unit increase in the decile of DE course sections taught at college campuses in a non-Title I partnership is associated with a .11-unit decrease in public university enrollment rate and a .17-unit increase in public two-year college enrollment rate (B = -.106, SE = .038, p = .006; B = .167, SE = .045, p < .001); the proportion of CTE sections is negatively associated with overall college enrollment rates. These associations do not appear significant in Title I partnerships. For Title I partnerships, we observe a positive relationship between the proportion of online course sections and any college enrollment rates.

We now turn to examine the relationships between DE partnership characteristics and degree completion and vertical transfer rates for Title I and non-Title I partnerships. The relationships between DE access and certificate and associate degree attainment and vertical transfer rates appear different across high schools' socioeconomic composition with a few exceptions. For example, in the non-Title I partnerships only, the average number of AP/IB courses taken negatively predicts associate degree attainment rate and positively predicts bachelor's degree attainment rate. In addition, in the non-Title I partnerships, the number of DE courses taken negatively predicts bachelor's degree attainment rate. Specifically, a one-unit increase in the number of DE courses taken in non-Title I partnerships is associated with a .58-unit decrease in bachelor's degree attainment rate (B = -.584, SE = .163, p < .001). This relationship is not observed in Title I partnerships. The differences in average math and English test scores between DE students and their high school in a non-Tile I partnership positively predict the partnership's associate degree attainment rate. In contrast, in a Title I partnership, the difference in average math test scores between DE students and their high school positively predicts the partnership's bachelor's degree attainment rate and negatively predicts its vertical transfer rate.

Some associations between DE access and bachelor's degree attainment rate show similarities in both Title I and non-Title I partnerships. The direction and size of the relationships between certificate attainment and variables such as the number of DE courses taken and the difference between DE student and high school English scores

appear in both types of partnerships, similar to those observed in the full sample. The percentage of low-income students negatively predicts bachelor's degree attainment rates in both Title I and non-Title I partnerships. A one-unit increase in the percentage of low-income students in Title I and non-Title I partnerships is associated with .11- and .16-unit decreases, respectively, in bachelor's degree attainment rate (B = -.114, SE = .046, p = .014; B = -.157, SE = .080, p = .049). In both types of partnerships, the difference in average English test scores between a partnership and high schools is also positively associated with bachelor's degree attainment and vertical transfer rates.

We also find a small number of relationships between DE partnership contexts and degree completion and vertical transfer outcomes across Title I status, where some significant relationships appear in one subsample but not in the other. As in the full sample, very small and small DE partnerships—compared to the large partnerships—are positively associated with certificate attainment rate and negatively correlated with vertical transfer rate in both Title I and non-Title I partnerships. The medium size of DE students—compared to the large DE student size—is also associated with a small increase in certificate and associate degree attainment rates and a small decrease in vertical transfer rate, but the associations appear only in non-Title I partnerships. Partnering with an urban high school, compared with a rural school, is associated with 30.2- and 42.7-percentage-point increases in both Title I and non-Title I partnerships' associate degree attainment rates, respectively (B = 30.153, SE = 5.217, $p < .001$; B = 42.671, SE = 12.858, $p < .001$). In contrast, positive relationships between partnering with an urban high school—compared with a rural school—and any college and university enrollment rates appear in non-Title I partnerships only. We also observe a positive association between partnering with an ECHS and associate degree attainment rates in both subsamples of partnerships; however, a positive relationship between ECHS status and certificate attainment appears in non-Title I partnerships only. The proportion of students who failed or withdrew from DE courses positively predicts associate degree completion outcomes in Title I partnerships only.

The relationships between DE course structures and partnership performance beyond college enrollment rates do not show clear patterns across Title I status. The proportion of online DE course sections predicts associate degree completion rates in

Title I partnerships—where a one-unit increase in the decile of online DE courses offered in a Title I partnership is associated with a .01-unit increase in associate degree attainment rate (B = .096, SE = .042, p = .022)—but this relationship does not appear in non-Title I partnerships. In contrast, the DE mixed-student composition measure negatively predicts certificate attainment rates and positively predicts bachelor's degree attainment rates only in non-Title I partnerships, suggesting that partnerships with a higher proportion of DE course sections that mix high school and college students experience lower certificate completion rates and higher bachelor's degree completion rates. The proportions of CTE DE course sections and DE course sections at college campuses are positively associated with certificate attainment rates in both Title I and non-Title I partnerships; however, the proportion of DE course sections at college campuses is negatively associated with bachelor's degree attainment rate only in non-Title I partnerships. In both Title I and non-Title I partnerships, the CTE DE course section measure is associated with the bachelor's degree completion and vertical transfer outcomes, and the measure on DE course sections at college campuses is positively associated with the associate degree completion outcome, while offering DE course sections at college campuses negatively predicts bachelor's degree attainment in non-Title I partnerships. The proportion of DE course sections taught by high school instructors is negatively associated with Title I partnerships' certificate completion rates. This association does not appear in non-Title I partnerships.

Table B1. Results With Rural Subsample for Regression Models Predicting DE Partnerships' Postsecondary Success Outcomes

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
DE access							
DE courses taken	0.356	-0.256	0.379	0.030	0.209	0.446	0.208
	(0.202)	(0.199)	(0.236)	(0120)	(0.162)	(0.255)	(0.481)
AP/IB courses taken	-0.051	-0.311	-0.070	0.256	-0.459	0.159	-0.678
	(0.294)	(0.343)	(0.283)	(0.156)	(0.238)	(0.255)	(0.715)
% Low-income students[a]	-0.104	-0.141	0.065	0.000	-0.068	0.048	-0.057
	(0.079)	(0.077)	(0.064)	(0.032)	(0.066)	(0.074)	(0.147)
Difference: DE & HS Algebra	0.010	-0.007	0.014	-0.023***	0.002	0.023*	-0.004
score	(0.010)	(0.011)	(0.011)	(0.005)	(0.010)	(0.010)	(0.019)
Difference: DE & HS English I	0.029	-0.040*	0.070***	0.015	0.001	0.002	-0.010
score	(0.015)	(0.019)	(0.015)	(0.011)	(0.014)	(0.017)	(0.023)
DE partnership contexts							
ECHS	-22.369*	13.537	-33.977***	16.722***	34.896***	-36.060***	56.315***
	(8.784)	(9.621)	(7.111)	(4.617)	(5.870)	(8.778)	(11.931)
DE student size (ref. large)							
Very small	-0.271	0.204	-0.808	-0.396	0.521	-0.253	-7.912***
	(0.822)	(0.780)	(0.694)	(0.397)	(0.638)	(0.876)	(1.619)
Small	0.200	0.631	-0.151	0.079	0.290	-0.440	-1.502*
	(0.362)	(0.367)	(0.338)	(0.210)	(0.324)	(0.405)	(0.720)
Medium	0.250	0.286	0.132	0.076	0.168	-0.243	0.109
	(0.238)	(0.242)	(0.212)	(0.138)	(0.187)	(0.298)	(0.467)
Count HS partners of DE college	-0.018	-0.004	-0.006	0.003	-0.040	-0.039	0.095
	(0.031)	(0.027)	(0.024)	(0.016)	(0.023)	(0.027)	(0.071)
Average class size	0.015	0.015	0.002	-0.010	0.010	0.007	-0.013
	(0.014)	(0.017)	(0.015)	(0.009)	(0.014)	(0.017)	(0.030)
% students failed/withdrew from	-0.111	-0.047	-0.123	-0.091*	-0.037	-0.049	-0.043
DE course[a]	(0.080)	(0.080)	(0.072)	(0.039)	(0.057)	(0.069)	(0.152)
DE course structures							
% DE sections: CTE[a]	-0.003	0.230*	-0.306**	0.008	0.077	-0.213*	0.132
	(0.085)	(0.099)	(0.099)	(0.037)	(0.081)	(0.102)	(0.130)
% DE sections: Gateway course[a]	0.061	-0.016	0.097	-0.012	0.027	-0.015	0.109
	(0.075)	(0.072)	(0.079)	(0.030)	(0.045)	(0.062)	(0.138)
% DE sections: Online[a]	0.139*	0.058	0.038	-0.105***	0.155***	0.115	-0.066
	(0.070)	(0.068)	(0.066)	(0.031)	(0.047)	(0.067)	(0.114)
% DE sections: Taught by HS	0.079	0.025	0.050	-0.004	0.033	0.138	-0.075
instructors[a]	(0.075)	(0.067)	(0.071)	(0.047)	(0.056)	(0.086)	(0.109)

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
DE sections: On college campus[a]	0.019 (0.039)	-0.007 (0.052)	0.039 (0.049)	0.059* (0.028)	-0.042 (0.051)	0.016 (0.056)	0.049 (0.074)
DE sections: Mixed composition[a]	-0.001 (0.048)	-0.015 (0.045)	0.014 (0.047)	0.049* (0.024)	-0.062 (0.043)	0.064 (0.055)	-0.024 (0.091)

Note. Partnership *n* = 1,634. The table presents linear regression results, and each column represents a separate regression model. All models also include high school, college, and year fixed effects and use robust standard errors. The analysis for college enrollment and degree attainment rates includes the entire sample, and the analysis of vertical transfer rate includes only students who started at two-year colleges for the first time. Subsample means (*SD*s) for the outcomes of interest in each of the six regressions are: any college enrollment: 81.5% (14.7); public two-year college enrollment: 38.3% (17.3); public university enrollment: 38.4% (19.0); certificate attainment: 6.0% (6.9); associate degree attainment: 17.6% (13.0); bachelor's degree attainment: 32.7% (17.8); vertical transfer: 21.6% (19.1).

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

[a] These partnership characteristics measured as percentages are scaled to capture deciles (i.e., to interpret coefficients, a one-unit change in the outcome rate corresponds to a 10-percentage-point change in that partnership characteristic).

Table B2. Results With Urban Subsample for Regression Models Predicting DE Partnerships' Postsecondary Success Outcomes

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
DE access							
DE courses taken	0.156	0.381	0.041	0.494**	0.081	-0.087	-0.377
	(0.125)	(0.219)	(0.181)	(0.184)	(0.144)	(0.181)	(0.219)
AP/IB courses taken	0.080	-0.290	0.310*	-0.062	-0.192	0.298*	-0.324
	(0.108)	(0.158)	(0.150)	(0.131)	(0.105)	(0.143)	(0.205)
% Low-income students[a]	-0.028	0.111	-0.118	-0.128	-0.038	-0.222	0.092
	(0.134)	(0.195)	(0.148)	(0.214)	(0.110)	(0.124)	(0.227)
Difference: DE & HS Algebra	0.021*	0.034*	-0.011	-0.030**	-0.006	0.021*	0.023*
score	(0.009)	(0.015)	(0.009)	(0.011)	(0.008)	(0.010)	(0.010)
Difference: DE & HS English I	0.018***	-0.044***	0.047***	-0.025***	-0.016***	0.048***	0.021*
score	(0.005)	(0.008)	(0.006)	(0.006)	(0.004)	(0.006)	(0.010)
DE partnership contexts							
Early college high school	5.574	-7.221	12.871**	-15.001**	39.269***	35.917***	11.525*
	(3.655)	(6.209)	(4.438)	(4.956)	(4.246)	(4.246)	(5.769)
DE student size (ref. large)							
Very small	-0.850	1.342	-2.340	2.634	-0.763	-0.763	-8.890***
	(1.300)	(2.067)	(1.515)	(1.524)	(1.201)	(1.201)	(2.025)
Small	-1.079	0.251	-0.990	0.700	-0.382	-0.382	-2.367
	(0.818)	(0.854)	(0.728)	(0.744)	(0.554)	(0.554)	(1.206)
Medium	-0.335	0.132	-0.332	-0.494*	0.083	0.083	0.423
	(0.221)	(0.298)	(0.260)	(0.238)	(0.179)	(0.179)	(0.322)
Count HS partners of DE college	-0.002	-0.006	0.006	0.008	0.004	0.004	-0.010
	(0.008)	(0.013)	(0.011)	(0.012)	(0.007)	(0.007)	(0.020)
Average class size	0.000	0.002	-0.004	0.015	0.011	0.011	0.009
	(0.018)	(0.029)	(0.023)	(0.026)	(0.015)	(0.015)	(0.029)
% Students failed/withdrew from	-0.174	-0.125	-0.032	-0.007	0.116	0.116	-0.028
DE course[a]	(0.118)	(0.144)	(0.141)	(0.138)	(0.112)	(0.112)	(0.192)
DE course structures							
% DE sections: CTE[a]	-0.117	0.126	-0.222	0.332*	-0.039	-0.275*	-0.054
	(0.077)	(0.150)	(0.126)	(0.150)	(0.076)	(0.123)	(0.120)
% DE sections: Gateway course[a]	-0.174	0.010	-0.159	0.112	-0.031	-0.203	-0.086
	(0.100)	(0.144)	(0.125)	(0.098)	(0.089)	(0.112)	(0.173)
% DE sections: Online[a]	0.288**	0.113	0.135	-0.056	0.082	-0.175	-0.172
	(0.098)	(0.111)	(0.103)	(0.097)	(0.103)	(0.112)	(0.171)
% DE sections: Taught by HS	-0.051	0.294**	-0.240*	0.009	0.021	-0.363***	-0.296*
instructors[a]	(0.093)	(0.113)	(0.115)	(0.089)	(0.072)	(0.100)	(0.140)

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
% DE sections: On college campus[a]	-0.002 (0.096)	0.260* (0.112)	-0.204 (0.107)	0.063 (0.097)	-0.008 (0.064)	-0.234** (0.088)	-0.112 (0.103)
% DE sections: Mixed composition[a]	0.024 (0.101)	0.036 (0.137)	0.052 (0.114)	-0.010 (0.125)	0.010 (0.087)	-0.057 (0.103)	-0.223 (0.145)

Note. Partnership *n* = 682. The table presents linear regression results, and each column represents a separate regression model. All models also include high school, college, and year fixed effects and use robust standard errors. The analysis for college enrollment and degree attainment rates includes the entire sample, and the analysis of vertical transfer rate includes only students who started at two-year colleges for the first time. Subsample means (*SD*s) for the outcomes of interest in each of the six regressions are: any college enrollment: 79.2% (16.7); public two-year college enrollment: 35.2% (18.9); public university enrollment: 39.6% (19.0); certificate attainment: 7.0% (14.2); associate degree attainment: 20.7% (21.5); bachelor's degree attainment: 27.5% (19.0); vertical transfer: 19.7% (18.6).

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

[a] These partnership characteristics measured as percentages are scaled to capture deciles (i.e., to interpret coefficients, a one-unit change in the outcome rate corresponds to a 10-percentage-point change in that partnership characteristic).

Table B3. Results With Title I Subsample for Regression Models Predicting DE Partnerships' Postsecondary Success Outcomes

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
DE access							
DE courses taken	-0.001	0.193	-0.150	0.302**	0.136	-0.144	-0.221
	(0.103)	(0.116)	(0.097)	(0.092)	(0.141)	(0.122)	(0.142)
AP/IB courses taken	0.087	-0.151	0.184*	-0.125	-0.091	0.115	0.018
	(0.074)	(0.087)	(0.085)	(0.077)	(0.070)	(0.074)	(0.121)
% Low-income students[a]	-0.191***	-0.098	-0.067	-0.073	-0.067	-0.114*	-0.008
	(0.049)	(0.053)	(0.046)	(0.049)	(0.044)	(0.046)	(0.075)
Difference: DE & HS Algebra	0.018**	0.001	0.022***	-0.003	-0.002	0.025***	-0.014*
score	(0.006)	(0.003)	(0.006)	(0.005)	(0.005)	(0.006)	(0.007)
Difference: DE & HS English I	0.044***	-0.016*	0.049***	-0.015**	0.007	0.022***	0.018*
score	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.009)
DE partnership contexts							
ECHS	17.533	8.512	15.909	-4.664	22.178***	-10.232	6.516
	(10.302)	(14.479)	(8.449)	(6.162)	(4.378)	(7.518)	(8.748)
DE student size (ref. large)							
Very small	-0.901	-0.044	-1.117	1.016*	0.501	0.274	-10.390***
	(0.640)	(0.757)	(0.661)	(0.443)	(0.707)	(0.657)	(1.010)
Small	-0.637*	-0.079	-0.509	0.666*	0.060	-0.267	-2.287***
	(0.313)	(0.314)	(0.330)	(0.259)	(0.337)	(0.295)	(0.520)
Medium	0.100	0.148	-0.040	0.152	-0.071	0.124	0.058
	(0.159)	(0.140)	(0.151)	(0.124)	(0.142)	(0.139)	(0.166)
Geographic locale (ref. rural)							
Urban	-0.396	-2.698	5.260	5.023	30.153***	-4.720	-3.428
	(12.868)	(31.544)	(21.561)	(5.304)	(5.217)	(17.938)	(33.257)
Suburban	0.440	1.183	-1.020	1.652*	1.091	0.730	-9.387***
	(0.770)	(0.843)	(0.762)	(0.673)	(0.747)	(0.754)	(1.489)
Town	0.245	0.062	0.185	-0.024	0.129	0.242	0.246
	(0.325)	(0.105)	(0.249)	(0.100)	(0.249)	(0.254)	(0.488)
Count HS partners of DE college	-0.006	0.001	-0.007	0.005	-0.008	-0.001	0.005
	(0.008)	(0.008)	(0.008)	(0.006)	(0.007)	(0.008)	(0.014)
Average class size	-0.010	-0.006	-0.008	-0.009	-0.025	-0.011	0.009
	(0.018)	(0.017)	(0.016)	(0.013)	(0.014)	(0.016)	(0.023)
% Students failed/withdrew from	-0.016	-0.081	0.075	-0.076	0.124*	-0.036	-0.048
DE course[a]	(0.059)	(0.058)	(0.051)	(0.046)	(0.054)	(0.051)	(0.075)

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
DE course structures							
% DE sections: CTE[a]	-0.047	0.080	-0.163*	0.179***	-0.048	-0.144*	-0.128*
	(0.053)	(0.050)	(0.066)	(0.046)	(0.041)	(0.073)	(0.065)
% DE sections: Gateway course[a]	0.093	0.001	0.111	0.026	-0.018	0.070	-0.009
	(0.064)	(0.067)	(0.064)	(0.037)	(0.045)	(0.063)	(0.137)
% DE sections: Online[a]	0.081*	-0.053	0.091*	-0.009	0.096*	0.051	-0.084
	(0.041)	(0.045)	(0.043)	(0.029)	(0.042)	(0.044)	(0.067)
% DE sections: Taught by HS instructors[a]	0.011	0.018	-0.008	-0.071*	0.049	-0.006	-0.037
	(0.040)	(0.034)	(0.042)	(0.029)	(0.034)	(0.037)	(0.060)
% DE sections: On college campus[a]	0.046	0.034	0.017	0.105**	0.091**	-0.028	-0.053
	(0.032)	(0.037)	(0.035)	(0.033)	(0.031)	(0.037)	(0.042)
% DE sections: Mixed composition[a]	-0.036	-0.026	-0.012	-0.015	-0.006	0.035	-0.014
	(0.036)	(0.032)	(0.034)	(0.027)	(0.030)	(0.032)	(0.053)
Partnership *n*	3,410	3,410	3,410	3,410	3,410	3,410	3,308

Note. The table presents linear regression results, and each column represents a separate regression model. All models also include year fixed effects and use robust standard errors. The analysis for college enrollment and degree attainment rates includes the entire sample, and the analysis of vertical transfer rate includes only students who started at two-year colleges for the first time. Subsample means (SDs) for the outcomes of interest in each of the regressions are: any college enrollment: 80.5% (14.9); public two-year college enrollment: 36.5% (16.6); public university enrollment: 40.2% (18.6); certificate attainment: 6.7% (9.6); associate degree attainment: 20.2% (17.3); bachelor's degree attainment: 31.3% (17.6); vertical transfer: 21.1% (17.6).

*p < .05, **p < .01, ***p < .001.

a These partnership characteristics measured as percentages are scaled to capture deciles (i.e., to interpret coefficients, a one-unit change in the outcome rate corresponds to a 10-percentage-point change in that partnership characteristic).

Table B4. Results With Non-Title I Subsample for Regression Models Predicting DE Partnerships' Postsecondary Success Outcomes

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
DE access							
DE courses taken	-0.345*	0.282	-0.501**	0.297*	-0.122	-0.584***	-0.255
	(0.137)	(0.159)	(0.166)	(0.126)	(0.153)	(0.163)	(0.211)
AP/IB courses taken	0.158*	-0.238**	0.329***	-0.100	-0.207**	0.262**	-0.082
	(0.079)	(0.088)	(0.096)	(0.065)	(0.063)	(0.095)	(0.132)
% Low-income students[a]	-0.159	0.043	-0.155	0.074	0.011	-0.157*	-0.048
	(0.090)	(0.093)	(0.086)	(0.072)	(0.072)	(0.080)	(0.112)
Difference: DE & HS Algebra	0.004	-0.001	-0.002	0.000	0.013**	0.006	0.008
score	(0.006)	(0.006)	(0.006)	(0.004)	(0.005)	(0.006)	(0.007)
Difference: DE & HS English I	0.028***	-0.031***	0.050***	-0.016***	0.010*	0.038***	0.032***
score	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.007)
DE partnership contexts							
ECHS	18.729	-3.041	29.267**	13.495***	31.431**	1.509	21.922
	(14.910)	(10.925)	(10.988)	(2.510)	(11.157)	(10.444)	(23.051)
DE student size (ref. large)							
Very small	-0.079	0.537	-0.278	1.270*	0.308	-1.341	-15.538***
	(0.730)	(0.857)	(0.855)	(0.522)	(0.660)	(0.868)	(1.306)
Small	-1.297*	-1.065*	-0.242	1.793***	0.408	-0.491	-3.398***
	(0.527)	(0.495)	(0.498)	(0.520)	(0.398)	(0.456)	(0.653)
Medium	0.029	0.015	-0.014	0.327*	0.298*	0.019	-0.542*
	(0.157)	(0.169)	(0.158)	(0.140)	(0.127)	(0.147)	(0.247)
Geographic locale (ref. rural)							
Urban	22.200*	-9.736	30.634*	6.621*	42.671***	25.695*	17.022
	(10.744)	(13.308)	(12.594)	(2.585)	(12.858)	(11.241)	(12.195)
Suburban	-0.144	-0.100	-0.093	-0.182	-0.184	-0.136	-0.400
	(0.424)	(0.313)	(0.457)	(0.297)	(0.300)	(0.508)	(0.509)
Town	0.055	-0.277	0.227	-0.304	-0.061	0.269	0.143
	(0.533)	(0.332)	(0.346)	(0.217)	(0.275)	(0.392)	(0.491)
Count HS partners of DE college	-0.004	0.000	-0.009	0.010	0.004	0.000	0.000
	(0.009)	(0.010)	(0.010)	(0.007)	(0.007)	(0.010)	(0.016)
Average class size	0.003	0.001	-0.002	-0.013	-0.015	0.001	0.028
	(0.014)	(0.011)	(0.013)	(0.011)	(0.009)	(0.014)	(0.018)
% Students failed/withdrew from	0.070	0.125	-0.043	-0.079	-0.054	-0.101	0.012
DE course[a]	(0.058)	(0.067)	(0.063)	(0.042)	(0.055)	(0.064)	(0.097)

	College Enrollment Rate			Degree Attainment Rate			
Variable	Any *Coeff* (*SE*)	Two-year TX public *Coeff* (*SE*)	Four-year TX public *Coeff* (*SE*)	Certificate *Coeff* (*SE*)	Associate degree *Coeff* (*SE*)	Bachelor's degree *Coeff* (*SE*)	Vertical Transfer Rate *Coeff* (*SE*)
DE course structures							
% DE sections: CTE[a]	-0.351***	0.035	-0.399***	0.485***	-0.009	-0.408***	-0.320***
	(0.085)	(0.078)	(0.078)	(0.084)	(0.050)	(0.086)	(0.092)
% DE sections: Gateway course[a]	0.016	0.014	-0.018	0.000	-0.050	-0.062	-0.130
	(0.046)	(0.055)	(0.060)	(0.033)	(0.045)	(0.054)	()0.095
% DE sections: Online[a]	0.083	-0.066	0.117*	0.003	0.007	0.038	-0.006
	(0.051)	(0.044)	(0.048)	(0.032)	(0.033)	(0.048)	(0.067)
% DE sections: Taught by HS instructors[a]	0.020	0.089*	-0.070	0.019	0.060	-0.022	-0.054
	(0.037)	(0.040)	(0.039)	(0.028)	(0.031)	(0.041)	(0.055)
% DE sections: On college campus[a]	0.009	0.167***	-0.106**	0.132***	0.152***	-0.142***	-0.097*
	(0.038)	(0.045)	(0.038)	(0.033)	(0.034)	(0.038)	(0.047)
% DE sections: Mixed composition[a]	0.011	-0.046	0.051	-0.047*	-0.009	0.082**	-0.016
	(0.030)	(0.028)	(0.027)	(0.019)	(0.021)	(0.027)	(0.054)
Partnership *n*	3,147	3,147	3,147	3,147	3,147	3,147	3,069

Note. The table presents linear regression results, and each column represents a separate regression model. All models also include year fixed effects and use robust standard errors. The analysis for college enrollment and degree attainment rates includes the entire sample, and the analysis of vertical transfer rate includes only students who started at two-year colleges for the first time. Subsample means (*SD*s) for the outcomes of interest in each of the regressions are: any college enrollment: 82.6% (13.6); public two-year college enrollment: 36.5% (16.0); public university enrollment: 41.0% (18.2); certificate attainment: 4.9% (8.9); associate degree attainment: 18.1% (16.2); bachelor's degree attainment: 38.0% (17.9); vertical transfer: 27.1% (19.1).

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

[a] These partnership characteristics measured as percentages are scaled to capture deciles (i.e., to interpret coefficients, a one-unit change in the outcome rate corresponds to a 10-percentage-point change in that partnership characteristic).