Dual Credit Education in Texas

Interim Report

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Preface

Dual credit (DC) education allows high school students to take college-level courses that simultaneously provide credit toward a high school diploma and a college degree. Although DC education programs have been implemented by institutions for more than 50 years in the United States, there is surprisingly little research that provides practical, evidence-based guidance on how to structure, target, and scale DC education programs to ensure that they benefit students—a problem expressed by researchers in prior work. The research discussed in this report addresses this need by examining DC education programs in Texas, a state that has witnessed a 650 percent growth in the number of high school students enrolling in DC education programs since 2000, according to data from the Texas Higher Education Coordinating Board (THECB). This unprecedented growth is partly the result of legislative action and partly the result of a concerted effort among Texas high schools and colleges to offer students a greater number of opportunities to earn college credit before they graduate from high school. The overarching goal of this research is to inform policymakers and stakeholders whether DC education programs need to be reformed and, if so, how to reform them to better support students in Texas through teaching, advising, assessment, and the allocation of resources, in turn helping Texas to reach the goals of 60x30TX—the state's strategic plan for higher education.

This interim report presents findings from the first phase of this study, which was designed to provide timely information on DC education programs to state lawmakers during the 85th Texas Legislative Session. Specifically, this interim report provides Texas policymakers and stakeholders with an initial perspective on the accessibility, diversity, quality, and efficiency of DC education programs in Texas. It also proposes areas of DC education to investigate in the second phase of the study. The report should be of interest to lawmakers and policymakers in Texas, policymakers in states interested in expanding DC programs, and researchers interested in DC programs.

The research was conducted by RAND Education, a unit of the RAND Corporation, in collaboration with the THECB and Gibson Consulting (Gibson). This research was funded by the College for All Texans Foundation (CFAT), through generous grants from Educate Texas, a public-private initiative of Communities Foundation of Texas, Greater Texas Foundation, Houston Endowment, and the Meadows Foundation. Any questions should be directed to the principal investigator, Trey Miller, at (310) 503-5364.

We circulated a draft of this report for public comment and peer review and have addressed the comments we received in this published report. The public comments we received are summarized in Appendix F.

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Summary

Dual credit (DC) education programs—delivered through partnerships between high schools and colleges and universities—offer high school students the option to take college-level courses that simultaneously award them college and high school credit. Over the past five decades, states and education institutions have created and broadened DC education programs to help high school students gain access to colleges and universities and to improve their chances of success. But despite this history, there is still a knowledge gap about how to design, target, and implement high-quality and cost-effective DC programs that benefit students, particularly when such programs are broadened.

Advocates of DC programs argue that DC education can help high school students adjust their college expectations, provide challenging courses, and help align curricula across high school and college. Other advocates have argued that DC education can help lower student costs for college and reduce the overall time to a college degree for DC participants. Having said that, DC programs are not without their critics.

Indeed, some stakeholders have argued that some DC courses may not be as rigorous as college-credit-only courses and, thus, may set up students for failure later on when they take college courses after high school graduation or enter the workplace. Other critics have argued that DC education may not be the best use of public resources. Funding for DC education can come from a number of sources, including local property taxes, state budgets, student tuition, and federal financial aid. Also, DC students may not always receive college credit for the DC courses they take, or they may take unnecessary college courses due to misinformation or a lack of information. Finally, some critics have argued that DC education is less accessible to traditionally underserved students, including minorities and low-income students.

What Is Dual Credit?

DC programs offer high school students the option of taking college-level courses that award both college and high school credit at the same time. Courses can be either academically oriented or career and technical education (CTE). Programs are delivered through partnerships between high schools and colleges and universities and can be offered on a high school, college, or university campus.

While these concerns are not new, they have grown in significance as DC courses have become more popular and as the implementation of DC education has evolved in practice. In Texas, policymakers, K–12 and college and university administrators, and the public have sought to better understand the extent to which DC education programs boost higher education access and completion. Specifically, these groups are looking for ways to identify whether reforms are needed to maximize the benefits of DC programs and minimize the concerns around them.

Existing research on DC has mostly reported positive results, but it has also documented some of the concerns raised by critics of DC. Importantly, few studies provide evidence that lends practical guidance for developing, implementing, and broadening DC programs—evidence that is currently relevant in the state of Texas, where, according to a report by the Texas Higher Education Coordinating Board (THECB), the number of DC participants has grown by 650 percent between 2000 and 2015 (THECB, 2016a). In addition, House Bill (HB) 505 (84th Texas Legislature) expanded access to DC in a number of ways.

Objectives

To address this research gap, the RAND Corporation (RAND), the THECB, and Gibson Consulting (Gibson) partnered to examine DC programs in Texas.

This report shares findings from Phase I of a two-year study that examines DC programs in Texas. The research questions (RQs) focus on the accessibility, diversity, quality, and efficiency of DC education programs:

- RQ 1: What **institutional policies and practices** shape how institutions advise DC students, teach DC courses, and determine student eligibility for DC courses?
- RQ 2: How have DC **participation rates** among different student groups and DC course delivery changed over time?
- RQ 3: What are the **academic outcomes** of high school students who took DC courses versus those who did not, prior to HB 505?
- RQ 4: Did high school students who took DC courses **complete college more efficiently** than students who never took DC courses?

Methods and Data Sources

To provide an initial and timely perspective on DC programs to state policymakers, we used several methods in this research to understand DC from multiple perspectives, and to validate findings across data sources:

- Quantitative analyses of **administrative data** collected by the THECB and the Texas Education Agency (TEA), which provide enrollment, assessment, and outcome information on DC students from 2000 to 2015. Because these data do not extend beyond 2015, we were unable to examine how HB 505 impacts college and university access and success, the source of many questions currently surrounding DC in Texas (RQs 2, 3, 4).
- A **review of academic and policy studies** on DC education programs in the United States and Texas, which provides a landscape of DC across states (RQ 1).
- **Interviews** with DC administrators at select Texas community colleges, which provide insights into how DC programs are implemented in practice (RQ 1).

> We used several methods to understand DC from multiple perspectives and to validate findings across data sources.

Combining these different data sources enables policymakers and practitioners to understand DC programs from a variety of perspectives—something that could not be achieved based on just one data source.

Key Findings and Recommendations

The most significant finding in Phase I was that, prior to HB 505, DC students had better college outcomes than high school graduates who did not take DC courses.

Phase I of the study led to four main findings.

- **[RQ 1] DC students (prior to HB 505) had better college outcomes than high school graduates who did not take DC courses.** DC students had higher grades in DC courses in the same subject as their non-DC peers, and higher grades in follow-on courses in the same subject. DC students also had higher college enrollment rates after high school, particularly at four-year colleges, and were significantly more likely to persist in and complete college. These outcomes are considered the most significant findings in this interim report. Nevertheless, based on this descriptive analysis, we cannot conclude that DC education improves student outcomes.
- **[RQ 2] DC instruction and advising varied across colleges and universities.** DC administrators reported varied approaches to ensure that DC and college-credit-only courses were comparable. For example, state policy mandates common learning objectives for all lower-division courses, and DC administrators reported using common syllabi and, in many cases, asking departments to oversee instruction and assessment. Guidelines by the regional accrediting body set minimum qualifications for college instructors, but they do not guarantee that DC instructors have equivalent academic backgrounds and teaching experience. Finally, DC administrators reported differences in advising practices across DC programs that related both to context (particularly distance from the partner college and whether the high school was an Early College High School) and to resource availability.
- **[RQ 3] Prior to HB 505, disparities in DC participation rates changed across demographic groups over time.** Through our quantitative analyses, we discovered disparities in DC participation rates by race/ethnicity, income, urbanicity (the urban or rural location of the student's high school), and academic background. While gaps in DC participation rates by race and ethnicity widened over time, this was partly due to the low rate of DC participation by African-American and Hispanic students in 2000. Indeed, growth in DC participation rates since 2000 was the highest among African-American and Hispanic high school graduates. Nevertheless, disparities in DC participation across student groups persist. These disparities could be driven by differences in DC access across high schools in Texas, preparation and demand for DC across demographic groups, access to alternative forms of college-level coursework in high school (such as through Advanced Placement courses or International Baccalaureate programs), or advising practices at high schools, or other factors. Our research thus far is unable to pinpoint the specific causes of these differences.
- **[RQ 4] DC students took about the same time and the same semester credit hours (SCHs) to complete a college degree as their non-DC counterparts.** Our quantitative analysis revealed that just over 3 percent of all DC courses taken by high school graduates

were retaken during the first two years of college and that most of the repeats were driven by poor performance in the DC course. We also found that DC students took, on average, half an academic year less to complete a four-year degree. DC students completed their degrees with roughly the same number of SCHs as students who did not take a DC course.

Our key recommendation is to wait for findings from the next phase of our study to make changes to policy surrounding DC programs in Texas.

Although our research thus far provides rich and detailed findings, they are limited in how they can provide guidance on whether and how to change DC programs. To date, the information in this report tells us that students who took DC courses before the passage of HB 505 outperformed those who did not, but does not inform us about the extent that DC education contributed to these better academic outcomes. It also does not tell us about the quality of instruction or advising that DC students receive, nor about the degree that DC produces a return on investment or why we see that African-American and Hispanic students participating at lower rates when compared with white students, even though they share the same set of characteristics. Thus, our **key recommendation** from Phase I is to wait for findings from the next phase of our study to make changes to policy surrounding DC programs in Texas.

Conclusions and Next Steps

The next phase of the research is designed to answer six research questions to inform reasoned decisions affecting DC policy and practice, as shown in Table S.1.

Answers to these questions will help inform policy decisions that ensure as many Texas students as possible benefit from appropriately targeted, high-quality, and cost-effective DC programs.

Table S.1
Research Questions for Phase II

Research Question	Study Objective
Are there systematic differences in curricula, course content, assessment methods and standards, and/or teaching approaches in DC and college-credit-only courses?	Examine the extent to which differences in faculty background and course modalities and contexts affect the curricula, course content and assessment methods and standards in DC courses, relative to college-credit-only courses.
Is there a way to improve DC advising to reduce the number of SCHs a DC student earns toward a college degree?	Investigate the types of guidance and information high school and college counselors give to DC students, and identify the barriers that may prevent unnecessary course-taking.
How much did students' previous academic preparation and behavioral dispositions, versus what they learned in their DC courses, contribute to their success?	Estimate the causal impact of DC education on improving student outcomes, particularly for disadvantaged students' course-taking and for different DC implementation models.
What are the financial costs of DC programs to stakeholders, given that Texas allocates funding to both high schools and colleges and universities to deliver DC and that DC students exhibit similar time-to-degree and SCHs-to-degree patterns as college-credit-only students?	Calculate the costs of implementing DC programs and the financial savings, if any, that DC programs generate for DC students and for the state.
Why have disparities in DC participation rates across demographic groups persisted and widened over time?	Examine potential causes for the observed disparities in DC participation, such as differences in DC access across high schools, preparation and demand for DC across demographic groups, access to alternative forms of advanced coursework, and advising practices.
Are institutions expanding DC programs in response to HB 505, and, if so, are students still benefiting?	Assess how colleges and universities have responded to HB 505.

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Abbreviations

ACGM	*Lower Division Academic Course Guide Manual*
AP	Advanced Placement
CTE	career and technical education
DC	dual credit
ECHS	Early College High School
EOC	End-of-Course Exam
ESL	English as a Second Language
GT	gifted and talented
HEI	higher education institution
IB	International Baccalaureate
OLS	ordinary least squares
SACSCOC	Southern Association of Colleges and Schools Commission on Colleges
SCH	semester credit hour
STAAR	State of Texas Assessments of Academic Readiness
TEA	Texas Education Agency
THECB	Texas Higher Education Coordinating Board
TSI	Texas Success Initiative
TSIA	Texas Success Initiative Assessment

CHAPTER ONE

Introduction

Background

It is widely known that college degrees generate long-term economic and social benefits to the individuals who earn them and that these benefits extend broadly to society. In 2015, median wages for workers with a bachelor's degree, ages 22 to 27, were $43,000, roughly $18,000 higher than the earnings of workers with only a high school diploma who belonged to the same age group (Federal Reserve of New York, 2015). At the beginning of 2014, workers with bachelor's degrees who were over age 25 were also 3 percentage points less likely to be unemployed, compared with workers with only a high school diploma (U.S. Bureau of Labor Statistics, 2017). These economic benefits are complemented by social rewards. Baum and colleagues (2013) found that college-educated adults were more likely than their counterparts to be in better health, spend more time with their children, and move up the socioeconomic ladder.

The many real and perceived benefits of college have led to a significant increase in the percentage of all 18–24-year-olds pursuing a postsecondary degree, now at 40 percent, up from 26 percent in the late 1970s (National Center of Education Statistics, 2016). And yet despite dramatic gains in enrollment over the years, nearly half of all college students do not earn a postsecondary credential, even though most aspire to do so (Karp, Bailey, Hughes, & Fermin, 2004; Roderick, Nagaoka, & Coca, 2009; Shapiro et al., 2015; Venezia, Kirst, & Antonio, n.d.). All too often, weak academic preparation, poor information and resources, and inadequate financial support are tall barriers to college success, particularly for low-income students and students of color who traditionally have been underserved by K–12 and postsecondary educational systems (Perna & Jones, 2013). Nationally, political and institutional leaders are working on devising strategies that make college more affordable and responsive to the needs of increasingly diverse and growing student populations.

Dual credit (DC) education is one strategy state and local decisionmakers are increasingly employing to widen college opportunities, boost college achievement, and reduce college costs (Bailey, Hughes, & Karp, 2002; McGee, 2016). DC education programs—delivered through partnerships between high schools and postsecondary institutions—offer high school students the opportunity to take college-level courses that simultaneously award them college and high school credit (Bragg & Kim, 2004; THECB, 2011). Through these partnerships, some DC high school students can earn college credits up to an associate degree at little to no cost with the aid of public subsidies. Recent evidence shows that DC education has become a staple in high schools nationwide, with more than four-fifths of high schools nationally providing a college-level course as DC during the 2010–2011 school year (Thomas, Marken, & Gray, 2013).

The appeal of DC education programs is premised on the assumption that they offer tangible benefits to a wide array of stakeholders (Bailey et al., 2002; Bailey & Karp, 2003; Mokher & McLendon, 2009; Orr, 1998; Orr, 1999). DC education is thought to provide rigorous college-level coursework to high school students, motivating them to commit to college at an earlier age, and to lower their college attendance costs by reducing time to degree. Setting student benefits aside, DC education programs also are thought to help bridge the gap between postsecondary expectations and high school practices—improving alignment in curriculum, teaching, and advising between the two education systems and generating revenue for both high schools and colleges in support of such efforts. Finally, DC programs are presumed to accelerate economic growth by increasing the overall education level of the population at an earlier age.

However, recently, some policymakers and members of the public have become critical of DC education programs, claiming that their benefits have been oversold to stakeholders. While these concerns are not new (Mokher & McLendon, 2009), they have been magnified as DC education programs have become more popular and evolved to meet the changing demands and needs of their beneficiaries. The principal concern is that DC courses may lack academic rigor and, as a result, may not be equivalent to college-level courses. Critics argue that this is because high school students simultaneously receive both college and high school credit for DC courses; as a result, such critics speculate that practitioners may dilute curriculum and standards to ensure that students earn college credit but also graduate from high school (Johnstone & Del Genio, 2001; Karp et al., 2004). Others have emphasized that DC opportunities are expanding in high schools serving affluent student populations who would have enrolled in college even without enrolling in DC courses, and that traditionally underserved students have limited access to DC education because they either cannot meet eligibility standards or because they have to pay tuition and fees to take DC courses (Hoffman, 2005; Hu, 2010; Karp, Calcagno, Hughes, Jeong, & Bailey, 2008). In addition, the fact that many states allocate formula funding to both high schools and colleges to administer DC programs has raised concerns that these programs may be inefficiently using public resources. Students and their parents in particular also have recently articulated serious reservations that some postsecondary institutions do not grant credit for DC courses (Gewertz, 2016; McGee, 2016). This issue has caught the attention of legislators and the popular press as more students share their stories of being unable to apply their DC courses toward their college degree, despite being under the assumption that they could.

How DC Education Is Defined

It is important to note up front that there is no consensus in the literature or among states on how to define DC education. The term *DC education* frequently is used interchangeably with *concurrent-enrollment* or *dual-enrollment* programs, even though some researchers, organizations, and policymakers have defined these terms differently. For example, Adam Lowe (2010) from the National Alliance of Concurrent Enrollment Partnerships (NACEP), a professional organization that facilitates partnerships between secondary and postsecondary education institutions to promote seamless education, referred to dual-enrollment and DC education programs as one and the same, but considered concurrent enrollment programs a different approach. However, Barnett, Gardner, and Bragg (2004) and others clearly distin-

guish between DC and dual-enrollment programs, citing that DC education is designed to give students high school and college credit for successfully completing college-level coursework, whereas dual enrollment allows students to concurrently enroll in high school and college coursework but does not guarantee them high school credit for postsecondary coursework.

The lack of consensus on the definition of DC presents a problem for researchers in that it has made it difficult to draw definite conclusions about DC education programs, both in terms of the magnitude and growth of these programs and in terms of identifying such programs' strengths and weaknesses and their potential opportunities and limitations.

For the sake of clarity, we adopt the formal definition of DC education provided by Texas policymakers in state guidelines. The Texas Administrative Code, Title 19, Part I, Chapter 4, Subchapter D, Rule 4.83, describes DC education as "a process by which a high school student enrolls in a college course and receives simultaneous academic credit for the course from both the college and the high school." Within that definition, we characterize academic DC courses as those that deliver content that is academic in nature, and career and technical (CTE) DC courses as those that develop workforce skills. We also adopt the definition of Early College High School (ECHS) provided by the Texas Education Agency (TEA), which labels ECHSs as high schools that offer DC courses that could lead to either an associate degree or at least 60 credit hours toward a baccalaureate degree for 9th-, 10th-, 11th-, and 12th-grade students at risk of dropping out of high school.

Throughout this report, we restrict our attention specifically to reports and analyses of DC education programs as we define them, and we note areas where research is lacking to highlight where our knowledge continues to be limited.

Objectives and Approach

Although DC education programs have been implemented by U.S. institutions for more than 50 years (McMannon, 2000), there is surprisingly little research that provides practical, evidence-based guidance for policymakers on how to structure, target, and scale DC education programs to ensure that these programs benefit students and are a cost-effective use of public resources (Bailey, Hughes, & Karp, 2003; Hoffman, 2012; Orr, 2002). However, there is consensus that more needs to be known about the effectiveness of DC education programs. Earlier this year, What Works Clearinghouse, an initiative of the U.S. Department of Education's Institute of Education Sciences, released a comprehensive review of existing impact research on dual-enrollment programs, which included programs that awarded students both high school and college credit (U.S. Department of Education, 2017). While this review suggests that dual-enrollment programs have positive effects on college enrollment, degree attainment, and credit accumulation, their effects on high school persistence, college readiness, and general academic achievement are less certain, in part because of the small samples on which these conclusions can be drawn. Because this review summarizes existing experimental and quasi-experimental impact research, it stops short of helping policymakers look inside the black box to discern which mechanisms and structures may drive these improvements and also where reform is needed.

This study, conducted by the RAND Corporation (RAND), in collaboration with the Texas Higher Education Coordinating Board (THECB) and Gibson Consulting Group (Gibson), seeks to address this research need by examining DC education programs in Texas, a

state that has witnessed 650 percent growth in the number of high school students enrolling in DC education programs since 2000, according to data collected by the THECB. This unprecedented growth is the result partly of legislative action and partly of a concerted effort among high schools and colleges to offer students a greater number of opportunities to earn college credit before they graduate from high school. The overarching goal of this research is to inform policymakers and stakeholders whether DC education programs need to be reformed and, if so, how to reform them to better support students in Texas through appropriate stewardship of public resources, in turn helping Texas to reach the goals of 60x30TX, the state's strategic plan for higher education. The study also aims to offer insights on how other states might develop effective and efficient DC education programs and contributes to prior academic scholarship on DC education.

This interim report presents findings from the first phase of this study, which builds on and extends previous research on DC education in Texas (Appleby et al., 2011; Friedman et al., 2011; Berger et al., 2014; Eklund, 2009; THECB, 2011). Designed to provide timely information on DC education programs to state lawmakers during the 85th Texas Regular Legislative Session, this report answers four specific research questions, which collectively provide Texas policymakers and stakeholders with a needed initial perspective on the accessibility, diversity, quality and efficiency of DC education programs:

- What institutional policies and practices shape how institutions advise DC students, teach DC courses, and determine student eligibility for DC courses?
- How have DC participation rates among different student groups and DC course delivery changed over time?
- What are the academic outcomes of high school students who took DC courses versus those who did not?
- To what extent did high school students who took DC courses complete college more efficiently than students who never took DC courses?[1]

In addition, this interim report proposes areas of DC education to investigate in the second phase of the study.

To answer these four research questions, we used both qualitative and quantitative research methods. Specifically, we conducted semistructured interviews with DC administrators who oversee and manage DC education programs at 15 community colleges that implemented DC courses in a variety of ways and contexts across Texas to answer the first research question. We also drew on student-level administrative records collected annually by the THECB and the TEA to descriptively investigate the second, third, and fourth research questions.

Limitations

It is important to note several limitations in this research that impact our conclusions. First, the quantitative analyses presented here examine DC student participation and performance using data collected before Texas lawmakers passed legislation that reduced grade-level and semester-credit-hour (SCH) restrictions on DC participation in 2015. If the characteristics

[1] For this study, we define *efficiency* in two ways: (1) number of semester credit hours to degree, and (2) time to degree.

and the enrollment patterns of DC and non-DC students remain the same after HB 505, the results reported in Phase I would likely stay the same. However, if there are shifts in the types and the preparation of students who are enrolling in DC education as a result of HB 505, then we may see changes in the performance of DC students relative to non-DC students after 2015. Moreover, the analysis is descriptive in nature and does not provide insight into the causal impact of DC programs on student outcomes.

Second, the qualitative analysis is limited in a number of ways. First, we sampled only 15 community colleges that deliver DC education. As a result, our findings do not describe every institutional policy and practice in place that affects how DC education is administered across all higher education institutions. Moreover, the information that we did gather was self-reported and, thus, could not be verified. The DC administrators we interviewed were knowledgeable about institutional policies that determine student eligibility for DC courses and faculty eligibility to teach DC courses; however, they had limited familiarity about the institutional policies that affect instruction and support services that DC students receive. Therefore, we were able to glean only limited information about the nature of instruction and advising for students in DC courses. Finally, the qualitative findings are based on interviews with one stakeholder group among many, and it is likely that other groups, such as high school administrators or counselors, DC instructors, or students, may have different perspectives.

Organization of This Report

This report is divided into three main sections. The first section—Chapters Two and Three—describes the basic landscape of DC education in the United States and in Texas, including growth in DC education participation and programming, access to DC courses, delivery of DC education programs, regulatory policies on DC education, and evidence on the impact of DC education on measures of achievement and efficiency. The intended goal here is to provide background and the context for the results of our research.

The second section of this report presents our findings from the qualitative and quantitative studies—Chapters Four and Five, respectively. Chapter Four explores institutional policies that affect how higher education institutions teach DC courses, advise DC students, and determine student eligibility for DC courses. Chapter Five examines the incidence of course retaking among DC students, charts DC enrollment and performance trends among high school graduates, and examines how the delivery of DC programs has changed over time.

In Chapter Six, we conclude the report and provide a roadmap for aspects of DC we will investigate in the second phase of the study.

CHAPTER TWO

Dual Credit Education in the United States

In this chapter, we provide some context on DC education in the United States. We start by examining the history of DC education, followed by discussing the evidence that shows the impact DC education programs have had.

History of DC Education in the United States

Higher education institutions (HEIs) have implemented DC programs for more than 50 years (Bailey, Hughes, & Karp, 2002; Mokher & McLendon, 2006), and DC was first legislated into state policy in California during the mid-1970s (Mokher & McLendon, 2006). Today, only three states—New York, New Hampshire, and Alaska—have not adopted formal policy on DC education (Education Commission of the States, 2016).

Although the vast majority of states acknowledge DC education as a credit-based transition program, state laws and rules governing DC education vary widely. In their report examining the regulation of DC education programs, Karp and colleagues (2004) found differences with respect to how states determine eligibility for DC courses, as well as with how they structure and fund DC instruction and support services. This variation in state policy is rooted in how states seek to ensure and maintain the rigor of DC education programs and in their vision of what DC education should accomplish. In addition, in areas of DC education where institutional discretion exists, how DC education is administered in high schools across the country can also be shaped by the organizational structure and the capacity of partnering institutions (Honig, 2006).

Growth and the Evolving Nature of DC Education Programs

Although DC education has functioned to help students transition credits from high school to college, its goals and architecture have changed over time. Originally conceived as a way to stave off "senioritis" and provide a challenging learning environment to affluent, gifted high school students (Bailey & Karp, 2003; Bailey, Hughes, & Karp, 2002; McMannon, 2000), many DC education programs are now designed to support a broader base of high school students with diverse demographic backgrounds and varying degrees of intellectual and emotional maturity for college-level coursework (Bailey et al., 2002). This shift in DC education has been motivated by two key factors: (1) a large body of evidence showing that rigorous academic preparation combined with increased awareness of college expectations

strongly predicts postsecondary success (Karp et al., 2004), and (2) the overall diversification of the high school student population in the United States (Maxwell, 2014; Western Interstate Commission for Higher Education, 2016). ECHSs, which typically deliver DC courses to at-risk high school students starting in the 9th grade, in particular, have embraced the potentially transformative role of DC education to boost success for traditionally underserved student populations.

The potential to eliminate the divide between secondary and postsecondary education policies, practices, and expectations has helped to popularize DC education across states and HEIs. In the latest comprehensive study of DC education in the United States, commissioned by the National Center for Education Statistics, Thomas and colleagues (2013) found that students in public high schools enrolled in more than 2 million DC courses during the 2010–2011 academic year, a two-thirds increase over the 2002–2003 academic year (Waits, Setzer, & Lewis, 2005). Many of these courses were taken by low-income students and students of color, who have gained access to DC education through ECHSs. Jobs for the Future (n.d.) reported that it has launched more than 280 ECHSs since 2000, which serve 80,000 students in 31 states. Because existing surveys on the prevalence of DC education in the United States have focused on high schools rather than high school students as the unit of analysis, it is still difficult to decipher precisely how many students participate in DC education programs, how many college credits students are earning through these programs, and how both of these numbers have changed since DC education was first delivered.

Research focused on DC education in specific states, however, provides some insights. For example, a recent analysis by the THECB demonstrates that Texas has witnessed a 650 percent increase in the number of students accessing DC education since 2000, and the number of students taking DC courses continues to increase, particularly among high school freshman and sophomores, since state lawmakers made eligibility less restrictive in 2015. Similarly, the Idaho State Board of Education reported that the number of students taking DC courses increased nearly 200 percent from 2008 to 2015, from 5,000 to almost 15,000, and also noted that the number of credits earned has grown almost 200 percent, from 30,000 to nearly 90,000 (Idaho State Board of Education, 2016). While these two examples are illustrative of enrollment growth in DC education, we nevertheless have a patchwork understanding of the extent to which high school students are participating in DC education nationwide, a problem echoed by researchers in prior reports (Bailey & Karp, 2003; Bailey et al., 2002).

Participation in DC Education

Although many states, HEIs, and school districts have engaged in concerted efforts to make DC education more inclusive of a wider variety of students, there is evidence that suggests that there is unequal participation in DC education among different high school student groups.

There are several reasons students in certain high schools may have different rates of participation in DC education programs. Many states and HEIs mandate that DC partnerships limit admission to DC programs to students who can demonstrate some level of academic proficiency or an aptitude or skill that qualifies them for more advanced coursework as a way to ensure their success (Karp et al., 2004). In fact, establishing eligibility for DC courses is a

feature that is addressed most often by state policy. Thomas and colleagues (2013) found that, among high schools with students enrolled in DC education, almost two-thirds reported that they had established requirements to enroll in DC courses.

Another reason participation in DC courses may be low may be related to the capacity of high schools to offer students other opportunities to earn college credit, such as through Advanced Placement (AP) courses or International Baccalaureate (IB) programs. The College Board (2014) reported that many states have attempted to close participation gaps in AP courses by race and ethnicity, through district- and school-level efforts to enroll more Latinos, African-Americans, and poor students into AP coursework (Rich, 2013). By contrast, rural high schools often are unable to offer more advanced academic courses to students because of resource constraints (Kena et al., 2016), which might incentivize them to partner with an HEI to deliver college-level courses through DC education online platforms instead of offering AP courses. Finally, some schools that educate predominately traditionally disadvantaged groups may be under-resourced to encourage or support participation in DC education. The phenomenon of "undermatching" shows that lower-income students with similar qualifications as their more advantaged peers are consistently less likely to apply and enroll in college, which may be partly due to different advising and counseling practices as a result of resource constraints (Roderick, Coca, & Nagaoka, 2011).

Delivery of DC Education

Today, DC education programs can be categorized into a wide range of different models and approaches, not just in terms of their modality (taught online, face-to-face, hybrid) but also in terms of their location (on a college campus or high school campus), their course content (academic or vocational), instructor of record (high school faculty or college faculty), and class composition (only high school students or a mix of high school and college students) (Andrews, 2000; Bailey & Karp, 2003). DC programs also differ along the age at which students can enroll, the number of college-level credits students earn from DC courses, and whether they are offered through structured pathways (Karp et al., 2004).

The variation in DC programming stems from flexibility that states grant HEIs and partnering districts and their schools to structure DC instruction and support to accommodate local needs and circumstances and ensure quality and rigor. As Karp and her coauthors (2004) suggest, although policymakers have expressed the most concern about ensuring that only qualified students are allowed access to DC education programs, they are generally less concerned about promoting a single model to deliver DC education. With regard to research on DC education, the topic of delivery is one of the least explored. We still do not know how prevalent various models and approaches are in the delivery of DC education, nor what is the right mix of models and approaches to ensure that different students benefit from DC education.

Funding

States vary in how they allocate funding for delivering DC courses. Karp and her coauthors (2004) found that 38 states had enacted legislation on tuition policies for DC education.

Some of these states, like North Carolina, exempt high school students from paying tuition and fees associated with DC courses, while other states give discretion to high schools and colleges in DC partnerships to determine whether they will place the financial burden of administering DC courses and support services on students and their families. Still other states provide financial assistance to students to cover the cost of taking a DC course. States that offer DC students tuition assistance may not offer additional financial aid to cover the cost of books and fees, which may dissuade low-income students from participating in DC education. To the best of our knowledge, all students must incur some cost to matriculate in DC education, although the amount will vary by the state or district in which the college is located.

Evidence on the Impact of DC Education Programs, and Its Limitations

A recent intervention report released by the U.S. Department of Education's What Works Clearinghouse in 2017 cited 35 investigations that have studied the effects of DC programs on academic outcomes. The vast majority of these studies are correlational in design, and most find that participation in DC education is positively related to a wide range of student academic outcomes, including high school graduation, college enrollment, college persistence, college grade point average (GPA), and college graduation, and negatively related with college remediation and dropping out of high school. However, only two of the 35 studies reviewed in the What Works Clearinghouse report met design standards that allow researchers to identify the causal impact of DC programs without reservations (Berger, et. al, 2014; Edmunds et. al, 2015) Three others met standards with reservations because they utilized quasi-experimental methods instead of experimental methods (An, 2013; Giani et. al; 2014; Struhl & Vargas, 2012). These five studies effectively tease out the extent that DC programs contribute to gains or losses in achievement by systematically controlling for the full array of differences (i.e., previous academic performance, race/ethnicity, motivation) that exist between students who enroll and do not enroll in DC coursework. Based on this research, there is substantial evidence showing that DC programs have positive effects on high school academic achievement and completion, college enrollment, credit accumulation, and college degree attainment. There is less evidence about the impact of DC programs on high school persistence and attendance, as well as college readiness, but what does exist suggests that DC programs may have a positive impact on these outcomes as well. Despite these findings, this research has been unable to find a noticeable effect of DC programs on college achievement.

Although the research base measuring the impacts of DC education is growing, it is still limited in that it has not systematically examined measures of efficiency, such as SCH, time to degree, or course retake as outcomes of interest. The overwhelming majority of impact studies focus almost exclusively on measures of achievement (i.e., college enrollment, persistence, credit accumulation, college credential attainment) or perceptions of the quality from a student perspective (Berger et al., 2014; Edmunds et al., 2016; Karp et al., 2008; Marshall & Andrews, 2000). While these outcomes are important, they are inadequate in helping policymakers and institutional leaders assess whether these programs produce savings for taxpayers and students and reduce a students' time to degree—two benefits lauded by advocates of DC programs. Amid concerns about the transferability of credits earned through DC programs to degree programs and reduced state investment in postsecondary

education, outcomes like credits to degree, time to degree, and course-retake rates are particularly consequential to examine.[1] In analyses conducted for this report, we address this research need by descriptively comparing high school graduates who did and did not take DC courses against these outcomes.

Another limitation in the current research base is the tendency among researchers to gloss over the different ways in which DC programs are implemented when examining impacts. Research has broadly documented that HEIs and partnering districts and high schools deliver DC instruction and supports using a variety of approaches and models, which often are shaped by their goals for DC education, their organizational capacities and relationships, and the background and needs of their students. Ultimately, one approach for delivering DC education, whether it be teaching DC courses on a college campus or using high school counselors to provide college advising, may be effective for one group of students but ineffective for another; however, it is unclear from the research base how to decipher which groups. Given the increasing diversity of the student population and the wide variation of DC delivery approaches, we plan to conduct a causal impact study that examines the differential effects of DC education to determine which programs may be more effective than others for particular student subgroups and to ensure flexibility in the design of DC education programs. At present, our study adds to this literature by providing descriptive evidence on long-term outcomes, including college completion. We also provide some evidence on the implementation of DC education based on interviews with administrators from Texas community colleges.

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[1] Since DC students must transfer credits earned as DC to gain credit when they enroll as full-time college students, there is concern that students may suffer from transfer credit loss similar to that suffered by other transfer students. However, there is also concern that some institutions may be less willing to accept credits earned through DC than they would be willing to accept credits earned through a college-credit-only course.

CHAPTER THREE

Dual Credit Education in Texas

In 1995, the Texas legislature passed HB 1336, which first recognized DC education as an intervention used to help high school students transition into college. In this chapter, we provide context on DC education in Texas, starting with an examination of the expansion of DC participation and programs in Texas over time, the diversification of the DC student population in Texas, legislative action expanding DC education in the state, the regulatory framework for DC education in the state, and prior research on DC education in Texas.

Expansion of DC Participation and Programs in Texas

Since 2000, Texas has witnessed an exponential growth in the number of students enrolling in DC courses. According to data gathered by the THECB, the number of high school students taking college-level courses through DC programs at public higher education institutions rose from 17,795 to 133,342 between the fall 2000 and fall 2015 semesters, an increase of roughly 650 percent. Some of that growth can be attributed directly to ECHSs. During the 2014–2015 school year, 35,375 students were enrolled in an ECHS, up from 23,390 the year before (Legislative Budget Board, 2016). In the fall of 2015, DC students made up almost 10 percent of all postsecondary education students in the state.

The number of HEIs that provide DC offerings also has increased in Texas. At the beginning of the 2015–2016 academic year, 96 of 105 HEIs delivered at least one DC course, up from 61 in the fall of 2000. Community colleges have had steady representation in the DC education market (75 percent), with public four-year institutions making up just under 20 percent of all public HEIs delivering college-level coursework for DC.

It is important to note that although community colleges represent three-fourths of HEIs delivering DC education, these institutions are not teaching three-fourths of all DC students. In 2015, 126,000 high school students took a DC course from a public two-year institution, compared with 7,500 high school students who took a DC course from a public four-year institution. Most of the growth in DC enrollment between 2000 and 2015 (95 percent) can be attributed directly to increases in DC course seats at public two-year colleges.

Diversification of the DC Student Population

As a result of the changing demographic make-up of Texas and efforts to broaden DC access to less advantaged populations, students enrolling in DC programs in the state have also become

more ethnically and racially diverse. In the fall of 2014, for the first time in history, Latino students made up the plurality of DC students, holding just over 42 percent of the DC seats at public higher education institutions in the state. In the following year, this proportion increased to 44 percent. These changes come at a time when the share of non-Hispanic white students in DC programs continues to drop. In the fall of 2000, non-Hispanic whites represented 71 percent of all DC students, whereas in the fall of 2015, they accounted for just 38 percent of them.

Changes in the ethnic and racial distribution of the DC student population may be driven in part by the ethnic and racial diversification of the state's overall student population (Murdock et al., 2014). Recent evidence from the TEA (2016) shows that Hispanics now account for more than 52 percent of all students in Texas public schools, 12 percentage points higher than in 2000 (TEA, 2000). By comparison, the share of students identified as white attending public school has been steadily declining and now constitutes a little more than 28 percent of the public school population (TEA, 2016). While African-American, Asian, and multiracial students represent small shares of all public school students, their enrollment numbers have also increased since 2015 (TEA, 2016). These trends are unlikely to change any time soon, as white students decrease their enrollment in Texas public schools (TEA, 2016), and as whites, in general, experience a sharp fall in birth rates (Pew Research Center, 2016).

Legislative Action Expanding DC Education

Since the Texas legislature passed legislation that allowed students to earn high school and college credit for college-level coursework in 1995, Texas policymakers have enacted several laws that have incentivized HEIs and school districts to initiate and sustain DC partnerships, support student enrollment in DC programs, and require student demonstration of academic proficiency to take DC courses. For example, in 2003, the Texas legislature enacted HB 415, which allowed both high schools and colleges to receive funding for providing DC instruction. Two years later, Texas lawmakers successfully passed HB 1, requiring all school districts to offer students the chance to earn a minimum of 12 college credits through AP, IB, or DC. That same bill called for the development of College and Career Readiness standards that eventually would be linked to rules determining eligibility for DC courses in state statue.[1]

Most recently, Texas relaxed state-level requirements limiting entry into DC courses. During the 84th legislative session in 2015, the Texas legislature passed HB 505, which prohibits the state from restricting DC education to just 11th- and 12th-grade students and the number of DC courses or SCHs a student may take within a semester or academic year or while enrolled in high school. Supporters of HB 505 successfully argued that making access to DC courses less restrictive would allow students to earn a postsecondary degree faster and in a less costly way. In the same legislative session, Texas lawmakers also repealed a section in Texas Education Code 130.008 that required HEIs to deliver DC education programs to high schools in their local service areas. Now, Texas public HEIs can team with any school district, and vice versa, within the state to provide DC offerings. Quantitative results presented in this report do not capture the effects of HB 505 on DC student participation or outcomes. However, in Phase II of the study, we intend to descriptively examine the types of students enter-

[1] The TEA provides a complete list of legislative measures shaping DC education policy in Texas up until 2009 (Texas Education Agency Office for Planning, Grants, and Evaluation and Shapley Research Associates, 2011).

ing DC education after HB 505 and track their academic outcomes in DC education and in college.

Regulatory Framework for DC Education in Texas

State statute establishes minimum quality standards for the administration of DC education in public and private high schools. Yet it also provides substantial freedom and discretion to HEIs to adopt additional standards of their own to ensure that high school students benefit from DC education programming. In this section, we describe the framework that governs DC education and ECHSs and identify the quality controls available to ensure and improve the quality of DC instruction and support services.

DC Partnership Agreements and ECHS Designation

Partnership agreements between HEIs and one or more school districts or private secondary schools to deliver DC education are developed independent of government oversight but are required by state rule to define how they will administer DC instruction and support services. Each agreement must address the following nine elements: (1) eligible courses, (2) student eligibility, (3) location of class, (4) student class composition, (5) faculty selection, supervision, and evaluation, (6) course curriculum, instruction, and grading, (7) academic policies and student support services, (8) transcripting of credit, and (9) funding.[2] These agreements, commonly referred to as memoranda of understanding, must be approved by a governing body or designated authorities of both partnering educational institutions before any DC courses can be delivered.

Because the state does not mandate uniformity across DC partnership agreements, HEIs and school district partners can customize these arrangements according to their needs and circumstances. A THECB analysis (2011) showed that there was considerable variation in how HEIs and school districts set up DC partnerships, noting that variance in the location of instruction, instructor of record, student financing, and institutional financing were the most common differences across arrangements.

However, establishing an ECHS to deliver DC courses does receive greater state scrutiny than setting up a DC partnership agreement. School districts interested in operating an ECHS must partner with an HEI to submit an application to the TEA for review and approval and must offer quality assurances to deliver DC education to at-risk high school students. In its application, a school must demonstrate that its early college model follows six common design principles embodied in the TEA ECHS Blueprint. This blueprint requires ECHS to (1) target students who are at risk of dropping out of high school and might otherwise not go to college, (2) sign a memorandum of understanding with a HEI, (3) develop and maintain a leadership team to oversee the design and the sustainability of the ECHS, (4) provide a course of study that allows students to receive a high school degree and an associate's degree or 60 hours of credit toward a bachelor's degree in an environment that provides academic, social, and emotional support, (5) determine a student's college readiness by administering the Texas Success Initiative Assessment (TSIA) and provide assistance to enable students to begin college-level

[2] Texas Administrative Code 4.84.

courses, and (6) provide a full-day program in an autonomous high school. The TEA requires school districts to renew their ECHS designation annually.

Course Eligibility and Access

Although the state cannot restrict the number of courses a student can take for DC, it does limit the types of DC courses that HEIs can claim for state funding. Courses delivered for DC by public two-year institutions must either be identified as college-level academic courses in the *Lower Division Academic Course Guide Manual* (ACGM) or as college-level workforce education courses in the *Workforce Education Course Manual*. Courses delivered for DC by public universities must be identified in the university's approved undergraduate courses inventory. State statute also prohibits public HEIs from delivering developmental education as DC courses. HEIs have the authority to narrow the range and number of DC courses they allow high school students to take. HEIs are not obligated by law to deliver academic or career and technical DC education in partnering high schools, and high schools are not required to offer students opportunities to take DC coursework.

Student Eligibility and Access

Texas Administrative Code 4.85 establishes minimum requirements that determine which high school students are eligible to enroll in DC courses but also grants HEIs considerable latitude over imposing other additional criteria that may limit student access to DC courses. Consequently, state rule does not guarantee high school students access to DC courses, even if they meet the minimum state eligibility standards for DC education.

To qualify for a DC course, high school students must meet state requirements for college readiness or DC eligibility. High school students can demonstrate college readiness by obtaining a minimum passing score on the Texas Success Initiative Assessment (TSIA) or by qualifying for an exemption from taking the TSIA. These exemptions include obtaining a minimum composite or subject specific score on the ACT, SAT, or the State of Texas Assessments of Academic Readiness (STAAR) End-of-Course Exams (EOCs) in Algebra II and English III, showing proof that they have successfully completed a college-level course, or declaring non-degree-seeking status, among others.

High school students can also enroll in a DC course if they meet DC eligibility standards. These standards do not require high school students to demonstrate college readiness through the TSIA or other alternative tests, but they do mandate them to exhibit some level of academic proficiency in reading, writing, or math. Some of the tests used to assess readiness for DC courses are ones that high school students can take before they reach the 11th- and 12th-grade year of high school and include the PSAT, PLAN, and the STAAR EOC in Algebra I and English II, courses typically offered in the first two years of high school. In this sense, DC eligibility standards are less rigorous than college readiness standards because they test a student's level of academic proficiency in content areas that are taught in earlier high school grades. DC standards also offer high school students an opportunity to participate in DC coursework if they have not yet enrolled in courses that allow them to take college-ready STAAR EOCs, or in grades when the SAT or the ACT is typically administered.

College readiness and DC eligibility standards apply only to students interested in enrolling in academic DC courses or career and technical DC courses that lead to a Level 2 certificate or an applied associate degree. According to state rule, high school students have to test at college readiness or meet DC eligibility standards only for courses with such requirements.

High school students in pursuit of courses leading to a Level 1 certificate are not subject to college readiness or DC eligibility standards.[3]

Although state rules set minimum eligibility standards for DC education, they also give HEIs considerable discretion to tighten these standards. While the Texas Administrative Code does not explicitly specify the criteria HEIs can use to restrict access, it asserts that additional requirements that HEIs impose must not conflict with the established rules set in state statute. As such, HEIs can impose stricter academic DC eligibility guidelines by placing a college readiness prerequisite on a college-level course that counts as DC, requiring students to demonstrate a minimum GPA, or mandating that DC courses be taken at a certain grade level.

Although ECHS target students who are least likely to enroll in college, all high school students are eligible to participate (Legislative Budget Board, 2016). Texas Administrative Code 4.155 requires students enrolled in ECHSs, unlike regular DC students, to be administered a board-approved instrument for the purposes of assessing college readiness using the TSIA. ECHS students are not required to demonstrate college readiness prior to enrolling.

Faculty Selection and Evaluation

Texas draws on The Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) standards to determine how HEIs should select faculty to teach both academic and CTE DC courses. For academic DC courses, the SACSCOC requires DC instructors to have at minimum a master's degree in the academic discipline being taught or a master's degree with 18 graduate credit hours in the academic discipline or subject being taught. For CTE DC courses, the standards are lower and mandate that instructors have a bachelor's degree in the subject or an associate degree and demonstrated competencies in the teaching discipline. HEIs can, however, establish institutional policies that go beyond those standards to select DC instructors.

Because SACSCOC does not stipulate that HEIs must select faculty who teach college-level courses on the main college campus as DC instructors, HEIs can hire high school teachers to provide DC instruction, as long as such teachers meet the minimum credential guidelines and follow departmental and institutional rules on required academic credentials. In addition, SACSCOC mandates that HEIs supervise and evaluate DC instructors using the same methods they use for faculty at the main college campus. College faculty who teach DC courses do not need to obtain a teaching certificate through the State Board for Educator Certification, which governs the standards of the K–12 teaching profession in Texas.

Instructional and Support Services

To receive accreditation, HEIs are required by SACSCOC to ensure that a DC course and the corresponding course offered on the main college campus are equivalent with regard to the curriculum, materials, instruction, and methods used to assess student performance. The same requirements apply to DC support services. These standards do not provide HEIs with explicit guidelines on how to demonstrate equivalency for each domain. Consequently, HEIs have considerable leeway to determine and demonstrate what constitutes comparable instructional and support services.

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[3] A Level 2 certificate consists of at least 30 but no more than 51 SCHs; Level 1 certificate consists of at least 15 and no more than 42 SCHs (THECB, 2012).

Delivery

HEIs and partnering districts and schools have full autonomy over the delivery of DC instruction. HEIs have discretion to teach DC courses using face-to-face, online, hybrid instructional modalities, college faculty or high school teachers, on a high school or college campus, or to only DC students or to a mix of DC and college-credit-only students. State rule allows high school students who are not earning college credit to take a DC course alongside DC students if (1) the course is required for completion under the State Board of Education High School Program graduation requirements, (2) the high school–credit-only students are AP students, or (3) if the course is CTE and the high school–credit-only students are earning articulated college credit.

Funding

State law allocates funding to both school districts and colleges for administering DC education. School districts receive state resources based on the average daily attendance of high school students who take DC courses, and community colleges receive funding for the number of contact hours of instruction they deliver to DC students. For public four-year institutions, funding is based on the number of SCHs delivered to DC students.[4] Texas funds DC courses at the same rate as college-credit-only courses for both two- and four-year institutions. State law also grants full discretion to HEIs to determine their respective DC policies on tuition and fees. However, by law, HEIs cannot require students enrolled in ECHS to finance any of their DC courses.

Prior Research on DC Education in Texas

Within the past decade, researchers have devoted more attention to DC education in Texas, but as is true with national and other state reports, data on DC instruction, support services, and delivery are still relatively scarce in Texas. Much of the discussion about DC education in Texas is descriptive and has centered mostly on charting trends and patterns in access, enrollment, and delivery of academic versus CTE DC courses administered to public high school students (Appleby et al., 2011; Eklund, 2009; Friedman et al., 2011; THECB, 2011). A positive characteristic of all these studies is that they use data on the entire universe of public high school students in Texas, rather than a limited sample, which is a common feature of studies based on randomized experiments. Nevertheless, these data are out of date, with most stemming from the mid-2000s; consequently, they do not reflect recent DC trends and patterns.

Perhaps the most salient finding from this descriptive research is that, despite enormous growth in the number of students enrolling in DC education, student access to DC courses has not been equally distributed. For example, while Eklund (2009) and the THECB (2011) discovered that more low-income students and students of color have matriculated in DC education over the years, Appleby et al. (2011) and Friedman et al. (2011) found that these student groups were nevertheless still underrepresented in DC courses relative to affluent and white students. This research also shows that rural students had greater access to DC educa-

[4] A contact hour is a measure that represents an hour of scheduled instruction given to students. A SCH is normally granted for satisfactory completion of one 50-minute session (contact hour) of classroom instruction per week for a semester of not fewer than 15 weeks.

tion than urban students (Eklund, 2009; Appleby et al., 2011)—a result that comports with conclusions made by other researchers using data collected at the national level and from other states (Pretlow & Wathington; Taylor & Lichtenberger, 2013; Thomas et al., 2013; Waits et al., 2005).[5] Also, Eklund (2009), Appleby and colleagues (2011), and Friedman and colleagues (2011) found that, compared with their counterparts, males, African-Americans, Hispanics, and economically disadvantaged students were more likely to enroll in CTE than in academic DC education. Friedman and colleagues (2011) also found that schools with lower DC enrollments were those with higher proportions of African-American and limited English proficient students, and with fewer AP and IB tests taken. This past year, the Office of Strategic Initiatives at the University of Texas System began a mixed-methods study to examine the extent that DC education promotes student success by conducting analysis of in-house student-level administrative records and interviews with DC stakeholders. Results from this study will be published in the fall of 2017.

Like most evaluation research on DC education, the findings from Texas also demonstrate that students respond positively to the opportunity to earn high school and college credit simultaneously for courses before graduating from high school. Yet this research also suffers from the same limitations that have plagued other impact studies in that it does not control for factors that potentially could bias estimates. Only Berger and colleagues (2014) have rigorously tested the effects of early college high schools on student outcomes in college by conducting a lottery-based randomized experiment in five states, Texas being one. They found that being admitted into an ECHS positively impacts a student's decision to earn a bachelor's degree after high school. However, ECHS students were just as likely to enroll in college after high school as students who were randomized out of the lottery. While Berger et al.'s study is an important contribution to research on DC programs, it is limited in that it examined a very select number of short-term student achievement outcomes, followed students longitudinally for a very short period of time (at most, seven years after the start of high school), and is based on a relatively small sample of students in 10 ECHSs, two of which are located in Texas. Finally, Jobs for the Future, in partnership with Educate Texas and three school districts, received an Investing in Innovation Fund (i3) grant in 2012 from the U.S. Department of Education to expand the reach of ECHSs in South Texas and Denver and to identify best practices for scaling the early college model. Findings from this initiative have yet to be released.

Given the current political focus on DC education, we need to update previous conclusions about DC education in Texas with more recent data and extend this research to examine the extent to which HEIs are changing how they deliver DC instruction and supports; how DC students are transferring earned college credits and graduating on time; and how DC programs, in and of themselves, positively affect student success in postsecondary education.

With this national and Texas context in place, we turn in the next two chapters to our qualitative and quantitative findings.

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[5] In their report, Friedman and colleagues (2011) found that public schools located in rural areas in Texas had lower enrollments in DC education. Because it is unclear how these authors identified rural schools, it is difficult to determine why this finding contradicts what Eklund (2009) and Appleby and co-authors (2011) found.

CHAPTER FOUR

Qualitative Findings: Institutional Policies and Practices Shaping the Implementation of Dual Credit Education

In this chapter, we present the findings from qualitative interviews of DC administrators at Texas community colleges. These interviews specifically explored institutional policies and practices that affected how institutions determine student eligibility for DC courses, advise DC students, and teach DC courses. Interviews also examined the perceived benefits and challenges of delivering courses for DC in the current policy environment from the perspective of DC-delivering HEIs. The following four subquestions guided this qualitative component:

1. How do HEIs determine high school students' eligibility for courses that are available for DC?
2. How do HEIs support high school partners and advise students taking courses for DC?
3. How do HEIs deliver and teach courses offered for DC?
4. What do HEIs regard as the greatest benefits and challenges of offering and delivering courses for DC to high school students?

The remainder of this chapter is divided into the approach we used to answer these four subquestions and the findings for each one.

Approach

Selection Criteria and Sampled Institutions

To provide a description of institutional policies and practices governing the delivery of DC education, particularly across multiple delivery modalities, we sampled 15 community colleges that delivered a large number of SCHs in urban and suburban or rural areas, partnered with multiple schools and districts, and varied in the way and the contexts where they administered DC education.[1] We restricted our attention to this set of HEIs for several reasons. First, community colleges are the HEIs that predominantly deliver DC education in the state. Second, we hypothesized that HEIs that deliver a large number of DC SCHs to multiple schools and districts were more likely to have established policies and practices in place around DC education and were more likely to be able to discuss these policies and practices at length. Finally, we hypothesized that institutional policies and practices around DC might vary across different

[1] Two of the institutions are a specific campus of a larger community college district/system. One other institution represented the entire community college district/system. All subsequent characterizations of the institution in this report correspond to the level at which the institution participated in the study.

implementation models, and, for this reason, we sampled HEIs delivered DC using different modalities and in different contexts. It should be noted that because we focus on community colleges, the results presented in this section do not speak to DC policies and practices at four-year universities and colleges. We purposively selected community colleges for this study based on six criteria: (1) size of the DC education programs—operationalized as the number of partnering districts and schools during the 2014–2015 academic year and the number of DC SCHs delivered, wherein the number of SCHs is defined as the number of contact hours per week delivered for a given course over a semester; (2) type of DC education delivered (academic versus CTE); (3) approach to delivering DC courses (location of course delivery, mode of instruction, faculty delivering instruction, early college high school designation); (4) growth of DC partnerships over time; (5) location of partnering high school (rural versus urban); and (6) demographic characteristics of student population served.

To give a sense of the variety of community colleges we sampled, eight institutions employed the early college model to deliver DC education, and ten institutions mixed DC students with college-credit-only students in their college-level courses. Almost all delivered both academic and CTE DC education, provided DC instruction on a high school and college campus, and used both high school teachers and college faculty. Table 4.1 summarizes the various ways sampled institutions delivered DC education. For more details on the process we used to select these specific community colleges, see Appendix A.

Interviews with DC Administrators

To recruit our interviewees, we sent an email to the president or chancellor of each sampled institution with a copy to the primary administrator of each HEI that oversaw and managed DC education at high schools. We asked them to invite individual(s) to participate in our

Table 4.1
Sampled Institutions' (n=15) DC Delivery Characteristics

Characteristic of DC Delivery in Sampled Institutions	Number of Sampled Institutions (total n=15)[a]
ECHS	Yes: 8
Type of courses offered	Academic: 15 CTE: 14
Location of course delivery	High school campus: 15 College campus: 14
Mode of course delivery	Face-to-face: 15 Online: 15 Hybrid: 12 Interactive Television (ITV) or Interactive Video Conferencing (IVC): 6
Instructor for course offered for DC	College faculty: 15 High school faculty: 13
Student composition in courses offered for DC	High school students with regular college students: 10 High school students only: 5

NOTE: Data in this table were collected from an online pre-interview questionnaire, described below and included in Appendix C.

[a] HEIs could belong to more than one category per row.

interview who could answer questions related to their institution's policies and practices that affected teaching, advising, and student eligibility within their institution's DC programs.

Through this process, we were able to conduct semistructured telephone interviews with 28 representatives at 15 different institutions. Table 4.2 summarizes the roles of the institutional representatives we interviewed. Interviews averaged about one hour and ranged from 32 to 102 minutes in length. All interviews were audio-recorded and subsequently transcribed for analysis.

Prior to the scheduled interview, institutional representatives completed an online questionnaire, which gathered basic contextual information about the HEI's DC program. We used these data to validate and supplement administrative records collected by the THECB and the TEA. We also used these data to help guide questions probing institutional representatives about their institution's decisions to adopt different delivery approaches. See Appendix A for the full list of contextual factors that we collected from each sampled community college.

We analyzed interview transcripts using Dedoose, software designed to analyze qualitative data (2016). To analyze the data, we first coded segments of the transcript by the interview topics and questions posed. Next, we undertook iterative thematic coding of each major topic and interview question to surface recurring patterns and common themes (Guest, MacQueen, & Namey, 2011; Miles & Huberman, 1994; Ryan & Bernard, 2003). We generated codes using both inductive and deductive coding methods. We also engaged in regular discussions to agree upon the coding structure, strategies, and rules for developing codes, as well as major emergent patterns and themes.

Findings

Our presentation of findings is organized according to our four qualitative subquestions outlined at the beginning of the chapter: (1) determining eligibility for DC education, (2) providing support to HS partners and advising DC students, (3) delivery and teaching of courses for DC, and (4) perceived benefits and challenges of delivering DC education.

Table 4.2
Number of Institutional Representatives Interviewed by Role

Role with Respect to DC Administration and Delivery	Example Titles[a]	Number of Individuals Interviewed (n=28)
Directly oversaw DC program	DC Director/Coordinator; Dean of DC; Administrator for High School Programs	12
Involved with academic affairs	Vice President for Academic Affairs; Associate Dean of Curriculum and Learning;	8
Involved with enrollment and student affairs	Vice President of Student Affairs and Enrollment; Director of Admissions	4
Involved with DC partnerships	Director of College and High School Partnerships; Vice President of Student Success Partnerships	4

[a] Some titles have been modified to protect the confidentiality of the participating institutions.

Determining Eligibility for DC Education

HEIs reported relying on state rule, established by the THECB, to determine which students were eligible to participate in DC education. In addition, all community colleges reported allowing high schools to impose additional criteria to restrict access to DC even further. Below, we identify the criteria that guided HEIs' decisions about students' eligibility for participating in their DC program.

Community Colleges Reported Adhering to THECB Rules to Determine Student Eligibility for DC Education, and Largely Relied on the TSIA

As mentioned in Chapter Three, state rules require that students meet DC eligibility guidelines or stricter college readiness standards to be considered for DC courses.

According to the community college representatives we interviewed, these rules were by far the strongest and most consistent force driving how their institutions selected students into DC programs. Representatives from almost all community colleges said they "follow the established rules," and one respondent stated, "We use state policy. We rely on state policy. That way the institution is not held liable for a decision that may or may not be supported by a state policy." Another expressed that "as long as [the criteria/requirement] was in the Coordinating Board rules, we felt like we needed and wanted to use it."

The majority of our studied community colleges reported drawing on more-rigorous college readiness standards, instead of DC eligibility standards, to determine whether a student qualified for DC courses. Specifically, representatives from nine community colleges made statements to the effect that they used the "exact same approach" and "follow the same guidelines" for high school students looking to participate in DC programs as for students entering into college-credit-only courses. One interviewee said, "[Students] have to be TSI clear. . . . They have to show that they're TSI clear like any other student." Another respondent elaborated, "[Students] have to be TSI-compliant to take DC courses."

The community colleges that we studied also mentioned that they used other assessments, such as the SAT, ACT, and STAAR EOC in English III and Algebra II to appraise a student's readiness for college-level coursework. According to state rule, students are exempt from meeting TSI standards if they earn scores at or above college readiness benchmarks established for these assessments. One interviewee, for example, stated, "We primarily use TSI scores as an eligibility factor but we also accept ACT and SAT scores, if they are in certain standards" [if students meet or exceed the minimum required score].

Interviewees from five community colleges also explicitly acknowledged using DC eligibility criteria in addition to college readiness criteria to determine students' eligibility for DC course-taking. One interviewee said, for example, "We use the Coordinating Board rules . . . So we use SAT, we use ACT, we use PSAT, . . . we have used the . . . EOCs for English 1 and 2. I understand those EOCs and that PSAT were not really designed to demonstrate college readiness, but . . . we have used every possibility." Another community college representative said, "For the academic [DC courses], [the eligibility criteria are] exactly the same as what's required of our traditional students, except we do let [DC students] use EOC scores." We infer the EOCs referred to here are the STARR EOC in English II and Algebra I, which, according to TEA rules, can be used to establish DC eligibility, but not college readiness.

A systematic review of community college responses suggested two major reasons for favoring college readiness standards over DC eligibility standards, and in particular for relying on the TSIA. The main factor is related to the fact that college readiness standards are more

rigorous than DC eligibility standards. For example, one respondent said that while their DC administration determined eligibility primarily by the TSIA cutoff score, it also allowed students to use their DC eligible EOC scores, acknowledging, "That doesn't actually make them college ready, but it waivers them in to allow them to take a class." Another interviewee shared that their DC administrators and faculty were concerned that students who qualified through STAAR EOC in English II and Algebra I would not be prepared for college-level work. We believe that these statements illustrate why our studied community colleges adopted college readiness standards over DC eligibility standards, particularly the TSIA as the instrument of choice in determining student eligibility for DC courses.

Another factor is related to timing of the administration of the TSIA, which is on-demand. Other assessments, like the SAT and the ACT, and specific college readiness STAAR EOCs, which would exempt students from taking the TSIA, are typically administered in the last two years of high school. One interviewee thought this was particularly applicable for ECHS students, saying, "These tests that I mentioned [i.e., ACT, SAT] are given at the end of the 10th grade. The results come at the end of that semester or summer so they can use them for the 11th grade, but ECHS kids, if they want to take classes in the 9th and 10th [grades], there's no other way to enroll except with the TSI."

While we did not systematically ask about differences between DC courses offered in CTE programs and those offered within academic programs, interviewees from 11 institutions pointed out that students taking CTE courses for DC do not have to perform at TSI standards.

Institutions Looked to High School Partners to Impose Additional Criteria to Further Restrict Access to DC Courses

Interviewees stated that eligibility for DC courses should be determined not only by a student's test score but also by his or her high school's recommendation or approval. As a result, community colleges often relied on their school district and high school partners to apply additional criteria to determine who should be able to enroll in DC courses. These eligibility criteria included past academic performance, previous course-taking, and students' grade and maturity level. Based on interviewees' responses, it is unclear whether high schools had explicitly articulated policies and academic performance thresholds that determined which students should receive recommendation or approval, or whether the process tended to be holistic and subjective.

Interviewees from 13 institutions explicitly talked about looking to high schools to make recommendations and to act as gatekeepers. One interviewee said, "We rely on each of our partnering high schools. They . . . get the message out, cast a net out there. And then they pull in students that they want to recommend to the program. So we're not necessarily part of who gets in and who doesn't. We're part of the process of determining who's eligible and who's not, based on the recommendation that's given to us from the high school." Several interviewees noted that, "High schools know their students better than we do . . ." and "We take them [i.e., the students] as they [high schools] give them to us."

Advising High School Partners and Students Taking Courses for DC

Our analysis suggests that community colleges provide two types of advising or support to high school partners with respect to DC programs: (1) general guidance and information about DC programs to the partnering district or high school, and (2) direct advising to DC students, particularly on course-taking.

Community Colleges Reported Providing Information and Guidance to High School Partners on the Structure of DC Program and Course Offerings

Interviewees from all community colleges reported providing information and customized support to help school districts or high schools understand their institution's DC program, the courses they offered, and the courses needed for certain degree plans, among other general topics. One interviewee said, for example, that their institution advised high school counselors and administrators "so that they understand what's in the college courses and how that matches with what is in the courses offered at the high school level." Another interviewee reported that their institution worked "closely with the high schools [counselors] . . . to identify which courses they want to offer for DC." Similarly, a third interviewee said that when a high school informed them that a number of their students expressed interest in pursuing a career in a health related field, they agreed to offering relevant, related coursework. A fourth interviewee reported actively helping partner school districts align DC courses with academic endorsements (i.e., area of academic focus), programs of study, and possible career paths.

In addition, community colleges reported supporting high school partners by providing training on how to advise DC students to high school counselors. Interviewees from nine of the 15 community colleges said that they offered regular training for high school counselors, usually in the form of workshops or meetings, to discuss topics around advising protocols and procedures, rules related to DC eligibility, and the high school-to-college transition.

Community Colleges Reported Providing Direct Advising of Varying Intensities to DC Students

Interviewees from nine of the 15 community colleges we sampled reported providing direct advising to students, particularly on course-taking. These community colleges delivered direct advising by sending college advisers to meet personally with DC students, or by holding informational meetings or large group orientations, which often included parents of DC students. Some institutions also offered online self-advising tools to students.

In providing direct advising, sampled community colleges reported offering two types: general and specialized. General advising was provided to students who were taking or restricted to taking core academic courses that broadly applied to many degree plans. Specialized advising was designed for students who were enrolled in DC courses that extended beyond the academic core or were tied with the student's academic endorsement. All community colleges mentioned providing DC students with information on how to transfer college credits earned through DC courses toward a college degree, though not necessarily toward a specific major or certificate.

The type of advising provided under the ECHS model was described by some community college representatives as particularly robust when compared with the types of advising provided in regular DC programs. Half of the studied community colleges that delivered DC education in an ECHS reported that college faculty and advisers engaged more with students and high school counselors and were more likely to advise students on individual degree plans or educational pathways, in relation to faculty and advisers working with students in regular DC programs. One interviewee characterized advising at an ECHS as "a little more in-depth" because advisers held regular meetings with all students, and students were put "on a plan to get through an associate degree by the time they graduate, [because] they're on a very strict limitation of what courses they can take. So we monitor that very closely, making sure they stick with their prescribed sequence. This is often negotiated with their school." Two interview-

ees suggested that the TEA guidelines requiring ECHSs to have a dedicated adviser/coordinator from the partnering HEI helped to achieve this level of advising.

Six community colleges revealed that they provided limited direct advising to DC students on course-taking for three reasons. The main reason related to the types of courses they offered to DC students. From our data, we learned that most community colleges limited DC courses to those found in the academic core. Because a student's anticipated major did not inform the DC courses that they take in these instances, some community colleges reported that there was little need to provide DC students specialized advising. For example, one interviewee said, "We do not offer any course DC that is not part of the academic transfer core curriculum. So we have no concerns that a student might take a DC course that isn't going to transfer. . . . So that alleviates any concern about advising in terms of is this course going to transfer, will this course benefit me." An interviewee from another institution in a similar situation said, "So it's not that [students] are not being advised. . . . They're just not being advised on a degree track right now because we don't offer enough credit hours."

Another, albeit less prevalent, reason was a shortage of advising staff. One representative noted that her institution "need[s] a lot more support" in delivering advising in regular DC programs because advisers had to support a larger number of students relative to ECHS DC programs. According to this representative, the ECHS advising system was "very good" and they "would love to have more of a one-on-one counseling experience with comprehensive high school students, but . . . it's a little challenging because of just the sheer numbers."

The final reason related to the geographic proximity between the community college and the partnering high schools. One interviewee said, "Most of our schools are rural, some of them are as far as two or three hours away from us, so most of the schools do their own advising." We note, however, that not all community colleges with rural partners found this to be a limitation. Some institutions with predominantly rural partners may have been able to deliver a significant amount of direct advising because they had a designated adviser whose role was to visit the high school campuses regularly.

Because of these limitations, a little less than half of our studied community colleges reported relying on high school counselors to provide advising to DC students. One representative said, "Most of our advising is done through the high school counselors. We bring our high school counselors in a couple of times a year and give them what they need and then . . . most of the schools do their own advising."

DC Delivery and Instruction

Community colleges delivered DC courses using a variety of delivery approaches. Of the 15 institutions we sampled, 14 noted on the pre-interview questionnaire that they delivered some DC courses on a college campus and others on a high school campus; only one institution reported delivering all its DC courses at a high school. Furthermore, all institutions stated that they delivered at least some courses face-to-face and some online.

Structure of DC Program Driven Largely by Logistical Factors, Resource Constraints, and the Preferences of Colleges and Partnering Districts and High Schools

Institutions appeared to base DC delivery decisions on a variety of factors. One of the most prominent factors mentioned by interviewees was geography. That is, nine of the studied community colleges that predominantly partnered with rural districts found it difficult to deliver courses face-to-face and/or on college campuses because of the distance that separated the

community college from the high school. As one interviewee explained, "Some of our partner high schools are an hour, an hour and a half away from us. . . . So it wasn't possible to have everyone come on campus." Likewise, another interviewee said, "We aim always to provide college courses face-to-face just for all its value and success, but given our service area [with] remote high schools that are just really far away, this becomes a challenge."

A second major factor was the difficulty of scheduling DC classes. Interviewees from seven community colleges stated that the start and end times for high school days and individual periods, for example, often limited when DC courses could be offered. They also relayed that students' extracurricular activities often interfered with the DC course scheduling. These challenges often lead community colleges to expand their online or hybrid course offerings. For example, one interviewee acknowledged, "We were doing everything, every combination. Every semester [looked] a little bit different as to how much percentage is ITV and how much is face-to-face and Internet. . . . It is all based on the school's needs, all based on what their schedule is." A representative from another institution said, "As we came up against some sort of either scheduling hurdle or distance hurdle, we became more creative in how we delivered. . . . Students and the parents were demanding [that] students take DC when it wasn't fitting into their schedule because they were involved with extracurricular. . . . So we've moved more and more to these hybrid and online models recently."

A third factor was an insufficient number of students who could enroll in a DC course. Several community colleges reported that they delivered DC courses online or by interactive television to ensure that DC students enrolled in different high school campuses could take DC courses. In some instances, students from several schools were combined into one course for this reason. As one interviewee explained, "We [have] four students from a smaller school district, and five students [from another]. There is no way that you could afford to send—you cannot even pay the school if they had a qualified instructor there for such a small class. So . . . we will combine those classes. And because of the ITV, [students] are able to participate."

A fourth factor related to the availability of qualified faculty. Representatives from all 15 sampled community colleges communicated that they employed high school teachers to help deliver DC courses.[2] Even within that group, interviewees from six community colleges reported that they did not have a sufficient number of instructors to teach all of their DC courses. In response, the community colleges reported applying two solutions. One solution was to maximize the use of their existing faculty (whether full-time or adjunct, college- or high school–based) by delivering DC courses online. As one interviewee stated, "We are roughly at about 1,600 students in DC, and we just cannot deliver instructors to the high school campuses. . . . And so that is when we get into online delivery." Another interviewee said, "In the small schools where we couldn't get qualified teachers, it really was not reasonable for us to send teachers out in such a wide area. So we used the online delivery." Another solution was to hire qualified high school teachers: "We encourage our schools, when they are hiring, to look for teachers who are certified that have those credentials because we . . . cannot meet the demand for DC instructors."

Finally, interviewees reported that college and district preferences also influenced how community colleges structured their DC programs. In some instances, the preferences of com-

[2] SACSCOC guidelines set minimum criteria for college instructors, and we have no reason to believe that the high school instructors teaching DC courses did not meet those criteria. However, we have no way to verify whether that is in fact the case.

munity colleges shaped the delivery of DC courses. Representatives from three institutions spoke of the importance of maximizing students' exposure to the atmosphere, experiences, and resources of a college campus. As a result, these community colleges prioritized delivering DC courses on their campus using face-to-face instruction whenever possible, especially for older high school students. One interviewee said, "I wanted the students to be on the college campus as much as possible to get the real flavor of being in college, to know where the library was, . . . to know where the business office was, . . . just the whole flavor of being on a college campus, rather than still being at a high school campus. I think it sends the message that this is different from high school."

Yet, in most instances, the demands and needs of districts and their high schools drove decisions around the delivery of DC education. Representatives from ten HEIs explicitly said they were inclined to do whatever was necessary to meet the demands of high schools, which included sending faculty to high schools to teach courses, using high school teachers as adjunct instructors, and running online courses. In the words of one interviewee, "I think the reason why the [college] pursues as many modalities as we can is because we want to be accessible to as many students as we can. . . . If we can make it happen, we're going to try."

Community Colleges Followed SACSCOC Credentialing Guidelines to Select DC Faculty

According to all interviewees, academic departments oversaw DC faculty selection and course instruction. They were in charge, for example, of hiring faculty who provided instruction for DC students and for ensuring that all college and high school faculty teaching DC courses met SACSCOC credentialing requirements. Eight institutions added that high school teachers who wanted to teach as adjuncts had to meet the same academic standards as other college adjunct faculty who taught in the department.

Most DC Courses Shared a Common Set of Learning Objectives as Articulated in the ACGM. In Many Cases, Instructors Used Common Course Syllabi and Textbooks, but Pedagogical Strategies and Assessments of Student Learning Were Mostly Left up to Instructors.

Each core academic course delivered by public community colleges in Texas, including DC courses, has a clearly articulated set of learning objectives provided in the ACGM. Most of the interviewees reported that all DC courses and their corresponding college-credit-only courses indeed shared the same student learning objectives. Some interviewees also reported the use of common course syllabi and textbooks to promote uniformity between DC and college-credit-only courses offered at their institution, particularly in cases where adjuncts were the faculty of record. It is unclear from our interviews whether the use of common syllabi and textbooks was ubiquitous across institutions or departments, and there is no state policy that mandates their use.

Interviewees reported that academic departments made little attempt to standardize the pedagogical strategies instructors used to teach or assess student learning in DC courses. Departments conferred substantial autonomy and authority to instructors regarding class assignments, assessments, and grading in their classrooms, including in DC classrooms. Because most of the individuals we interviewed (i.e., administrators of DC programs or student affairs, or higher-level administrators of academic affairs) were not faculty members in an academic department, we were able to elicit only limited information about how DC faculty provided instruction or assessed the student learning in DC courses.

While we did not specifically ask about how institutions evaluated DC faculty or DC instruction, representatives from nine community colleges remarked that their academic departments regularly assessed or audited DC courses. For example, some reported that department chairs visited high schools to observe how high school faculty taught, collected student work samples, and gathered student surveys on an instructor's pedagogical effectiveness. Finally, a representative from one institution specifically explained that they analyzed data to check that the grades submitted by DC faculty aligned with those submitted by other faculty who taught college-credit-only courses.

Perceived Benefits and Challenges to Delivering DC Education

To address our fourth research question, we asked interviewees about the benefits and challenges to delivering DC education.

Perceived Benefits

The interviewees in the present study almost always identified the benefits for students first, and for community colleges last, if these were mentioned at all. In any case, interviewees perceived that DC education offered numerous benefits for students, community colleges, high schools, and the community at large.

DC Programs Expose High School Students to, and Prepare Them for, Academic and Behavioral Expectations of College and Help Families Reduce College Costs

Collectively, the interviewees from the 15 institutions identified a range of academic, behavioral, and financial benefits for students enrolled in DC programs. In particular, taking courses for DC was thought to build students' academic confidence, positively correlate with the high school completion rate, and help students gain college-transferable credits and potentially an associate degree by the time they graduate from high school. Interviewees stated that once DC students enrolled full time in college, they could also take a more manageable course load. Interviewees also noted that students who took DC courses appeared to be more college-ready and capable of persisting through college. Interviewees also believed that college credits earned through DC programs translated into financial relief for students and their families, because students could earn college credits tuition-free or at a greatly reduced cost.

DC Programs Serve as an Effective Student Recruitment Tool

Representatives from ten institutions collectively acknowledged that DC programs were an effective recruitment tool for their institution. That is, through DC programs, the institutions built positive relationships with students and parents that could help encourage these students to enroll in their institution. By establishing a DC program, colleges may benefit financially from increasing enrollment of high school students with DC experience. Furthermore, interviewees reported that DC programs can help institutions build more academically able and responsible student bodies.

DC Programs Allow High Schools to Offer Additional Options for More-Rigorous Coursework

Interviewees from five institutions mentioned that high schools benefit from DC programs in that they allowed high school students to take more-rigorous coursework. Specifically, high schools may be unable to offer upper-level or honors courses because of staffing or scheduling barriers. Partnering with a college to deliver DC courses means that students seeking a course

that is not available at the high school, such as Calculus, can enroll in a college course at the community college. Similarly, if an insufficient number of students at a given high school expressed interest in a course, these students can potentially enroll in a course with other DC or college-credit-only students. For rural schools and other schools short on resources, this can be a particularly attractive arrangement.

DC Programs Benefit the Greater Community

Interviewees from three community colleges identified that the larger community also benefits from DC programs. Specifically, one interviewee believed that these programs fostered a college-going culture and boosted college-level education attainment. According to another interviewee, DC programs save the federal government significant costs because students are not using federal financial aid for DC courses. Finally, one interviewee focused on the benefits of DC CTE programs, reporting that they provide particular benefits for industries by generating interest among students in these fields, which in turn helps to grow community colleges' DC CTE programs.

Perceived Challenges

When prompted to discuss challenges related to delivering DC education, interviewees focused on those that affected first and foremost their institution. Interviewees reported encountering difficulties related to working within their own institutional contexts, working with partner high schools, and working directly with high school students.[3]

Coordination with High School Partners Required for DC Programs Is Often Taxing for Community Colleges

Community colleges reported facing numerous challenges in coordinating DC programs. For example, interviewees from 11 colleges communicated that it was particularly difficult to coordinate with high schools over scheduling courses, given differences in the way community colleges and high schools schedule courses, and other logistical limitations, such as transportation (i.e., school busing schedules). In addition, aligning institutional policies with school district and high school policies that affect how DC is delivered has sometimes been a challenge. For example, when state rules or institutional policies change, DC administrators reported needing to inform their partners and requiring them to adapt to these changes. Meanwhile, community colleges have also had to adhere to policies of their partners, which may differ by district or school.

In recognizing some of the challenges related to coordinating the delivery of DC education with high school partners, interviewees from five institutions recommended building strong relationships among superintendents, principals, teachers, and counselors. Two respondents reported the importance of delineating decisions around delivery, advising, and teaching for sustaining DC partnerships. For example, one respondent suggested having a "good, clear memorandum of understanding between the institutions" (i.e., HEI and school districts). According to the interviewee, in this regard, HEIs should view school districts as partners and neither dictate what they should do, nor allow the school districts to assert undue control over the program.

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[3] It is important to note that many of these challenges are likely to vary across DC contexts, particularly between ECHSs and traditional DC programs.

Some DC Students Are Underprepared for the Rigors of College Coursework and to Make Informed Decisions About Course-Taking

Representatives from four community colleges explicitly noted that some high school students were academically and emotionally underprepared for DC coursework and that these students' sense of responsibility and maturity may still need to develop. Complicating matters further, some interviewees stated that many students who enrolled in DC programs do not yet know which field to pursue and, as a result, may end up taking courses they did not need for their eventual major or career path. Often these problems stem from undue pressure placed on high school students by their parents to take advantage of the opportunity to enroll in DC when it may not be appropriate. That the majority of the studied institutions did not explicitly mention students' underpreparedness or immaturity as a challenge may suggest that community colleges believe that DC students, for the most part, met the expectations of college-level courses. This may be the result of the prevailing use of the TSIA and other eligibility criteria (i.e., previous course-taking) to select students into DC coursework, and a reflection of what we find in our quantitative analyses, which show that DC students outperformed students who never took DC courses on a wide range of achievement measures.

DC Partnerships Experience Difficulty Finding Faculty Who Meet SACSCOS Requirements to Teach DC Courses

A final challenge mentioned in our interviews is the difficulty of finding qualified faculty to teach DC courses. Interviewees from seven sampled institutions expressed that they lacked a sufficient number of faculty to instruct DC students, particularly for community colleges that partner with multiple school districts to deliver DC education. Compounding this problem has been the inability of community colleges to rely on high school teachers to serve as DC instructors, since many do not have the academic qualifications or type of work experience required by SACSCOC to teach academic or CTE DC courses.

Limitations

Four limitations of analyses impact our conclusions. First, the 15 institutions selected for this study constituted a modest sample, and no four-year HEIs were included. As a result, we could not generalize our findings beyond two-year colleges and, specifically, beyond the 15 institutions we sampled. Second, the institutional representatives interviewed for the study had varying degrees of knowledge about the interview topics. In fact, we discovered that the DC coordinators and administrators we interviewed had extensive knowledge about enrollment, advising, and general program delivery, but peripheral knowledge about how their institutions taught and assessed student learning in DC courses. Typically, chief academic officers and departmental faculty oversee these aspects of DC education, and because few of our interviewees were in those roles, the knowledge we gained about DC instruction and assessment was limited. Future studies seeking insight into these aspects of DC delivery would benefit from speaking with chairs of academic departments that offer courses for DC, as well as faculty members who provide instruction, including high school teachers who deliver such courses as adjunct faculty. Third, the data we gathered were self-reported. We did not triangulate our data against other sources, such as documents on DC policies and practices. Given that our interview questions focused on the institutional policies in place, to the extent that institutions

perceived the study as a compliance check, despite our making it clear that this was not the purpose of the study, it was possible respondents may have provided what they perceived to be desirable responses or may have offered guarded responses that may not wholly or accurately represent the facts. Finally, for this analysis, we did not separately examine ECHS from other DC implementation models. As a result, it is unclear the extent to which the policies and practices in place to deliver DC education at ECHSs are similar to those in place for implementation models that face less regulatory scrutiny.

Conclusions

In this chapter, we have examined the institutional policies and practices shaping the implementation of DC education in a select set of 15 community colleges that delivered DC using different approaches and in different contexts. Below, we summarize our key findings in each of our topic areas:

1. **Determining eligibility for DC education:** Community colleges adhered to THECB rules for determining students' eligibility for taking courses for DC, and most used the TSIA as their instrument of choice. HEIs, however, looked to high school partners to act as gatekeepers by applying additional eligibility criteria to identify the students most likely to benefit.
2. **Advising high school partners and students taking courses for DC:** Community colleges offered information and guidance to districts and schools on how to structure DC programs and also train advisers. In addition, HEIs provided direct advising to DC students, particularly on course-taking. The type of courses institutions offered, resource availability, and geography were factors that affected how advising was provided.
3. **DC delivery and instruction:** Community colleges delivered DC courses through a variety of approaches. Logistical factors, such as geography and availability of instructors, played a role in the approach taken. Within institutions, academic departments, rather than DC program offices or departments, oversaw DC faculty selection and course instruction. While most DC courses shared a common set of learning objectives as articulated in the ACGM, and many departments shared syllabi and textbooks to promote commonality between DC and college-credit-only courses, college instructors, including those who taught DC courses, had substantial freedom to determine pedagogy and learning experiences.
4. **Perceived benefits and challenges of delivering DC education:** DC education provided perceived benefits for high school students by exposing them to, and preparing them for, the expectations of college while also helping their families by reducing college costs. For some community colleges, DC programs served as an effective student recruitment tool. A challenge that a few interviewees perceived was that some DC students were unprepared academically and emotionally for the rigors of college coursework.

CHAPTER FIVE

Quantitative Findings: Descriptive Analyses of Participation Rates and Academic Outcomes of DC Students, and of DC Programs

In this chapter, we present results from a descriptive quantitative analysis of DC programs in the state of Texas. We designed our descriptive quantitative analysis to answer three of the three primary research questions for the larger study:

- How have DC participation rates among different student groups and DC course delivery changed over time?
- What are the academic outcomes of high school students who took DC courses versus those who did not?
- To what extent did high school students who took DC courses complete college more efficiently than students who never took DC courses?

In the remainder of this chapter, we discuss the approach we took to doing the quantitative analysis and then the quantitative findings related to the three research questions above.

Approach

Our analyses draw on administrative databases from the THECB and the TEA that allow us to track cohorts of graduates of all public high schools in Texas into any public or private not-for-profit college or university in Texas, thus capturing detailed individual-level information on student demographics, college enrollment and degree completion, and credits earned over time. For the 2000–2015 cohorts of Texas public high school graduates, we can capture individual-level information about their participation in DC in high school, including the number of SCHs earned in high school as DC.[1] For all college-level courses completed in 2012–2015, which included those delivered for DC, we can capture more detailed course-level information, including information about the course modality (face-to-face, online, or hybrid), faculty characteristics (tenured, adjunct, and whether the instructor of record was also employed as a high school teacher), and location of delivery (on a college campus, on a high school campus, or at an ECHS). We describe the individual administrative data files that we draw on and the approach we used to link them to develop our analytic data files in Appendix E.

[1] Because the THECB started to collect administrative data on DC participation starting in 1999, we can only observe DC participation from 9th–12th grade starting with the 2002 cohort of high school graduates. For the 2000 cohort of high school graduates, we can observe DC participation in the 11th and 12th grade, and for the 2001 cohort of high school graduates, we can observe DC participation in the 10th, 11th, and 12th grade.

We use these analytic data files to paint a rich descriptive picture of patterns in DC participation, delivery, and course-taking in Texas over time, and we primarily rely on simple descriptive statistics presented in intuitive figures and tables to achieve this. However, where appropriate, we draw on regression methods to paint a richer picture that allows for more meaningful comparisons between DC and students who take college-level courses solely for college credit. Throughout this section, unless otherwise noted, all reported differences between DC participants and nonparticipants are statistically significant.

Findings

Here, we describe trends in participation in DC programs in Texas from 2000 through 2015.[2] We also describe patterns in delivery of DC programs spanning 2012 through 2015. Then we describe student outcomes associated with taking DC courses in high school. Finally, we describe efficiency-related variables and outcomes associated with taking DC courses in high school.

Access and Participation

In this section, we describe changes in DC participation from 2000 through 2015. We also document DC participation rates for students with particular demographic characteristics and examine whether there are disparities in DC participation by demographic characteristics and whether those disparities changed between 2000 and 2015.

DC Participation Peaked in 2011, but the Number of DC Courses Delivered in Texas Continued to Increase

It is widely believed that DC programs have been growing rapidly in recent years in Texas. Indeed, as shown in Figure 5.1, the total number of SCHs of DC delivered in Texas expanded each year during the 2000–2015 timeframe, reaching 130,000 SCHs in 2015. However, Figure 5.2 shows that DC participation, which we define as the share of graduates of Texas public high schools who took at least one DC course during their junior or senior years of high school, peaked at around 22 percent in 2011 and declined from then until 2015, when it stood at 18 percent. In the subsections that follow, we examine reasons why this decline in participation may have occurred, despite the increase in total number of SCHs delivered through DC programs. These include an increase in the overall population of Texas, an increase in the number of DC SCHs that participants take, and a slight increase in DC participation in earlier grades. Currently, our data do not allow us to examine DC participation of current high school students, which also may have increased in recent years.

The Vast Majority of DC Participation Occurs in 11th and 12th Grades, but Participation Rate of 10th Graders Increased in Recent Years

Figure 5.3 shows DC participation by grade for the 2003–2015 high school graduation cohorts and shows that most DC participation for those cohorts was concentrated in 11th and 12th grades. However, there was some growth in participation in the 10th grade, with 3 percent of the 2015 high school graduation cohort having taken at least one DC course during 10th grade.

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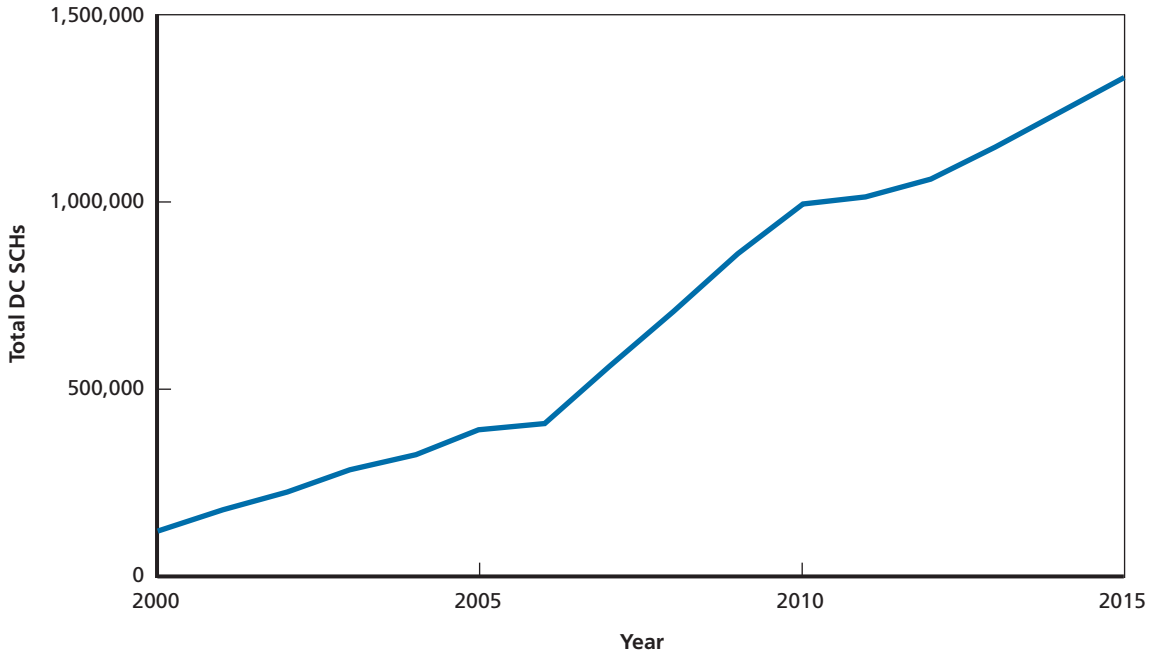
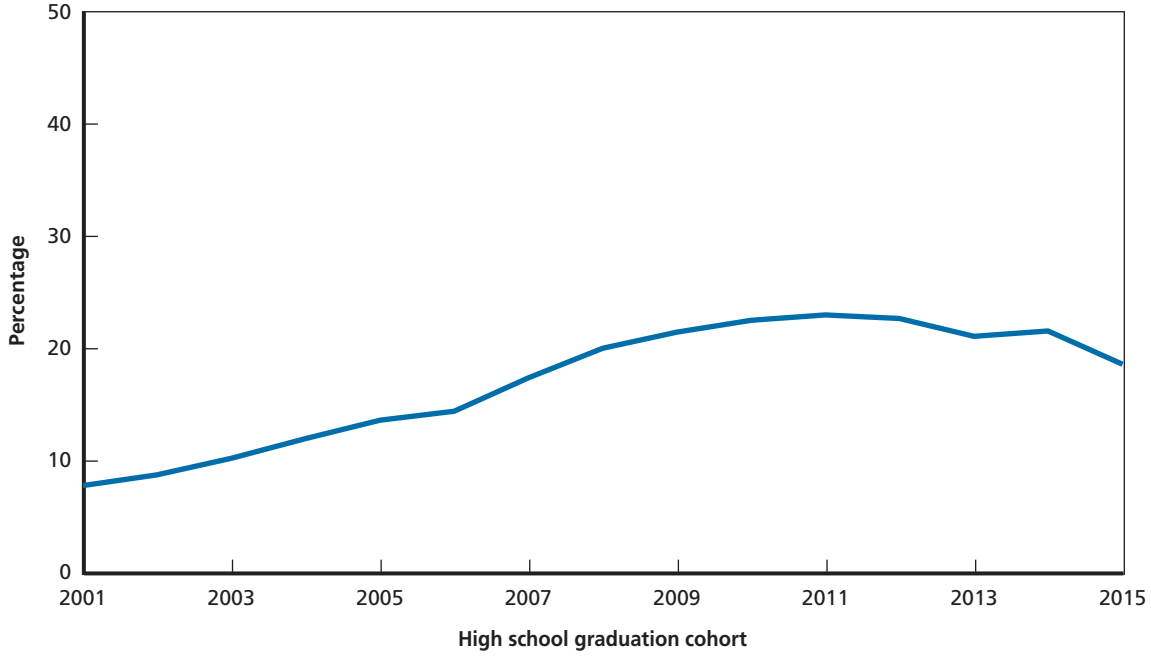
[2] For part of this analysis, we focus exclusively on DC participation in 11th and 12th grade because we cannot observe 9th and 10th grade participation in DC for earlier cohorts.

Figure 5.1
Total Number of SCHs of DC Delivered in Texas in 2000–2015



RAND *RR2043-5.1*

Figure 5.2
Percentage of Graduates Who Took Any DC Course in Their 11th- or 12th-Grade Years



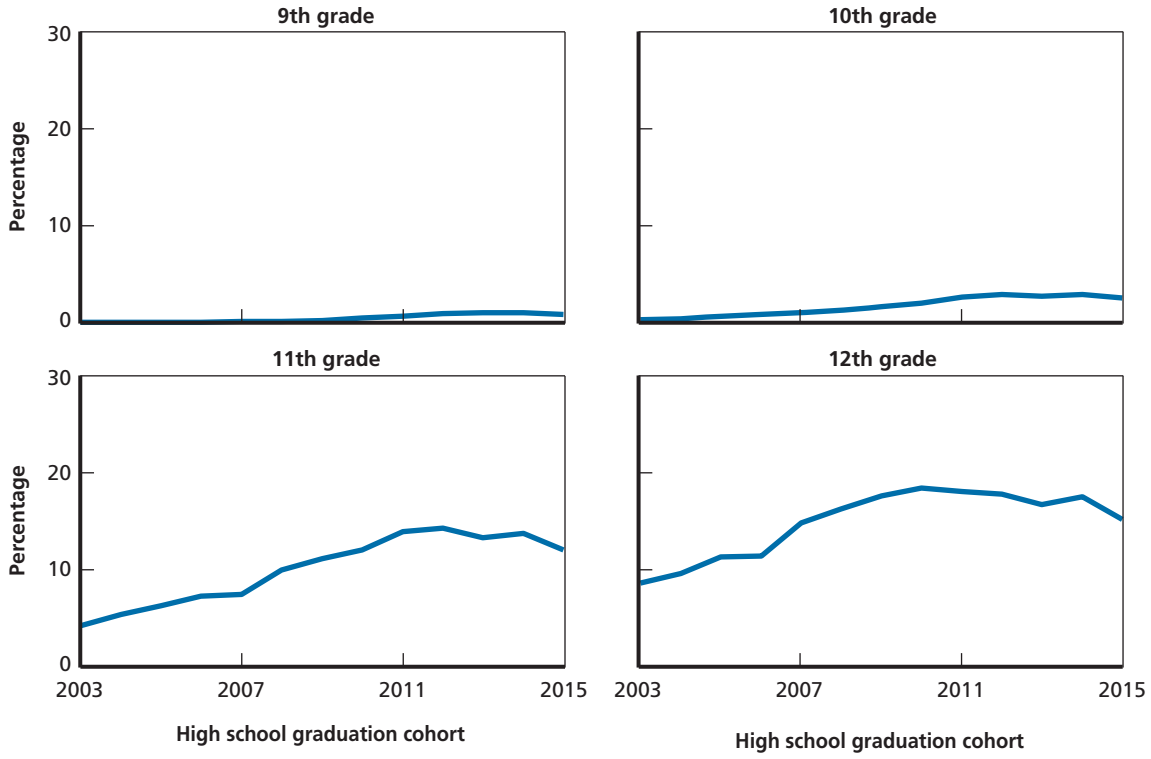
RAND *RR2043-5.2*

However, Figure 5.3 does not capture a potential uptick in 9th- and 10th-grade DC participation due to HB 505, because the students affected by recent rule changes would not have graduated by 2015. We are in the process of obtaining data from the TEA that will allow us to examine DC participation for current high school students.

The Average Number of SCHs of DC Earned per High School Graduate Participating in DC has Increased over Time

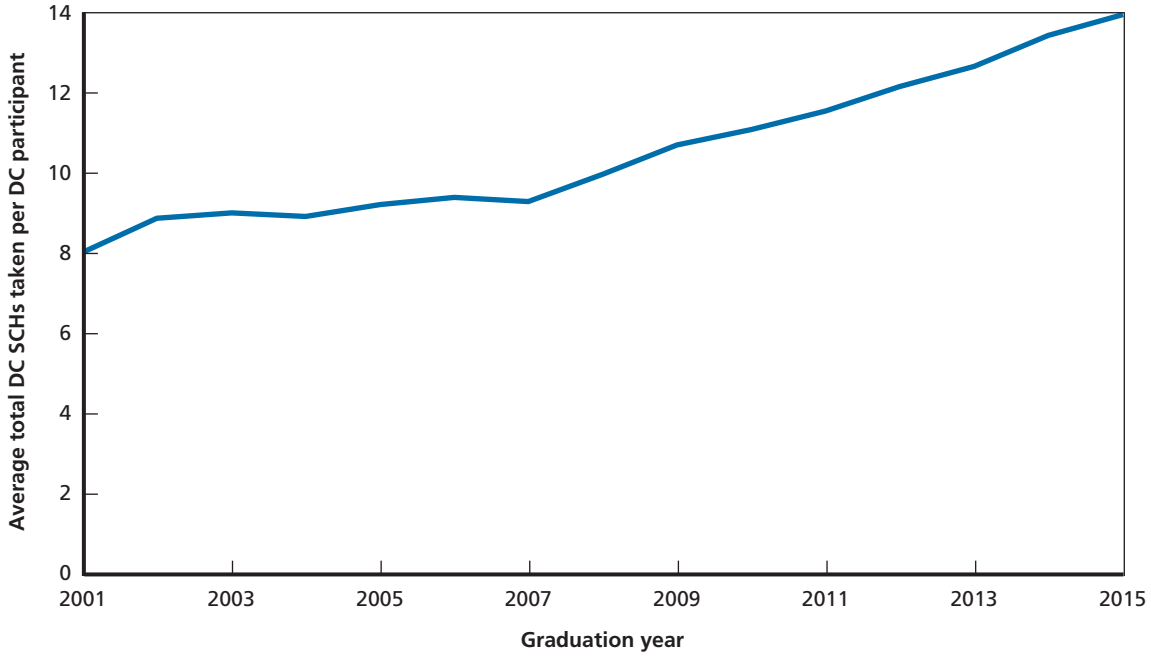
As noted above, a potential explanation for the increase in the total number of SCHs of DC courses, despite the slight decrease in DC participation, is that students who participate in DC have been taking more SCHs of DC over time. While some students in Texas, particularly those attending ECHS, earn a considerable amount of college credit through DC programs, the majority of students take only a course or two. Figure 5.4 shows the average number of credits earned in DC programs in 11th and 12th grades by graduates of Texas public high schools who participated in DC for the 2001–2015 high school graduation cohorts. The results show that the average student who takes a DC course takes a relatively modest amount of DC in his or her 11th and 12th grade years. The average student took 8–14 SCHs of DC, or 3–5 DC courses over a two-year period. However, the average amount of DC SCHs taken per graduate who participated in DC has increased considerably over time from 8 in 2001 to 14 in 2015. The fact that DC participants are taking an increasing amount of DC can, thus, partially explain the fact that participation rates declined in recent years despite the continued increase in overall SCHs earned in DC programs in Texas.

Figure 5.3
DC Participation by Grade for the 2000–2015 High School Graduation Cohorts



RAND *RR2043-5.3*

Figure 5.4
Average Total DC SCHs Taken Per DC Participant, by Year, Conditional on Taking DC



RAND *RR2043-5.4*

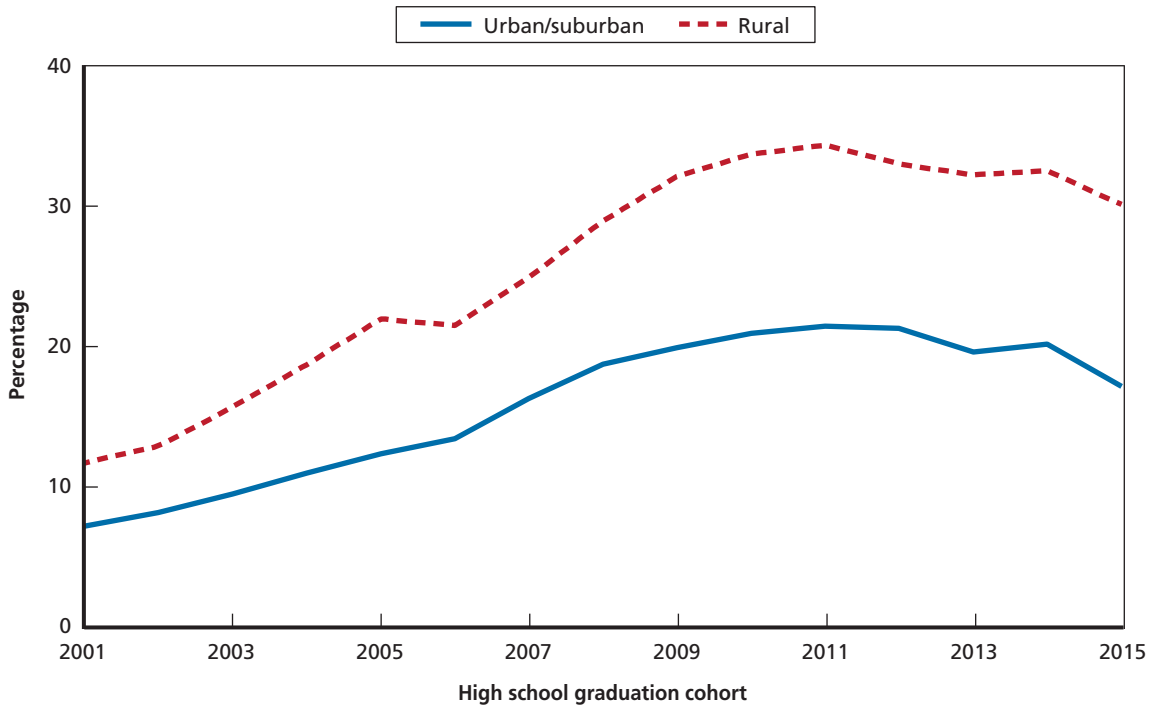
Documenting Disparities in DC Participation

As described in Chapter Three, past research has shown that the population of DC participants in Texas became more diverse during the 1990s and 2000s (Eklund, 2009). However, this increase in diversity among DC participants coincided with a rapid increase in the diversity of the state as a whole. Indeed, other studies showed that minorities and low-income students were underrepresented in DC courses across Texas during the same period (Appleby et al., 2011; Friedman et al., 2011). These findings are consistent with national studies showing that DC participation is generally lower among disadvantaged groups. In this section, we update the information in past studies and document disparities in DC participation in Texas by race/ethnicity, income, urbanicity, gender, and academic characteristics over the period 2000–2015.

Graduates of Rural High Schools Were More Likely to Participate in DC Programs Than Graduates of Urban or Suburban High Schools

Our qualitative interviews with DC administrators suggested that smaller and rural high schools found DC programs to be an attractive way to offer more rigorous college-level coursework to their students. Such schools are less likely to be able to offer other college-preparatory programs like AP or IB classes. This finding suggests that DC participation rates might be higher among graduates of Texas public high schools in rural counties. Figure 5.5 shows that this is indeed the case. Graduates of rural high schools, who represent 14 percent of all public high school graduates in Texas, had higher participation rates in each high school graduation cohort since 2001. Participation rates by graduates of rural high schools peaked at about 34 percent in 2011 and declined to 30 percent in 2015. In contrast, participation rates by graduates of high schools in urban and suburban counties peaked at about 21 percent in 2011 and

Figure 5.5
Participation Rates in DC Education in the 11th and 12th Grades, by Urbanicity



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declined to 17 percent in 2015. This is despite the fact that 79 percent of high school students who took DC education graduated from high schools located in urban and suburban areas.

Graduates of High Schools in the Upper Rio Grande and West Texas Regions Were More Likely to Participate in DC Programs; Graduates of High Schools in the Metroplex and Gulf Coast Regions Were Less Likely to Do So

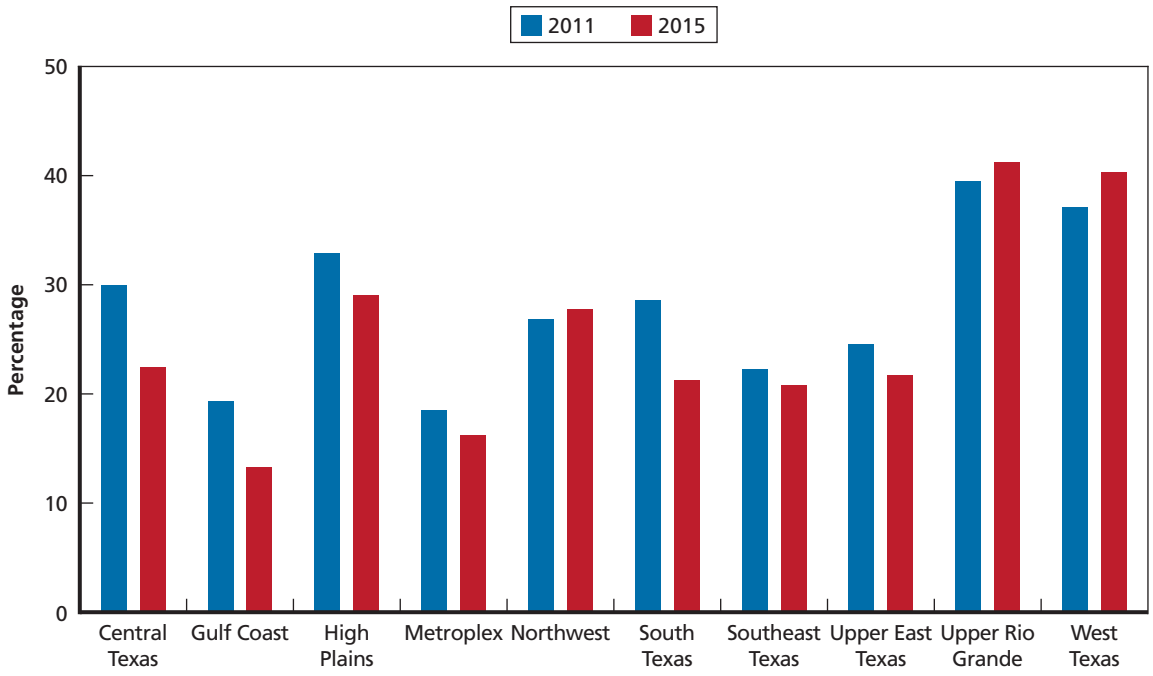
We also examined participation rates by region. Figure 5.6 shows the participation rates in 2011 and 2015 for each of the ten Texas Higher Education Regions as defined by the THECB.[3] Mirroring the patterns in Figure 5.5, we see that participation rates were lowest in the two regions that contain the state's largest urban centers of Dallas/Fort Worth and Houston. About 13 percent of 2015 public high school graduates in the Gulf Coast Region and 16 percent from the Metroplex Region took a DC course in their junior or senior year of high school. In contrast, the highest DC participation rates of more than 40 percent in 2015 were in the western part of the state, specifically in the Upper Rio Grande Region that includes the El Paso metropolitan area and in the mostly rural West Texas Region.

African-American and Hispanic Students Were Less Likely Than White Students to Participate in DC Programs

We also examined DC participation rates by race and ethnicity. Figure 5.7 shows the DC participation rate by race/ethnicity for the 2000–2015 cohorts of Texas public high school gradu-

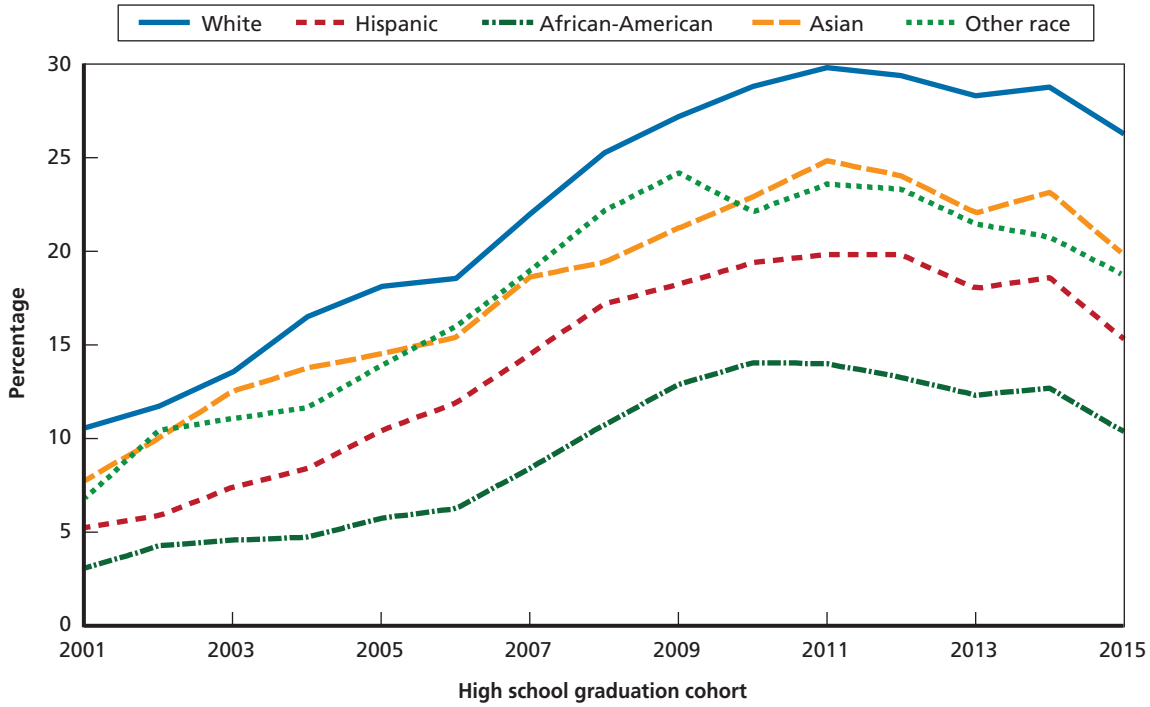
[3] We chose to examine DC participation rates in 2011 because it was the peak year for DC participation rates in Texas, and 2015 because it was the latest year of data.

Figure 5.6
Participation Rates in DC Education, by Geographic Region



RAND *RR2043-5.6*

Figure 5.7
Participation Rates in DC Education in the 11th and 12th Grades, by Race/Ethnicity



RAND *RR2043-5.7*

ates. Whites and Asians had higher participation rates than African-Americans and Hispanics. DC participation rates of white high school graduates peaked at about 30 percent in 2011 and declined to 26 percent in 2015. DC participation rates of African-Americans peaked at about 13 percent in 2009 and declined to approximately 10 percent by 2015; DC participation rates of Hispanics peaked at about 20 percent in 2011 and declined to approximately 16 percent by 2015.

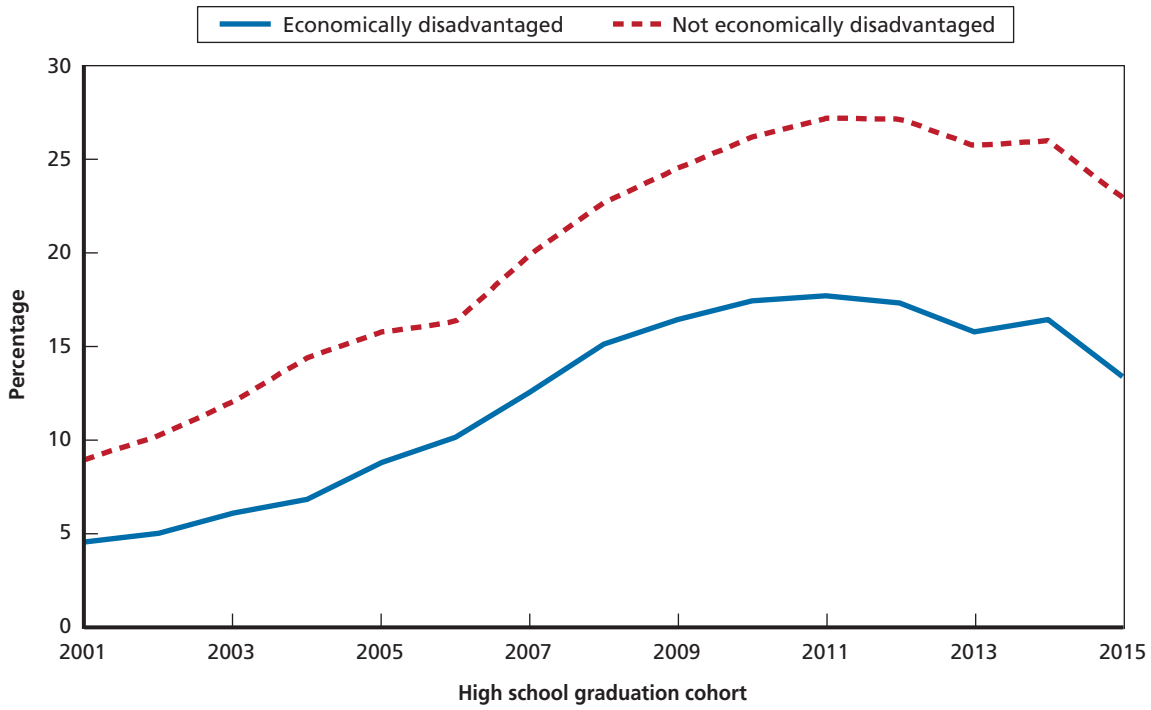
Economically Disadvantaged Students Were Less Likely to Participate in DC Programs

We also examined DC participation rates by income status. Figure 5.8 shows the DC participation rate by economic disadvantaged status for the 2001–2015 cohorts of Texas public high school graduates. We define economically disadvantaged by whether or not the student was eligible for free or reduced-price lunch in high school. Results show that economically disadvantaged students had lower participation rates than students who were not disadvantaged. DC participation rates of economically disadvantaged high school graduates peaked at about 18 percent in 2011 and declined to 13 percent by 2015. DC participation rates of students not considered economically disadvantaged peaked at about 27 percent in 2011 and declined to approximately 23 percent by 2015.

Females Were More Likely Than Males to Participate in DC Programs

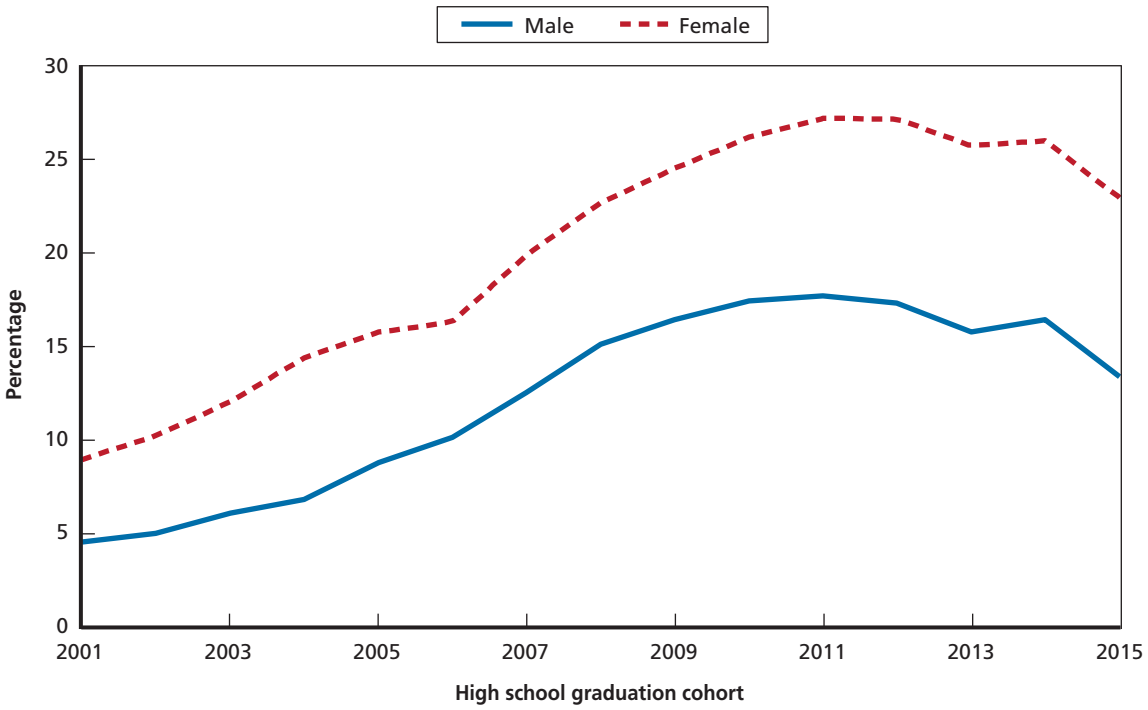
We also examined DC participation rates by gender. Figure 5.9 shows the DC participation rate by gender for the 2001–2015 cohorts of Texas public high school graduates. Mirroring trends in college enrollment nationally, males had lower participation rates than females. DC participation rates of male high school graduates peaked at about 20 percent in 2011 and declined to

Figure 5.8
Participation Rates in DC Education in the 11th and 12th Grades, by Economic Status



RAND *RR2043-5.8*

Figure 5.9
Participation Rates in DC Education in the 11th and 12th Grades, by Gender



RAND *RR2043-5.9*

16 percent by 2015, while DC participation rates of females peaked at about 26 percent in 2011 and declined to approximately 21 percent by 2015.

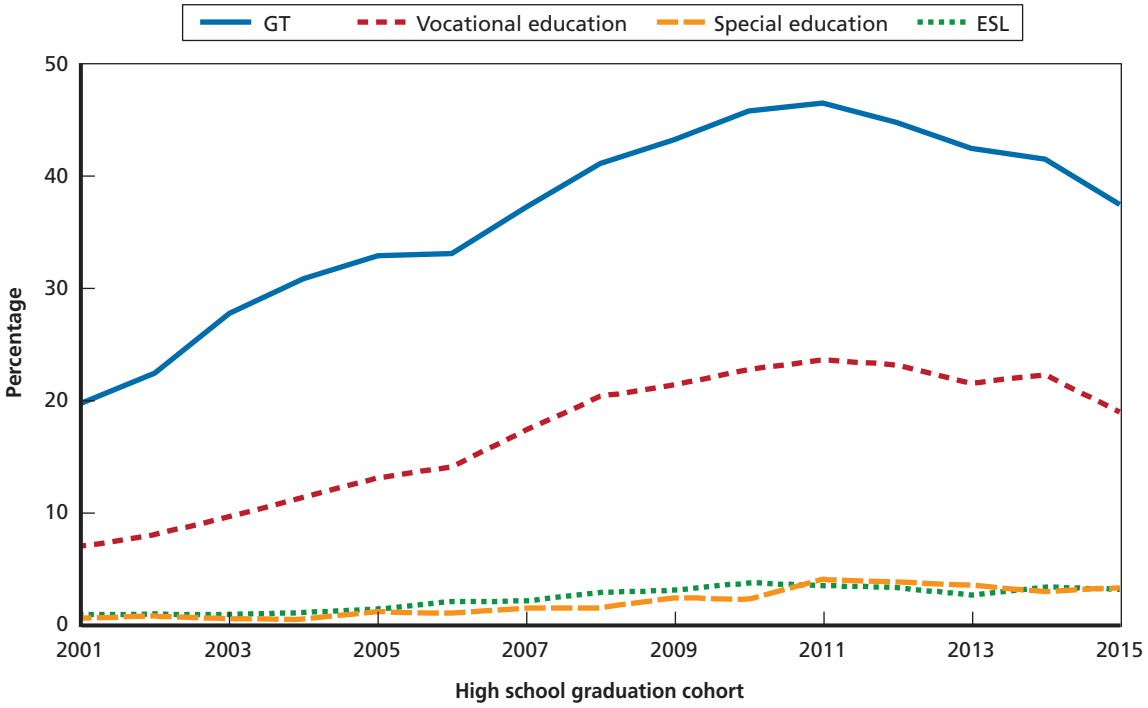
Graduates of Gifted and Talented Programs Were More Likely to Participate in DC Programs, While Those in Special Education and English as a Second Language Programs Were Less Likely to Do So

We also examined DC participation rates by student academic characteristics. Figure 5.10 shows the DC participation rate for students in gifted and talented (GT) programs, vocational education programs, special education programs, and English as a second language (ESL) programs for the 2001–2015 cohorts of Texas public high school graduates. The results demonstrate the selective nature of DC programs, in that GT students were significantly more likely to take DC courses than were students in special education or ESL programs. Participation rates of GT students peaked at about 47 percent in 2011, and declined to roughly 38 percent by 2015, whereas participation rates by ESL and special education students hovered near zero in all years but increased slightly over time. Interestingly, students in vocational education programs were about as likely to take DC courses as were students in academic programs. It is likely that many of these students were taking CTE courses as DC, and as we show below, the delivery of CTE DC has increased over time.

Changes in Disparities in DC Participation Rates over Time

The results thus far have demonstrated disparities in DC participation rates by race/ethnicity, economically disadvantaged status, urbanicity, gender, and a range of student academic characteristics.

Figure 5.10
Participation Rates in DC Education in the 11th and 12th Grades, by Academic Characteristics



RAND *RR2043-5.10*

Because education leaders are using DC as a way to promote access and success, particularly for traditionally underserved student groups, we wanted to assess the degree to which disparities in participation rates were changing over time. To do this, we ran ordinary least squares (OLS) regressions predicting DC participation as a function of these student characteristics. These OLS models are more robust than the simple descriptive statistics presented above because they allow us to examine the relationship between the rate of DC participation and a given student characteristic, such as income, holding all the other student characteristics constant. This analysis allows us to assess whether, for example, African-American students were more or less likely to participate in DC than a white student with similar characteristics. We ran these models separately for students who graduated in 2000–2006, 2007–2011, and 2012–2015 and examined whether there was a statistically significant change in the relationships between student characteristics and DC participation over time. We describe these models in more detail and present detailed tables with coefficient estimates and statistical tests in Appendix E.

Figures 5.11–5.13 summarize the results of these OLS models with a series of bar graphs that plot the estimated relationship between each student characteristic we examined and DC participation by high school graduation cohort group. Collectively, the results suggest that the disparities in DC participation rates were widening between 2000 and 2015. For example, for the period of 2000–2006, African-American high school graduates were 5.9 percentage points less likely than white students with similar characteristics to participate in DC in 12th grade. However, in 2012–2015, that difference increased to 9.3 percentage points, showing that African-Americans in more recent cohorts were even less likely to participate in DC. Similar

Figure 5.11
Probability of Taking DC in 12th Grade, by Race/Ethnicity, Disaggregated Across Years (2000–2015)

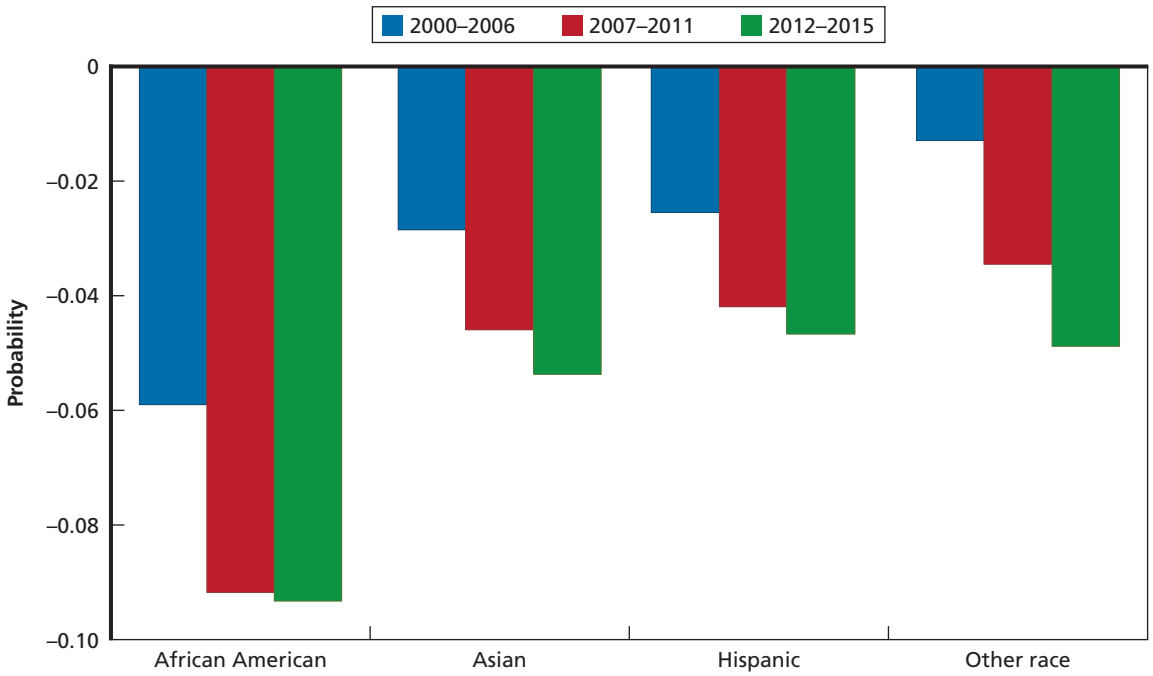


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Figure 5.12
Probability of Taking DC in 12th Grade, by Academic Characteristics, Disaggregated Across Years (2000–2015)

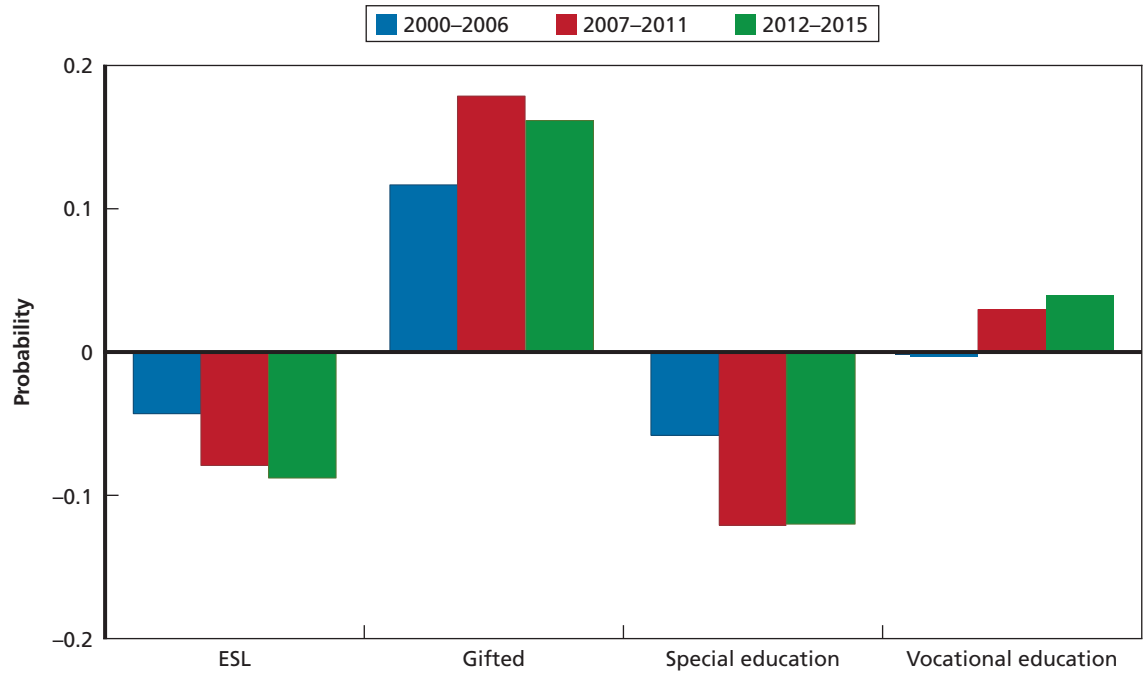

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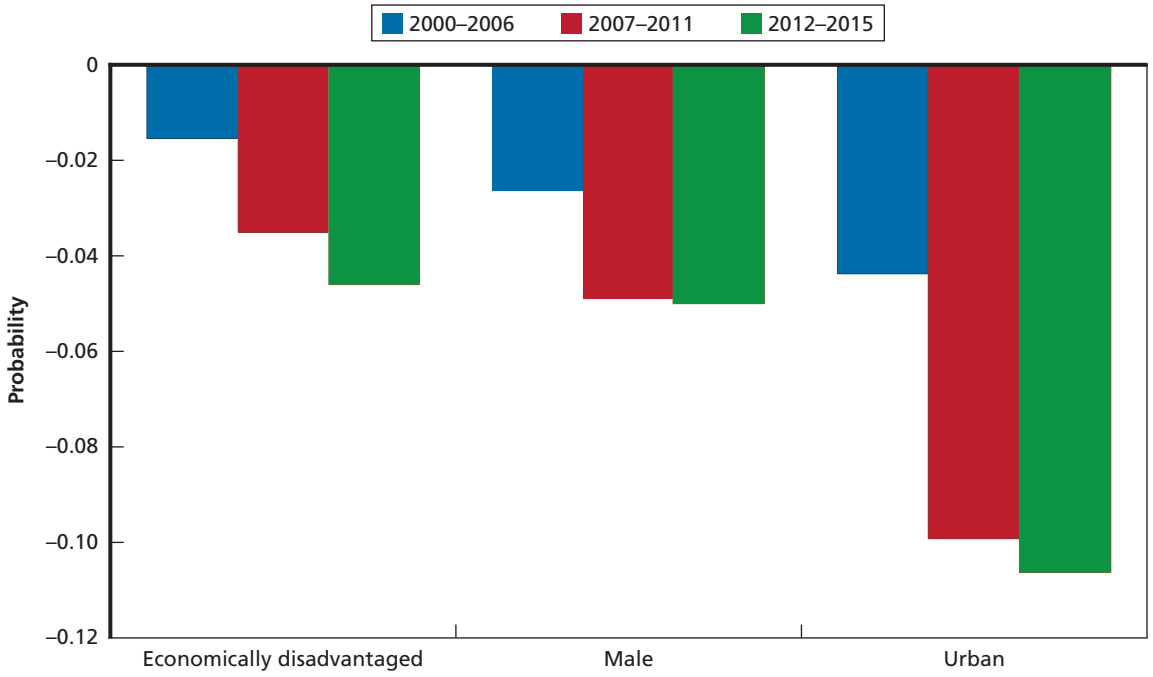
Figure 5.13
Probability of Taking DC in 12th Grade, by Economic Disadvantage, Gender, and Urbanicity, Disaggregated Across Years (2000–2015)



RAND *RR2043-5.13*

patterns hold for the other student characteristics, and the differences between the 2000–2006 and 2012–2015 high school graduation cohorts are all statistically significant.

While gaps in DC participation rates by race/ethnicity have widened, this is partly due to the wide gaps in DC participation that initially existed in 2000. Indeed, African-American students reported the largest annual growth rate in DC participation at just under 11 percent between 2000 and 2015, and Hispanics came in a close second at 10 percent. The fact that African-American and Hispanic students participated in DC education at such low rates in 2000 explains why these two student subgroups have made the largest increases compared with other student groups. This finding is consistent with THECB analysis demonstrating growth in DC participation among traditionally underrepresented racial and ethnic student groups, and the increasing diversity of the DC student population overall (THECB, 2016).

More generally, disparities in DC participation rates among different student subgroups could be driven by various factors, including differences in access to DC across high schools in Texas, preparation and demand for DC, access to alternative forms of college level coursework in high school such as AP and IB, and advising practices at high schools. Phase II of the study aims to pinpoint the specific causes of these disparities.

Delivery of DC Instruction

In this section, we describe patterns in the delivery of DC courses. We begin by describing the key design features of DC courses that we can capture in administrative records. These include information about the type of institution that delivered the course, whether it was an academic or CTE course, characteristics of the faculty member of record for the course, and informa-

tion about course modality and location. Much of the analysis presented here relies on detailed course-level administrative data that have only been available since 2012, so we focus primarily on recent high school graduation cohorts. We begin by documenting the overall patterns in DC delivery and then assess the extent to which students with particular characteristics are more or less likely to take DC courses with particular features.

Note that, throughout this section, when we calculate mean characteristics of DC courses, we weight individual courses by the number of students taking the course for DC. So, for example, a course with 15 high school students taking the course for DC and 15 students taking it for college-credit-only would receive a weight of 15, whereas a course with two high school students taking the course for DC and 28 taking it for college-credit-only would receive a weight of 2.

DC in Texas Primarily Is Delivered by Two-Year Institutions and Focuses on the Academic Core

Historically, DC programs in Texas primarily were focused within two-year colleges. However, a handful of four-year colleges have well-established DC programs, and a few have plans to establish programs in the near future. An analysis of THECB administrative records shows that from 2012 through 2015, Texas public four-year institutions delivered 29,478 DC course seats, whereas public two-year institutions delivered 776,451.

Our qualitative interviews with DC administrators suggested that many institutions focus their DC offerings within the academic core to ensure that course credits transfer. Table 5.1 shows the total number of DC courses delivered for the 10 most common courses over the

Table 5.1
Total Number of DC Course Seats Delivered for the Ten Most Common Courses from 2012 Through 2015

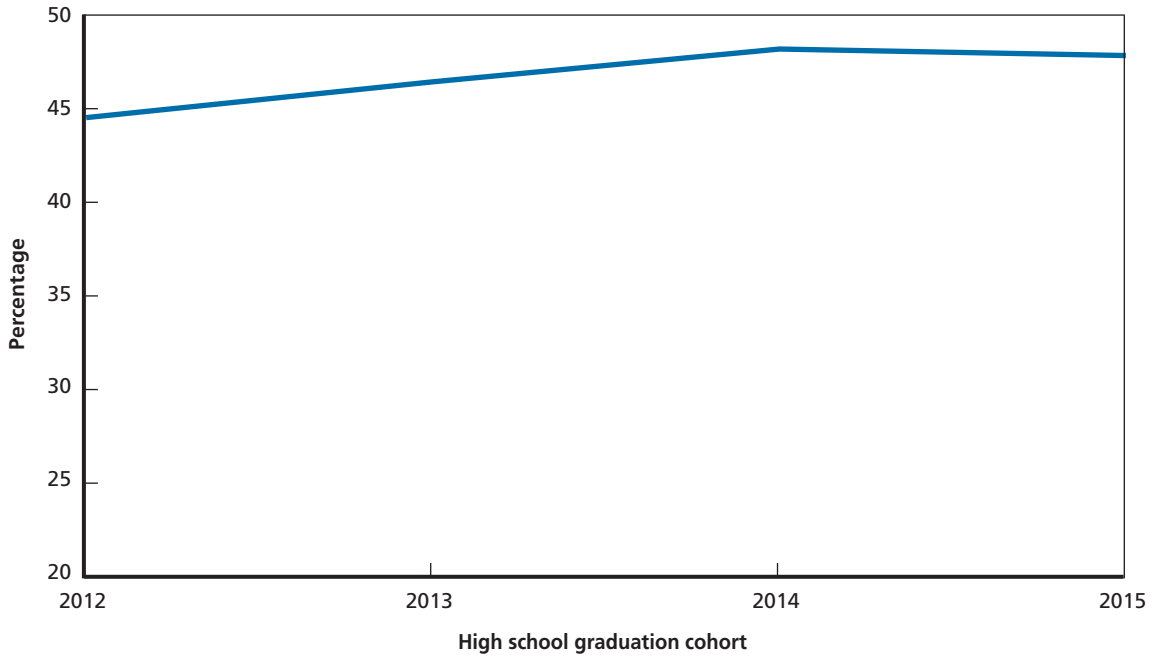
Course Prefix	Course Number	Course Name	Number of Course Seats Delivered
ENGL	1301	Composition I	97,417
ENGL	1302	Composition II	87,550
HIST	1302	United States History II	61,372
GOVT	2305	Federal Government	59,383
HIST	1301	United States History I	57,167
ECON	2301	Principles of Macroeconomics	46,109
MATH	1314	College Algebra	31,335
ENGL	2322	British Literature	19,102
PSYC	2301	General Psychology	15,259
GOVT	2301	Federal and State Government	13,779
ENGL	2323	British Literature II	11,506

period of 2012–2015.[4] All of the most common courses were from the academic core. The most common DC courses were the freshmen English (English 1301 and 1302), history (History 1301 and 1302) and government (Government 2301 and 2305) courses, all of which are either mandated by state statute or nearly universally included as required core academic coursework for an associate or bachelor of arts degree in Texas. Other common courses included Math 1314 or 1414 (a three- or four-hour college algebra course that is often the first college-level mathematics class required for an associate or bachelor of arts degree), as well as core courses in economics and psychology. Also interesting is that all but one of the ten most common DC courses was an arts and humanities course, while just one was a science, technology, engineering, and mathematics (STEM) course.

There Has Been a Significant Increase in DC Course Delivery on High School Campuses and at ECHSs

Some institutions and policymakers have voiced concern over a perceived increase in the number of DC courses being taught on high school campuses. Figure 5.14 shows the share of DC course seats where the course was delivered on high school campuses. The results show that more than half of all DC course seats were on high school campuses over those years and that the share increased from 44 percent to 48 percent from 2012 to 2015.

Figure 5.14
Share of DC Course Seats Where Course Was Delivered on High School Campuses



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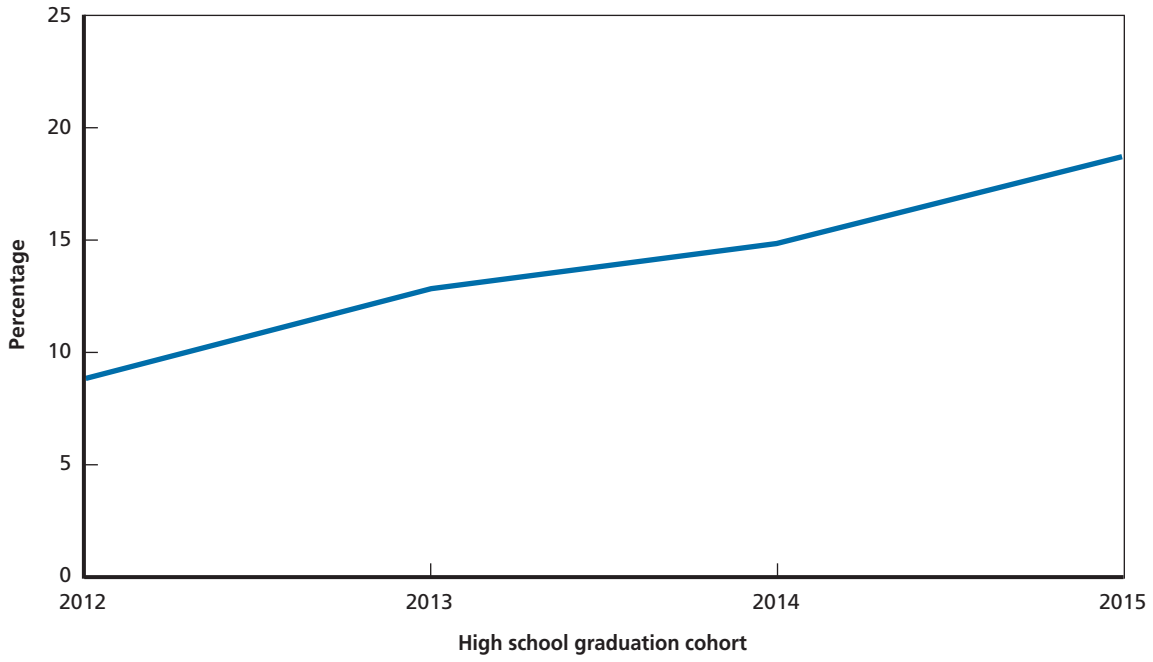
[4] Because Texas uses a common course numbering system for all two-year colleges and because the majority of four-year HEIs participate in a process to link their core courses to the common course numbering system, we are able to count the total number of DC courses delivered statewide by course number.

ECHSs offer high school students the opportunity to begin taking most of their classes as DC starting as early as 9th grade, while also providing a number of support programs and more comprehensive advising services. As described in Chapters Two and Three, ECHSs have shown promise in two large lottery-based assignment studies (Berger et al. 2014; Edmunds et al. 2016), and they are common in Texas. Figure 5.15 shows the share of DC course seats where the course was delivered by ECHS from 2012 to 2015.[5] The results show significant growth in the share of course seats delivered by an ECHS, increasing from 9 percent to 19 percent from 2012 to 2015.

Instructors of DC Courses Are More Likely to Be Part-Time and Adjunct, to Not Possess a Doctorate, and to Be Concurrently Employed as a Teacher at a Texas Public High School

In light of the large and growing number of DC courses being taught on high school campuses, some stakeholders have voiced concern that the faculty teaching DC courses may not be as qualified as those teaching college-credit-only courses. Our qualitative interviews with DC administrators suggested that community colleges adhere closely to SACSCOC requirements when identifying faculty to teach DC courses, but none of the respondents whom we talked with indicated any systematic effort to ensure that DC instructors were equally

Figure 5.15
Share of DC Course Seats Where Course Was Delivered by an ECHS



RAND *RR2043-5.15*

[5] Some ECHSs are stand-alone high schools where only ECHS students attend, while others are embedded within a larger high school. Our data identify the public high schools in Texas that had a designated ECHS within them, and information about whether that ECHS was stand-alone or embedded. For ECHSs that were embedded within a larger high school, we cannot distinguish the students who participated in the ECHS from the other students attending the high school. As such, Figure 5.15 shows the share of DC course seats delivered to all students who attended a high school that had an ECHS embedded within it.

qualified in terms of education and teaching experience as those teaching college-credit-only courses. Figure 5.16 shows the characteristics of faculty members teaching DC courses versus college-credit-only courses at Texas public two-year colleges in 2015. The results show that DC instructors indeed had less education and experience on average, than instructors of college-credit-only courses. A total of 56 percent of DC course seats had an adjunct instructor as the faculty member of record, whereas the corresponding statistic for college-credit-only courses was 35 percent. Approximately 46 percent of DC course seats had a full-time instructor as the instructor of record, while the corresponding statistic for college-credit-only courses was 65 percent. Just 12 percent of DC course seats had a faculty member of record with a doctorate, whereas the corresponding statistic for college-credit-only courses was 19 percent. We assessed whether there were any significant changes in faculty characteristics of DC and college-credit-only courses between 2012 and 2015; we did not find significant changes, so we do not report trends here.

We also linked our faculty records to TEA data on the universe of teachers at Texas public high schools to identify course seats where the faculty member of record was also a teacher at a Texas public high school. The results suggest that about 41 percent of DC course seats were taught by an instructor who was also concurrently employed as a high school teacher, whereas the corresponding statistic for college-credit-only courses was just 2 percent.

Most DC Courses Are Delivered in a Face-To-Face Format, but Online Delivery Is More Prevalent in DC Than in College Credit–Only Courses and Is Growing

We also compared course modalities in DC and college-credit-only courses in Figure 5.17. The results show that the majority of both DC and college-credit-only courses were taught face-

Figure 5.16
Characteristics of Faculty Members Teaching DC Versus College Credit-Only Courses at Texas Public Two-Year Colleges in 2015

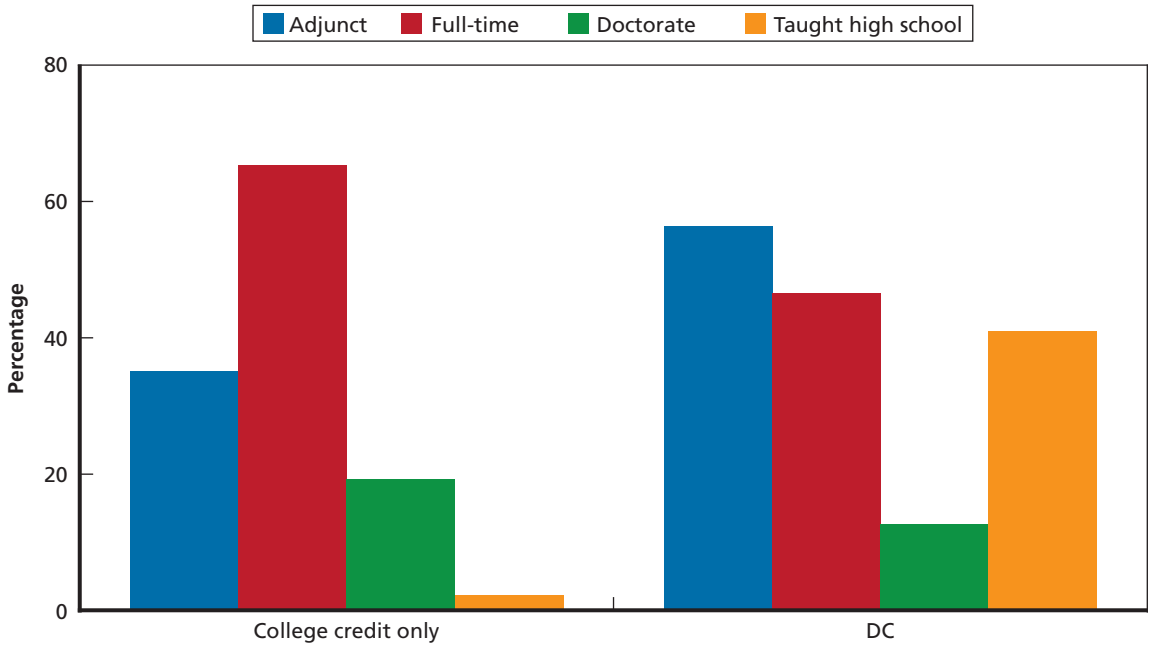


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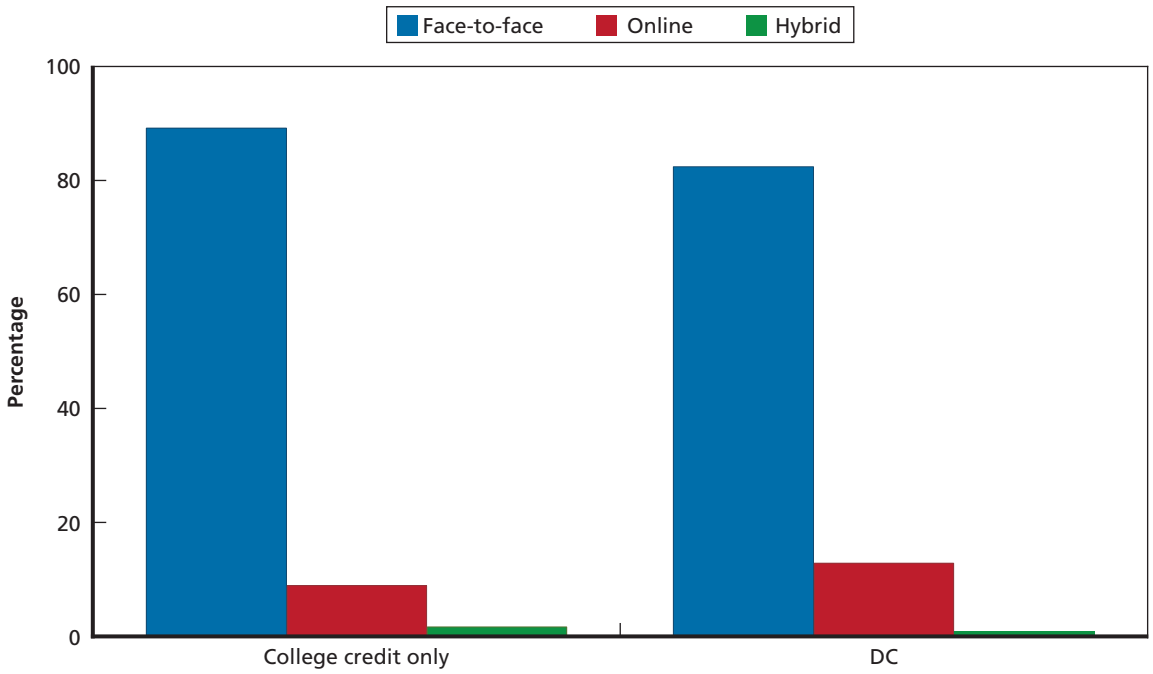
Figure 5.17
Course Modality in DC and College Credit-Only Courses (Averaged over 2012–2015)



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to-face, but that online delivery was slightly more prevalent in DC than in college-credit-only courses. Thirteen percent of DC course seats were taught online versus 9 percent of college-credit-only course seats. We checked to see whether there were significant trends in course modality from 2012 to 2015 and found a substantial increase in DC courses being taught online. Figure 5.18 reports these results and shows that, since 2012, the share of DC course seats being taught online had increased from 10 percent to 13 percent.

CTE DC Is a Small Share of DC Course Seats but Is Growing

We also examined the share of DC course seats that were for CTE versus academic courses. Overall, CTE is a small share of DC courses in Texas. From 2012 to 2015, just 7 percent of all SCHs of DC delivered in Texas were for CTE courses. While that number has held relatively constant since 2012, the total number of course seats for DC CTE had increased from 7,560 to 13,720, as shown in Figure 5.19.

Academic Outcomes of DC Students

In this section, we describe patterns in DC outcomes for DC students who enrolled in public and private not-for-private HEIs in Texas. We begin by examining patterns in course grades in DC courses versus regular college courses. Next, we analyze student performance in follow-on courses (which we define below) for prevalent DC courses that have a natural follow-on course. These are Math 1314/1414 (College Algebra) and English 1301 (Composition I). Finally, we describe differences in college enrollment, college readiness, persistence, and completion at two- and four-year colleges by DC participation.

Figure 5.18
Share of DC Course Seats Where Course Was Delivered Online

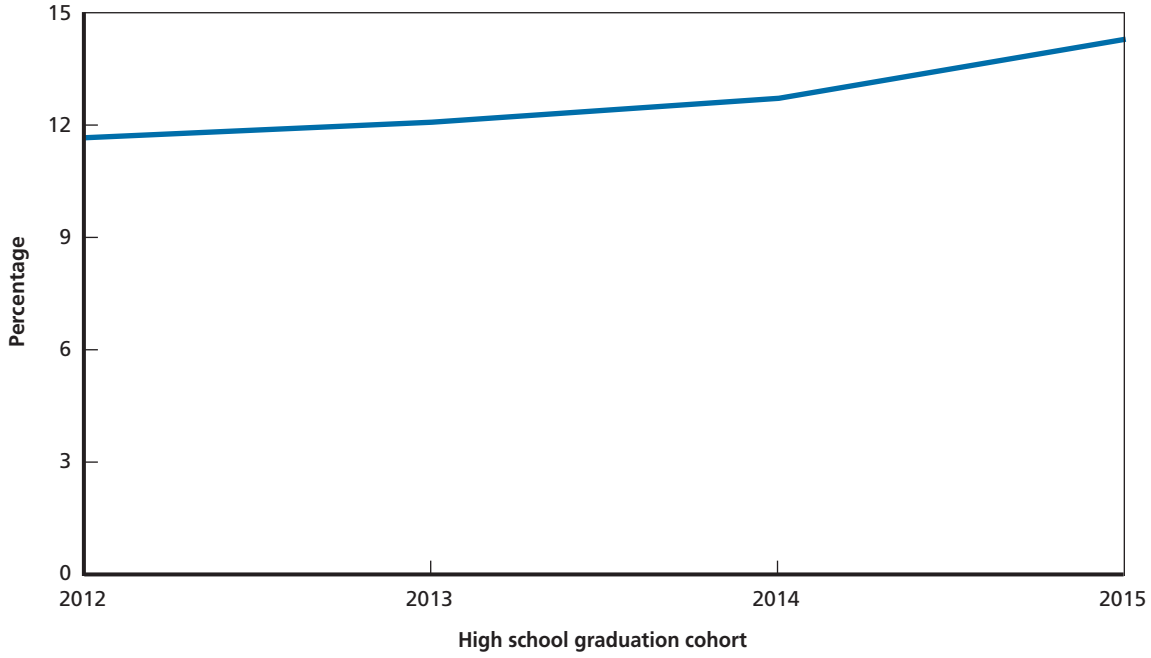

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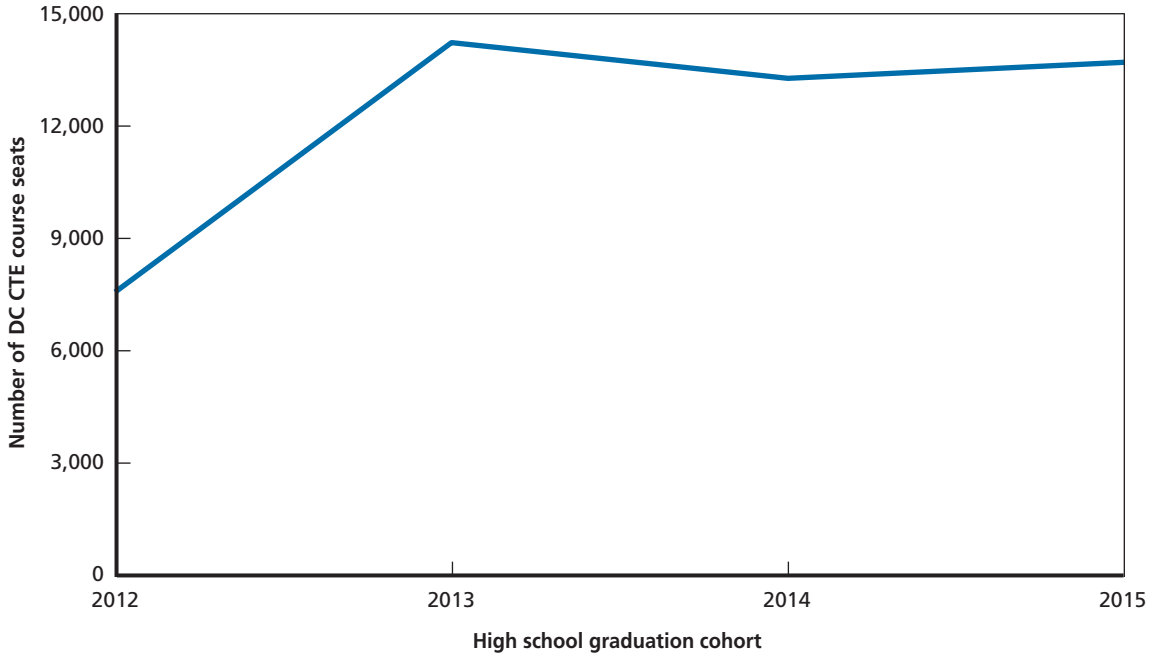
Figure 5.19
Total Number of DC CTE Course Seats from 2012 to 2015



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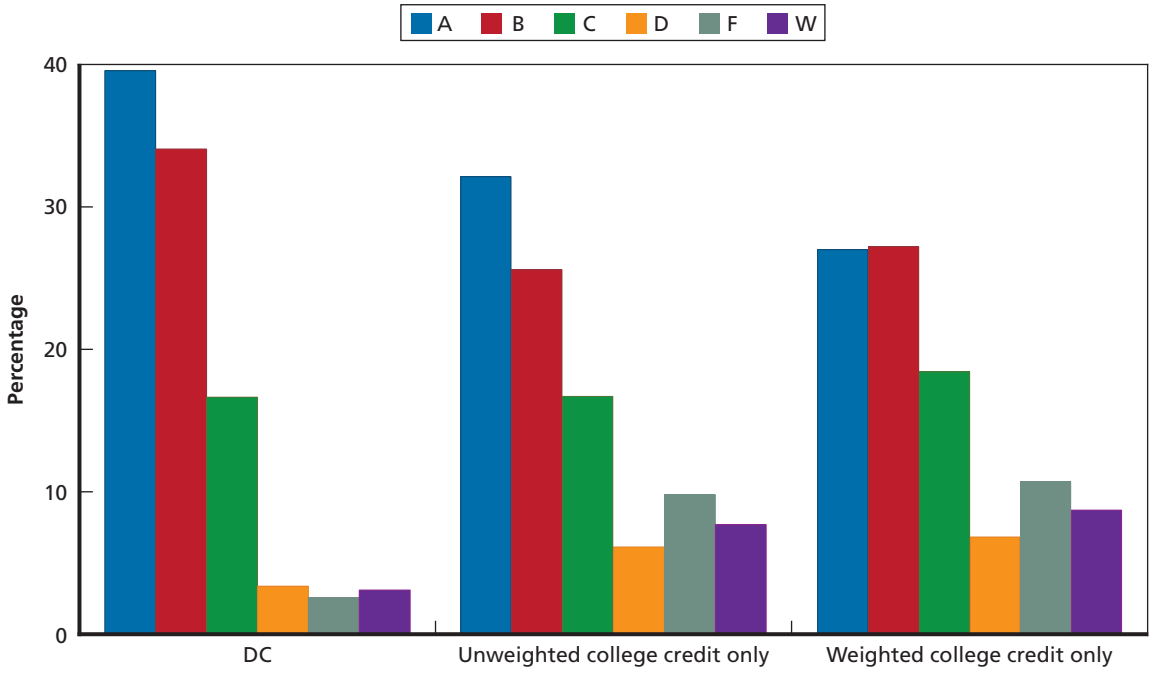
Students Received Higher Grades in DC Courses Relative to College-Credit-Only Courses

We examined how student course performance in DC courses compared with course performance in regular college-level courses. Figure 5.20 shows the grade distribution for all college-level courses delivered by Texas public institutions from 2012 to 2015 by course type. The upper left set of columns marked "Dual Credit Course Seats" show the grade distribution in all DC courses. The upper right set of columns marked "Unweighted College Credit-Only Course Seats" show the grade distribution in all college-credit-only courses delivered to college students. The results show that courses taken for DC have significantly higher grades and lower withdrawal rates, compared with all college-credit-only courses. Nearly 40 percent of all grades given for DC courses were A's, and 74 percent of grades for DC courses were B's or higher. Just 6 percent of students in DC courses failed or withdrew from them. In contrast, 32 percent of grades given for college-credit-only courses were A's, and 26 percent of grades for college-credit-only courses were B's. Eighteen percent of students in college-credit-only classes failed or withdrew from them.

One reason course grades may differ in DC courses relative to college-credit-only courses is that the types of courses taught for DC are different than those taught only for college credit. We have seen that DC courses are universally lower-division courses and mostly concentrated within the academic core. In contrast, college-credit-only courses include upper-division courses and major-specific courses that would not be offered as DC courses. To the extent that course grades systematically differ across the types of courses that are likely to be delivered as DC, relative to the overall distribution of college-credit-only courses, the comparison we made above may not reflect true differences in course performance. To address this issue, the lower

Figure 5.20
Grade Distribution for all College-Level Courses Delivered by Texas Public Institutions from 2012 to 2015, by Course Type



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left set of columns, marked "Weighted College Credit-Only Course Seats," show the grade distribution in college-credit-only courses weighted so that they mirror the distribution of courses delivered for DC. The grade distribution in these courses when taught as college-credit-only courses is still lower than the grade distribution in DC courses. This likely reflects the fact that course grades are generally higher in upper-division and major-specific courses than they are in the academic core. The key takeaway from Figure 5.20 is that course performance is generally better in DC courses than in college-credit-only courses.

DC Students Do Better in Follow-On Courses Relative to College-Credit-Only Students

The analysis thus far has documented that course performance in DC courses is generally better than when those same courses are taken by college students for college credit only. A number of factors could explain this finding. For example, our qualitative interviews suggested that high schools often limit DC enrollment in ways to promote student success, and our quantitative analysis has also documented the selective nature of DC programs. The higher course grades in DC courses could reflect these selection patterns. Then again, we have also documented the differences in faculty characteristics and the fact that many DC courses are taught on high school campuses and by credentialed instructors who are concurrently high school teachers. Thus, it is also possible that DC courses are graded differently or are less rigorous on average than typical college courses delivered for college credit only.

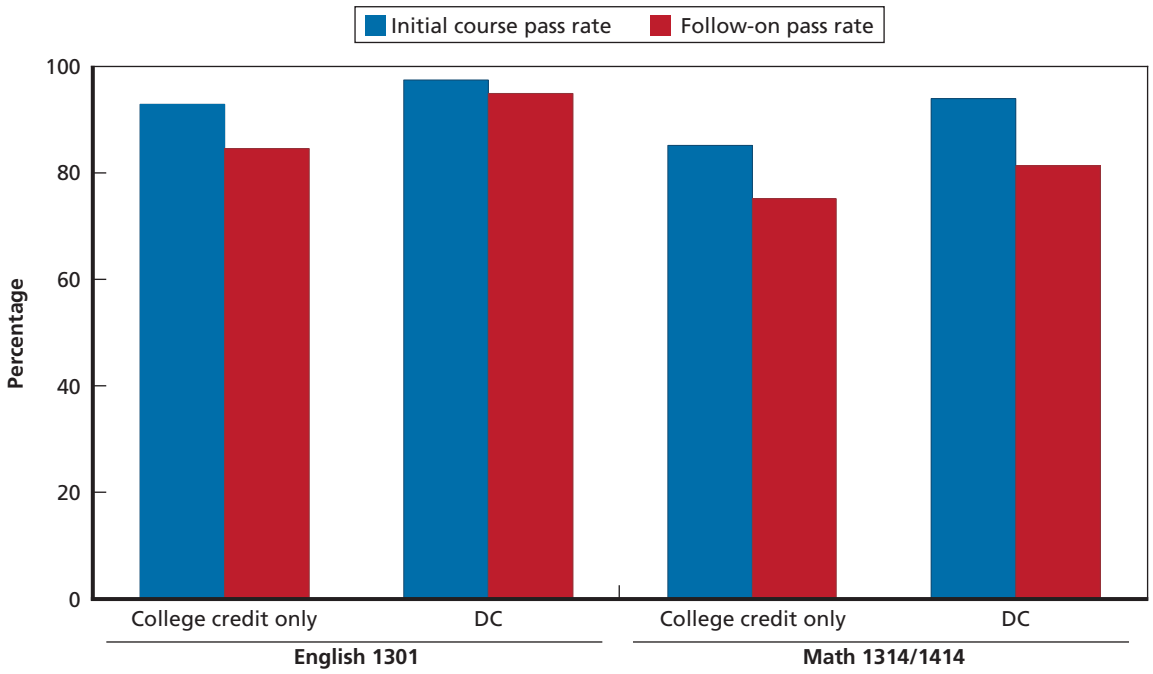
The two sets of factors described above are likely to have different effects on student performance in follow-on courses, or courses that require taking an introductory college course as a prerequisite. On the one hand, if DC courses are less rigorous or graded less stringently than college-credit-only courses, we might expect students who take DC courses to suffer in follow-on courses taken after graduating from high school that draw on the content and knowledge that should be developed in the DC course. On the other hand, if the selection processes for DC courses ensure that higher-ability students take DC courses, then these students are likely to do better in follow-on courses.[6] While we are reasonably confident based on our qualitative and quantitative findings that DC students are positively selected and hence should be expected to perform better in subsequent college-level courses, we have very limited information to inform our expectations about the rigor and grading of DC courses relative to college-credit-only courses.

We examined the course performance of DC students in follow-on courses. We focused on two common DC courses that are required as prerequisites for common academic core courses. Specifically, we focused on English Composition I (English 1301), because it is the most common DC course and because most students are required to take English Composition II (English 1302) and a number of other writing-intensive courses, such as government and history, that require English 1301 as a prerequisite. We also focused on College Algebra (Math 1314/1414), because it is the most common math DC course, and because most students in STEM majors must also take calculus, physics, and chemistry courses that require it as a prerequisite.

The first set of columns in Figure 5.21, marked "ENGL 1301," show student pass rates in English 1301 in blue and courses that require English 1301 as a prerequisite in red. The leftmost set of columns marked "College credit only" show these pass rates for students who took

[6] We define follow-on courses as courses that require the introductory college-level course as a prerequisite for enrollment. For example, English Literature is a follow-on course to English Composition.

Figure 5.21
Pass Rates of DC and College-Credit-Only Students in Follow-On Courses



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English 1301 in college for college credit only. The rightmost set of columns marked "DC" show these pass rates for students who took English 1301 in high school as a DC course. The results show that students who took English 1301 as a DC course were more likely to pass both English 1301 and follow-on courses that require it as a prerequisite. Specifically, 97 percent of students who took English 1301 as a DC course pass it, whereas 93 percent of students who took English 1301 as a college-credit-only course, after having enrolled in college, passed it. At the same time, 95 percent of students who took English 1301 as a DC course and subsequently enrolled in a course that required English 1301 as a prerequisite pass the follow-on course. The corresponding figure for students who took English 1301 as a college-credit-only course is 84 percent.

The second set of columns in Figure 5.21, marked "Math 1314/1414," replicate the above analysis for College Algebra and its follow-on courses. We find similar patterns as we did for English 1301. Students who took College Algebra as a DC course had higher pass rates both in College Algebra and in college-level STEM courses that required College Algebra as a prerequisite.

Given the selection patterns into DC courses, these results do not necessarily imply that DC courses are equally rigorous and graded like college-credit-only classes, but they give us some degree of confidence that the students who gained access to them were able to pass courses that require content knowledge that should be developed in the DC courses.

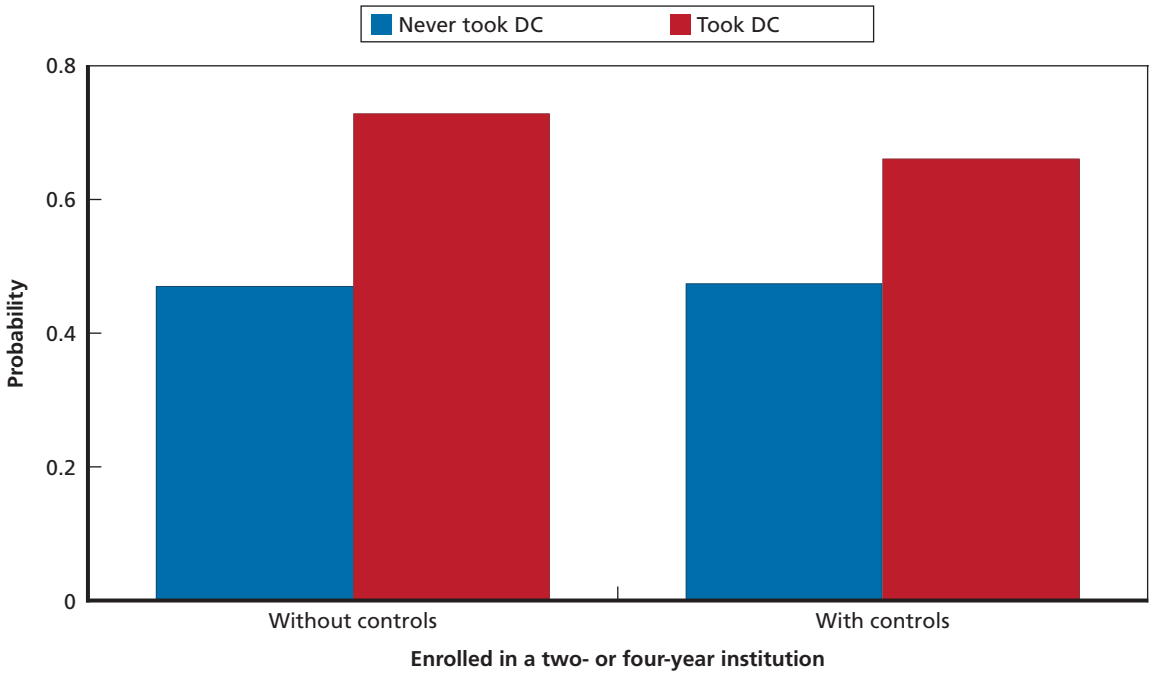
Students Who Took DC During High School Had Better College Outcomes Than College-Credit-Only Students

We examined student outcomes for students who took DC courses during high school versus those who did not. Figure 5.22 presents differences in college enrollment rates for Texas public

high school graduates from the 2000–2014 high school graduation cohorts for students who did and did not take at least one DC course in their 11th- and 12th-grade years of high school. Here, we define college enrollment as enrolling in college at least one year after graduating from high school. The leftmost set of columns, labeled "Without Controls," presents the college enrollment rates for these two groups of students.[7] Students who took at least one DC course in high school had significantly higher college enrollment rates than students who did not take a DC course. Specifically, 72 percent of Texas public high school graduates who took a DC course subsequently enrolled in college in the academic year after completing high school. In contrast, the corresponding statistic for Texas public high school graduates who did not take a DC course was 47 percent.

The raw differences in college enrollment by DC participation partly reflect the selectivity of DC programs that we have documented previously in this report. To partially adjust for these selectivity patterns, we ran OLS regression models to adjust college enrollment rates for observable student characteristics. These models are described in more detail in Appendix E, but the results are summarized in the columns marked "With Controls." The results suggest that the differences in college enrollment rates by DC participation are smaller but still large and meaningful, even after controlling for observable student characteristics. Specifically, conditional on observable student characteristics, 67 percent of Texas public high school graduates who took a DC course subsequently enrolled in college in the academic year after completing

Figure 5.22
Probability That a High School Graduate Enrolled in College After High School, for Those Who Did and Did Not Take DC Courses



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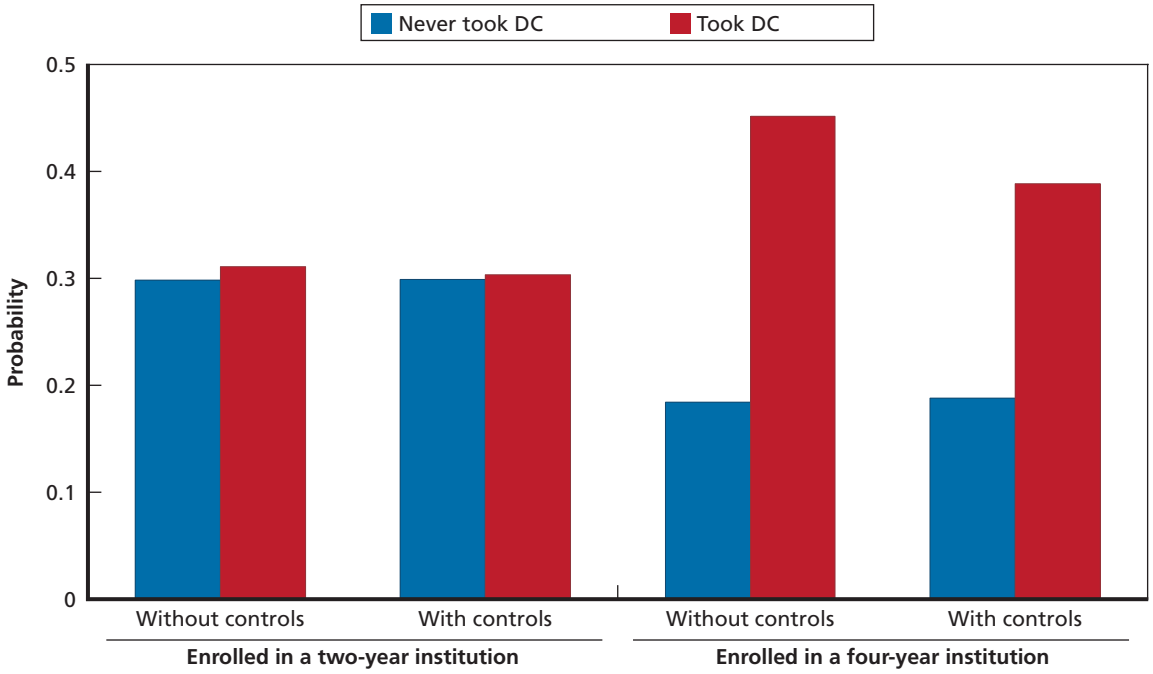
[7] We defined college enrollment as enrolling at any public or private nonprofit institution in Texas in the spring for fall semester after graduating high school.

high school. In contrast, the corresponding statistic for Texas public high school graduates who did not take a DC course was 50 percent. These results again confirm the selective nature of DC programs, while also confirming that the students who participated in DC programs had higher college enrollment rates than those who did not. However, the set of student characteristics we could include in the models was quite limited and, notably, did not include any measure of student academic background, such as a score on a standardized assessment. Thus, we do not claim our results suggest a causal relationship between DC participation and college enrollment.

Figures 5.23 replicates the analysis above but breaks the college enrollment rate down by whether the student initially enrolled in a two- or four-year college. Interestingly, the results indicate that all of the increase in college enrollment for students who took a DC course in high school channeled through four-year colleges. While enrollment rates in two-year colleges were similar among students who did and did not take a DC course in high school,[8] enrollment rates in four-year colleges were nearly three times as high for students who took a DC course in high school.

Figure 5.24 replicates the analysis above for two-year college persistence rates, defined as being enrolled during the academic year immediately after high school graduation and either still being enrolled during, or having completed, an academic credential before the end

Figure 5.23
Probability That a High School Graduate Enrolled in Two- or Four-Year School After High School, for Those Who Did and Did Not Take DC Courses



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[8] The differences in enrollment rates at two-year colleges by DC participation status are statistically indistinguishable from zero.

of the second academic year. These models are based on the 2000–2013 high school graduation cohorts to give a full follow-up window for all cohorts. The results suggest that DC students were more likely to persist for one year, even after controlling for a limited set of student characteristics.

Figures 5.25 and 5.26 replicate the analysis in Figure 5.22 for enrolling in a college without having met college readiness standards and college completion. Here, *completion* is defined as completing any academic credential within eight years of high school graduation and is defined for the 2000–2007 cohorts of high school graduates to provide a uniform follow-up window. *Enrolling not ready* is defined as enrolling in college in the academic year immediately after high school graduation and not meeting the state's definition of college readiness. The results are consistent with our other outcomes in that DC students were more likely to complete college and less likely to enroll in college as not ready, even after controlling for a limited set of observable student characteristics.

Overall, our findings suggest that DC students appear to have had better course performance, higher pass rates in follow-on courses, and better student outcomes than students who enrolled in college without having taken a DC course in high school. The differences are partially, but not fully, explained by differences in observable student characteristics, again confirming the selective nature of DC programs. While our results show statistically significant and large differences in an array of student outputs and outcomes associated with DC participation that persist even after conditioning on observable student characteristics, the results do not imply that DC participation is causally related to these outputs and outcomes because we

Figure 5.24
Probability That a High School Graduate Enrolled and Persisted in College After High School, for Those Who Do and Do Not Take DC Courses

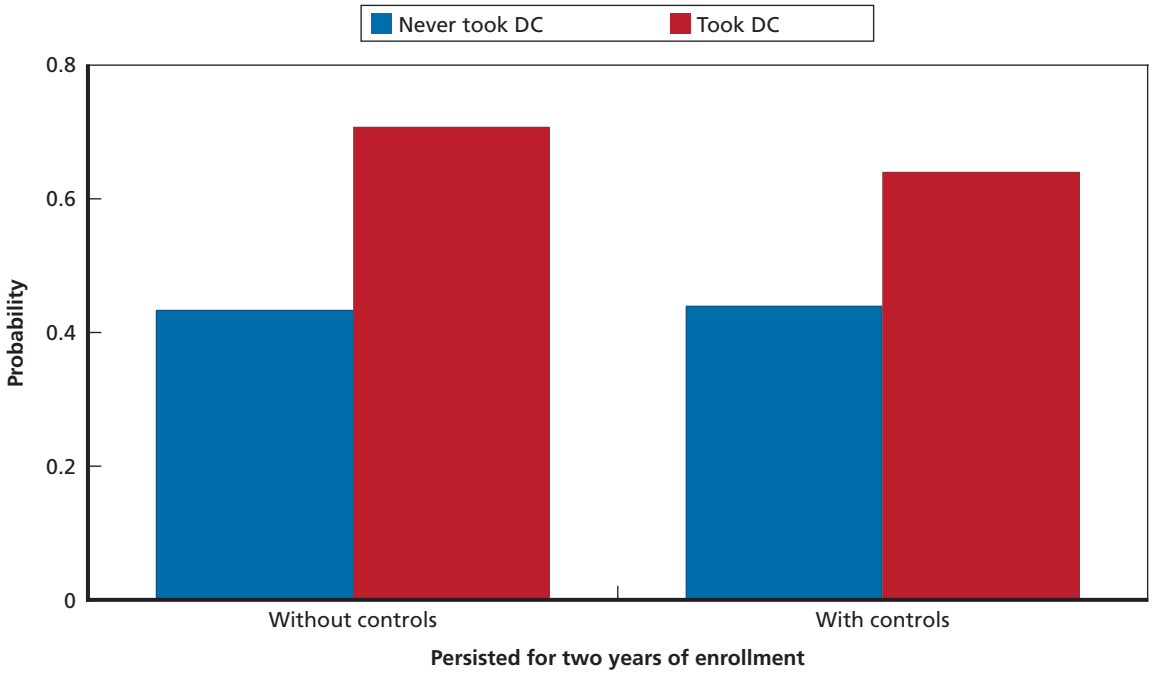

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Figure 5.25
Probability That a High School Graduate Was Not Ready for a Two- or Four-Year School, for Those Who Did and Did Not Take DC Courses

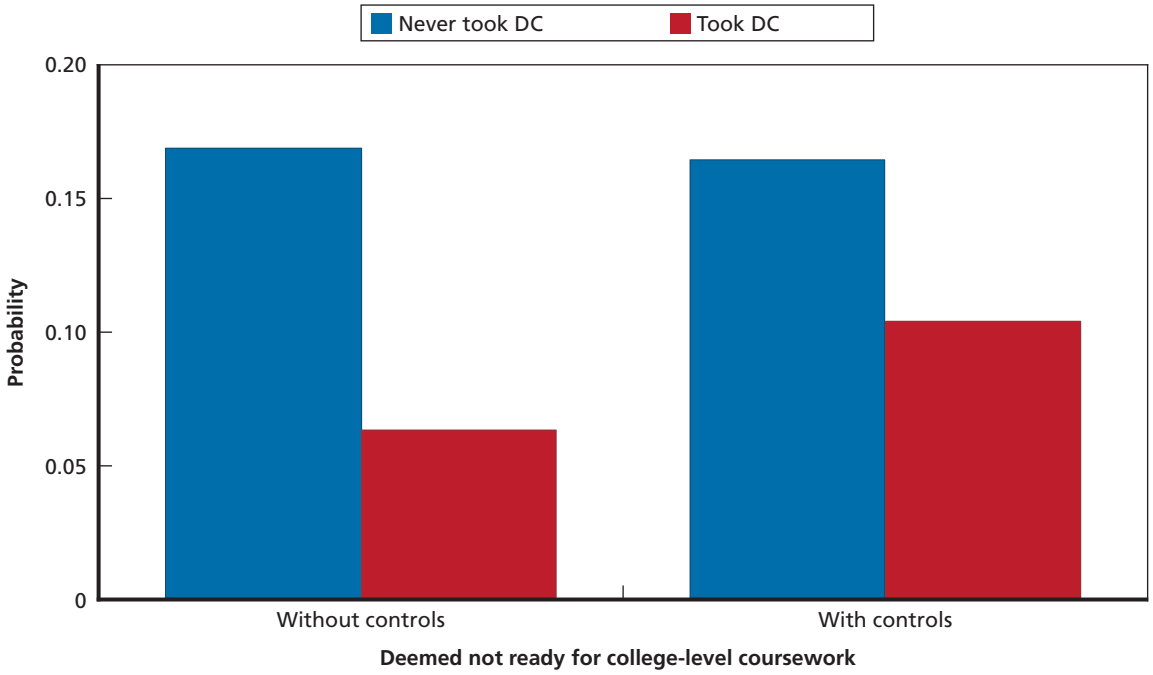

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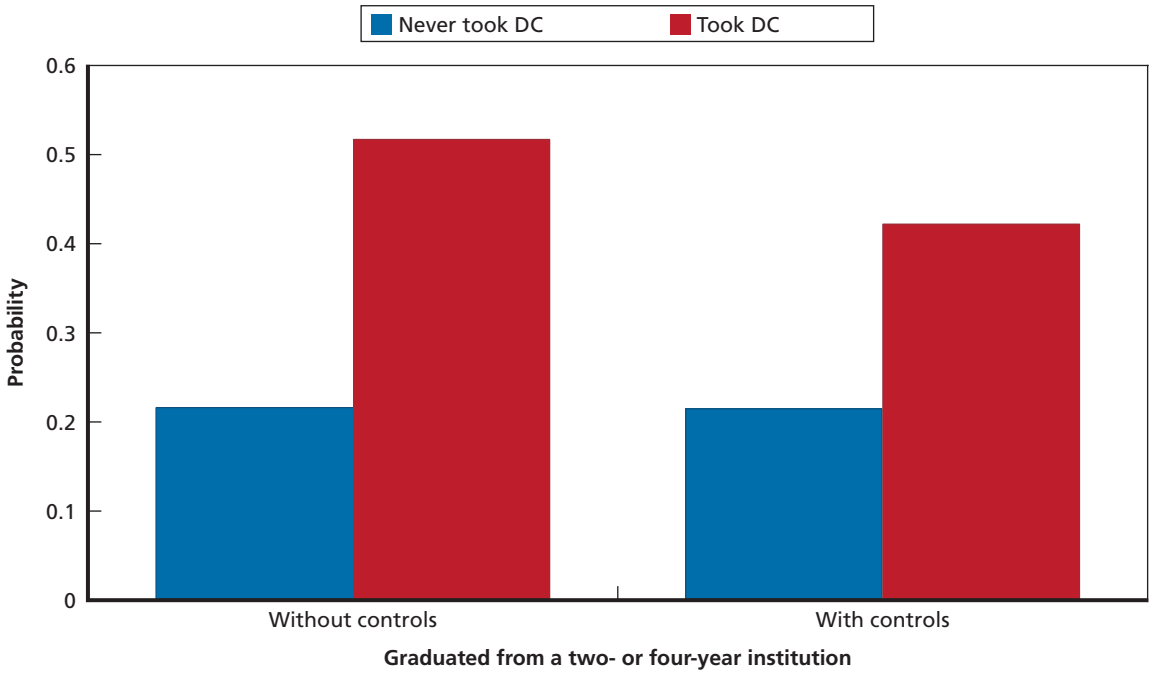
Figure 5.26
Probability That a Student Graduated from a Two- or Four-Year Public Institution



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are unable to fully account for the selection into DC programs. Further research using experimental or more robust quasi-experimental methods is needed to establish a causal relationship.

Efficiency in Course-Taking Patterns

In this section, we present results related to the efficiency of DC programs. We begin by presenting results from an analysis of whether students who take DC courses retake those courses once they enroll in college. We then present results of an analysis of differences in SCHs to degree and time to degree by DC participation.

Course Retake Rates Are Low and Driven by Course Performance

One concern voiced by multiple stakeholders, including students, parents, and policymakers, is that colleges do not always accept DC courses and that some students are required to retake those courses once they enroll in college. To investigate the extent to which this is happening in practice, we analyzed detailed transcript records for students from the 2013–2014 cohorts of Texas public high schools who enrolled in a Texas public college or university in the academic year immediately following high school graduation. We chose these cohorts because we were able to track DC enrollment in the junior and senior years of high school, as well as enrollment in college-level courses during the first two academic years of college. Using the detailed transcript data, we calculated the percentage of all academic DC courses that were retaken during the first two years of college.

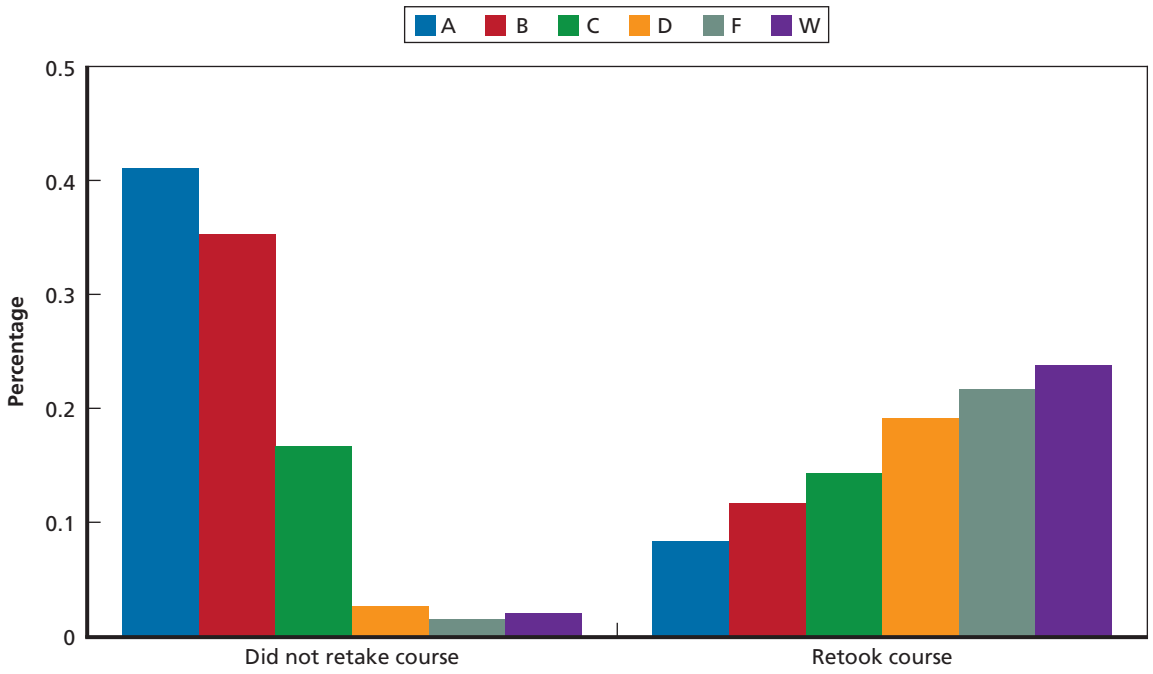
Calculating course retake rates in the manner described above is possible in Texas because all public two-year colleges are required to use a common course numbering system for core courses that are listed in the state's ACGM. While four-year colleges are not required to use the ACGM course numbering system, the majority of public four-year colleges voluntarily participate in the Texas Common Course Numbering System (TCCNS). Colleges participating in the TCCNS submit a "course matrix," which matches their courses to a corresponding course in the ACGM to facilitate transfer credits.

Thus, to calculate the course retake rate, we first converted as many college-level courses that a student took during high school and the first two years of college as possible to a common course number using the TCCNS. We then checked to see if DC courses a student took during high school were retaken during college. Using this method, we find little evidence that DC courses are being retaken in large numbers when students enroll in college. Overall, just 3.2 percent of all DC courses were retaken during the first two years of college. This number should be thought of as a lower bound, since not all public four-year colleges participate in the TCCNS, and it is not clear that those institutions that do participate accurately translate all their lower-division courses to the ACGM.

In Figure 5.27, we examined student course grades in DC courses by whether that course was retaken or not. The results demonstrate student course performance in the DC courses that were retaken in college was quite low.[9] Sixty-four percent of students who retook a DC class initially received a D or lower or withdrew from the DC course, compared with just 6 percent of students who did not retake the class. These results suggest that the majority of course

[9] We checked whether the differences in grade distribution by retake status was driven by the types of DC courses that are retaken by students. We weighted the retaken courses to reflect the distribution of DC courses that were not retaken. The patterns that emerged were qualitatively similar to those reported here, so we did not report the weighted distribution here.

Figure 5.27
Student Course Grades in DC Courses, by Whether Course Was Retaken or Not



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retakes are driven by poor performance in the DC course. However, it is worth noting that 20 percent of students who retook a course earned an A or a B in the DC course in high school.

SCHs to Degree Is Similar for Students Who Did and Did Not Take DC Courses in High School

Another concern that has been voiced by some stakeholders is that taking DC courses in high school may increase the total number of SCHs it takes, on average, to complete a degree, when including the SCHs earned through DC. This could arise if DC participants have difficulty transferring credits they earned in high school to college or applying them to their degrees. It may also arise if DC participants take DC courses and are poorly advised or simply do not know what they eventually want to major in and do not take courses that apply to their eventual field of study. Finally, some fields, such as engineering, have long sequences of major-specific coursework that begin in the first or second year of college. Such courses are rarely offered for DC, and so if a student completes a significant share of his or her core coursework through DC before enrolling in college, she or he may end up taking additional courses to fill up time while completing the required major sequence. To assess whether this concern bore out in practice, we compared SCHs to degree for students who enrolled in college in the academic year after completing high school and completed a bachelor's degree within eight academic years for students who did and did not take a DC course while in high school.[10] The results are reported in the rightmost columns of Figure 5.28 and suggest that students who took a DC course in high school actually took slightly fewer SCHs (148 versus 149) to complete their

[10] This analysis included the 2000–2006 cohorts of Texas public high school graduates.

degrees when compared to students who did not take a DC course.[11] It is worth noting that SCHs to degree is relatively high in general, given that most four-year degree programs in Texas require 120 SCHs of coursework.[12]

One reason why DC students might take less total SCHs to complete their degrees could be that students who take a DC course in high school are significantly more likely than students who do not take DC courses to initially enroll in a four-year college, as we showed in Figure 5.23. It is well established that transfer students who start at a two-year college and transfer to a four-year college to complete their degrees take more SCHs to complete their degrees due to transfer credit loss. Since DC students are more likely initially to enroll in four-year colleges, they are less likely to suffer from this this problem. To assess the extent to which this issue may be driving the differences in SCHs to degree for students who do and do not take a DC course in high school, we calculated SCHs to degree for students who initially enrolled in a four-year college by DC status. The results, reported in the leftmost columns of Figure 5.28, show that, among students who initially enrolled at a four-year college, DC students took slightly more SCHs (146 versus 145) to complete their degrees, when compared when students who did not take a DC course in high school. Overall, the results on SCHs to degree suggest that DC students took a similar amount of SCHs to complete their degrees, when compared with students who did not take a DC course in high school.[13]

Time to Degree Is Lower for DC Students Than for Students Who Do Not Take a DC Course in High School

The literature suggests that students who take DC courses in high school are likely to take less time to complete their degrees once they enroll in college because they took some of their college-level coursework while in high school. To assess whether this was the case in Texas, we compared time to degree for students who enrolled in college in the academic year after completing high school and completed a bachelor's degree within eight academic years for students who did and did not take a DC course while in high school. The results are reported in the rightmost columns of Figure 5.29 and suggest that students who took a DC course in high school took significantly less time (5.3 years versus 4.8) to complete their degrees when compared when students who did not take a DC course. Since DC students were more likely to enroll initially in a four-year college, we also calculate time to degree for students who initially enrolled in a four-year college by whether they took a DC course in high school or not. The results, reported in the leftmost columns of Figure 5.29, show that students who initially enrolled in a four-year college and took a DC course in high school took 4.7 years to complete their degrees, compared with 5.0 years for students who did not take a DC course.

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[11] While the difference in SCHs to degree by DC participation status is statistically different from zero, it is quite small and suggests that SCHs to degree is similar for these two groups.

[12] Another potential source of inefficiency are credits that students earned without completing a degree or credential. We did not analyze differences in credits for non-degree recipients by DC status.

[13] DC participants might be expected to complete their degrees more quickly than students who do not take DC. We have shown that DC students appear to have been academically prepared for college-level coursework. It is also reasonable to hypothesize that DC students were likely to have been more prepared along other dimensions, such as noncognitive factors and motivation, since they signaled in high school that they wanted to complete a college degree and took it upon themselves to take college-level courses in high school. It is reasonable to think that these students could more easily navigate the complex pathway to a college degree. In that sense, parity in SCHs to degree may not be an appropriate comparison, since all-else-equal, DC students would be likely to have lower SCHs to degree than students who did not take DC in high school.

Figure 5.28
SCHs Earned Toward a Four-Year Degree

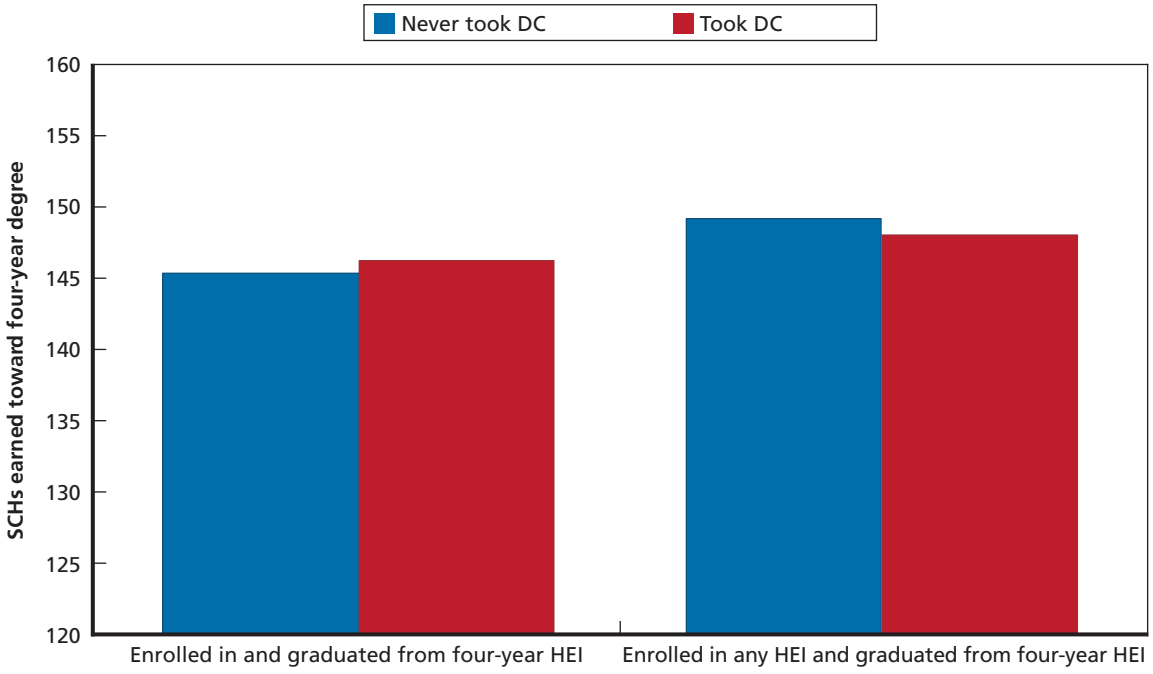

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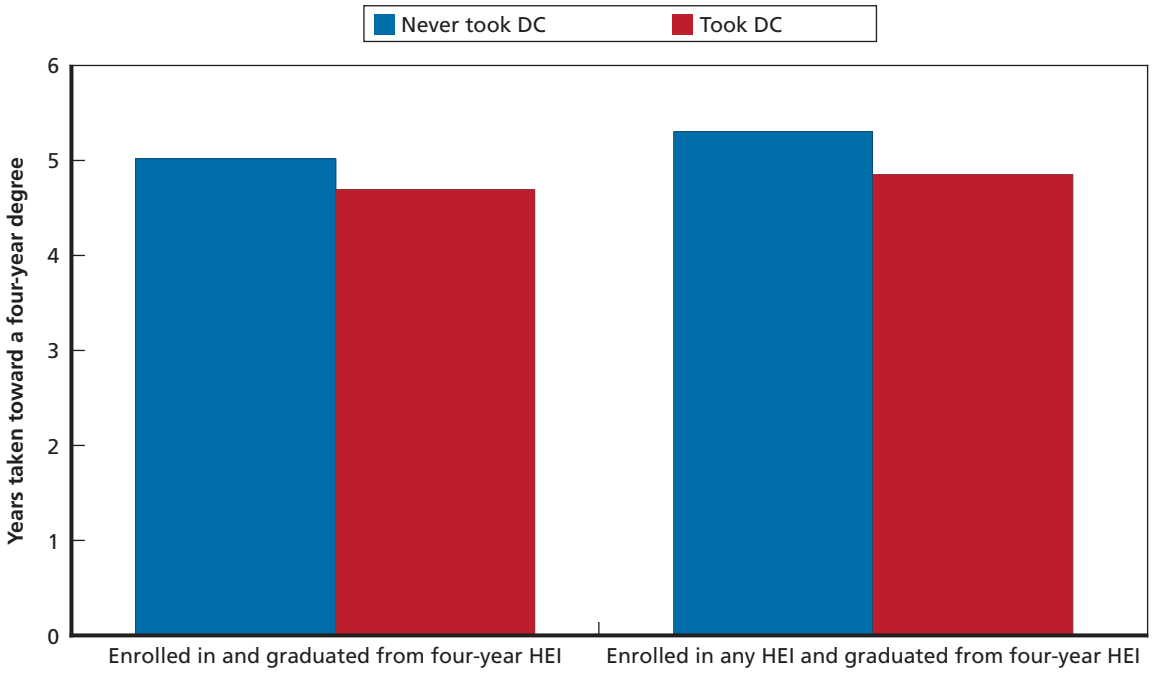
Figure 5.29
Years Taken Toward a Four-Year Degree



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Conclusions

In this chapter, we have presented results from a series of descriptive quantitative analyses of DC in Texas. These analyses drew on administrative data from the THECB and the TEA and were organized around the key themes of participation, delivery, outcomes, and efficiency. Below, we summarize our key findings in each of our topic areas:

1. **Access and participation:** Participation in DC increased until 2011 and declined slightly from then until 2015. The decline in DC participation was likely related to the continued diversification of the state as a whole and the concomitant increase in demographic groups who were less likely to participate in DC. Indeed, throughout the study period, students who were white, not economically disadvantaged, and enrolled in GT programs were significantly more likely to participate in DC programs, relative to students identified as African-American, Hispanic, and economically disadvantaged.
2. **Delivery:** Delivery of DC courses varied and changed over time. Faculty who teach DC courses were significantly less likely to hold doctoral degrees and significantly more likely to be adjuncts. Overall, 41 percent of DC course seats were taught by a faculty member who was concurrently employed as a high school teacher by a Texas public high school, and nearly half of all DC course seats were taught on a high school campus. The share of DC course seats being delivered by an ECHS increased from 9 percent to 19 percent from 2012 to 2015. While the course modes of DC courses were similar to those in college-credit-only courses, the share of DC course seats being taught online increased from 9 percent to 15 percent between 2012 and 2015.
3. **Outcomes:** DC students outperformed college-credit-only students on a variety of outcome measures, including enrolling in college, being placed out of developmental education, performance in follow-on classes taken after enrolling in college, and persisting in and graduating from college. We suspect that better academic preparation may contribute to better performance among DC students, but we do not know to what extent.
4. **Efficiency in course-taking patterns:** DC students who completed a bachelor's degree took practically the same number of SCHs to complete a degree as their non-DC counterparts; however, they took almost half a year less to earn that degree from the time they enrolled in college. The fact that DC students start taking college courses earlier explains why they complete college in a shorter amount of time. Moreover, we observed low incidence of DC students retaking courses they took as DC during their first two years of college, and most of the retake we did observe was driven by poor performance in the DC course.

CHAPTER SIX

Conclusions and Next Steps

This interim report has presented findings from the initial phase of a study of DC programs in the state of Texas. The overarching study goal is to inform policymakers and stakeholder whether DC education programs need to be reformed and, if so, how to reform them to better support students, in turn helping Texas to reach the goals of 60x30TX—the state's strategic plan. This interim report was designed to provide information to the 85th Texas Regular Legislature that could guide policy and legislation governing DC programs. It provides an initial perspective on the accessibility, diversity, quality, and efficiency of DC education programs in Texas. In this chapter, we distill the key findings and propose a set of next steps in the form of research objectives for the second study phase.

Findings

We highlight the most salient findings from the interim report, drawing from both the qualitative and quantitative results of our work. The italicized paragraph captures the main point, while the bulleted points below the paragraph provide supporting evidence.

Academic Achievement and Participation

Participation in DC education was related to better performance along a wide range of student outcomes. While diversity of students taking DC courses increased between 2000 and 2015, gaps in DC participation rates persisted.

- DC students outperformed high school students who did not take DC on a variety of outcome measures, including enrolling in college, being placed out of developmental education, performance in follow-on classes taken after enrolling in college, and persisting in and graduating from college. We suspect that better academic performance prior to the DC experience may contribute to better performance among DC students, but we do not know to what extent.
- Students who were white, not economically disadvantaged, and enrolled in GT programs were significantly more likely to participate in DC programs, relative to students identified as African-American, Hispanic, and economically disadvantaged.
- The observed disparities in DC participation could be driven by differences in DC access across high schools in Texas, preparation and demand for DC across demographic groups, access to alternative forms of college level coursework in high school (such as AP and IB),

systemic biases in advising practices at high schools, or other factors. Our research thus far is unable to pinpoint the specific causes of these differences.

Delivery of Instruction and Advising

HEIs delivered DC instruction and advising using a wide array of approaches, and the use of some of these approaches has changed over time. It is unclear how differences in these delivery approaches affect the rigor of instruction and assessment of student learning in DC courses, as well as the quality of advising in DC programs.

- While SACSCOC sets minimum standards for who can teach any college level course, including DC courses, it does not guarantee that DC instructors have comparable education, instructional backgrounds, and experiences. Fifty-six percent of DC courses delivered to students who graduated from high school in 2015 were taught by adjunct faculty, and 41 percent were taught by a faculty member concurrently employed as a high school teacher. By contrast, 35 percent of college-credit-only courses were taught by adjunct faculty, and just 2 percent were taught by a faculty member concurrently employed as a high school teacher by a public school in Texas.
- The percentage of DC courses taught on a high school campus increased from approximately 48 percent to 55 percent between 2012 and 2015, a difference of close to 7 percentage points. In addition, the percent of DC courses taught on ECHS campuses increased, to about 18 percent in 2015, up from just under 10 percent in 2012.
- Community colleges reported using college staff and high school counselors to deliver DC advising, which varied in content, degree of contact with students, and location of delivery. Resource constraints, scheduling conflicts, and geographic proximity of high schools to HEIs shaped the advising DC students received.

Efficiency in Course-Taking Patterns: Credit Hours and Time to Degree and Course Retake

DC students do not exhibit less efficient course-taking patterns than students who start their college education without college credit earned through DC.

- DC students who completed a bachelor's degree took practically the same number of SCHs to complete a degree as their non-DC counterparts; however, they took almost half a year less to earn that degree from the time they enrolled in college. The fact that DC students start taking college courses earlier explains why they complete college in a shorter amount of time.
- Just over 3 percent of all DC courses taken by high school graduates who subsequently enroll in college were retaken during the first two academic years of college. Most of the retakes were driven by poor performance in the DC course.

Conclusions and Next Steps

The most notable findings in this report are that recent high school graduates who took DC courses performed better in follow-on courses and achieved higher rates of collegiate success than their peers who did not take DC courses. In addition, high school students who earned college credit through DC courses did not retake DC courses at high rates after enrolling in

college and were just as likely to graduate with a similar number of SCHs as students who never took a DC course. We suspect that reported institutional adherence to state rules that establish minimum guidelines around who is able to matriculate in DC courses may help to explain why DC students had better outcomes than their non-DC counterparts. Similarly, rules requiring public HEIs to accept previously earned college credits may help to clarify why the overwhelming majority of college courses earned through DC programs are transferred.

While it is tempting to conclude that efforts to expand DC programs should continue in Texas based on these findings, several important questions should give state lawmakers and policymakers pause. For example,

- To what extent do wide differences in the way HEIs approach delivery of DC education affect the academic rigor of DC instruction and the quality of DC advising?
- Is there a way to improve DC advising to reduce the number of SCHs a DC student earns toward a college degree?
- Why do disparities in DC participation continue to persist across demographic groups?
- While DC students had better outcomes than students who did not take DC courses, how much did students' previous academic preparation and behavioral dispositions, versus what they learned in their DC courses, contribute to their success?
- What are the financial costs and benefits of DC programs to stakeholders, given that Texas allocates funding to both high schools and HEIs to deliver DC education and that DC students exhibit similar inefficient course-taking patterns as college-credit-only students?
- Finally, are institutions expanding DC programs in response to HB 505, and, if so, are students still benefiting?

These questions also emerged in the comments we received from the public on our draft version of this report.

These remaining research questions inform the proposed research objectives, found below, in the study's second phase. In addressing these questions, we will coordinate our efforts with other concurrent research efforts ongoing in Texas, including but not limited to the University of Texas System study described in Chapter Three:

- **Examine the extent to which differences in faculty and course characteristics affect the curricula, course content and assessment methods and standards in DC courses, relative to college-credit-only courses.** Results in this report revealed significant differences in instructor background and training and in contexts for DC and college-credit-only courses. The extent to which these differences affect the academic rigor and the quality of instruction that DC students versus college-credit-only students receive is unclear based on the research presented in this report and merits further investigation, particularly in light of the substantial freedoms afforded to college faculty over what happens in college classrooms.
- **Investigate the types of guidance and information high school and college counselors give to DC students, and identify factors that may promote more efficient course-taking.** Results in this report also show that HEIs differentiate the kinds of advising they give to DC students based on a variety of factors, including resource availability, geographic proximity to high school students, and the types of college-level courses they

deliver to high school students. At present, we do not have a clear understanding of the types of support and information that students are given under these different advising models, and whether some models may work more effectively than others in helping students make more-informed decisions about what courses to take, where to apply to college, and how to effectively navigate the challenges of a postsecondary education.

- **Estimate the causal impact of different approaches to DC education on improving student outcomes, particularly for disadvantaged students.** A limitation of the quantitative analyses presented in this report is that they descriptively compare measures of academic achievement and course efficiency between high school student graduates who did and did not take DC courses. At the same time, our analysis also documented systematic differences between these two groups of students in terms of demographic and academic background, and these dissimilarities might be contributing to the differences we observe in post DC academic performance and course-taking patterns between these two groups. Our report has also been unable to account for other potential factors, such as noncognitive skills, parental education, and life circumstances, that could also be contributing to differences in student outcomes. Estimating the causal impact of DC programs on a range of short- and long-term student outcomes will therefore be important to identify the extent to which DC programs, in and of themselves, boost student success and generate financial savings for students and their families, particularly for disadvantaged students. In conducting these analyses, we will also investigate the impact of specific approaches to DC education that we can identify in the data, including CTE DC and ECHSs.
- **Calculate the cost of implementing DC programs, and the financial savings, if any, they generate for DC students and the state.** Our study has highlighted a number of different approaches to delivering and paying for DC education that vary considerably across the state. These different approaches and funding mechanisms are likely to have important implications for the accessibility of DC programs to students, the sustainability of DC programs for high schools and colleges, and the costs of DC programs to taxpayers. Assessing the degree to which DC programs efficiently use public resources overall and under different approaches and funding mechanisms will be key to helping state lawmakers determine where they should allocate spending to improve DC programs.
- **Investigate the causes behind the observed disparities in DC participation rates across demographic groups.** Our study demonstrated wide disparities in DC participation across a range of student demographic characteristics, including race/ethnicity, income, urbanicity and academic characteristics. Our research thus far is unable to pinpoint the specific causes of these patterns. In the second phase of the study, we will investigate the extent to which these patterns could be driven by differences in DC access across high schools in Texas, preparation and demand for DC across demographic groups, in access to alternative forms of college level coursework in high school (such as AP and IB), and advising practices at high schools, among other factors.
- **Assess how HEIs have responded to HB 505, which removed state grade-level and SCHs restrictions for students participating in DC education.** The quantitative analyses presented in this report do not assess changes in student participation and performance after HB 505 took effect in 2015, which made it easier for HEIs to enroll high school students in DC education at an earlier age and in an unlimited number of SCHs. An important next step will be to examine whether HB 505 incentivized HEIs to enroll

9th- and 10th-grade students, and DC students as a whole, in a larger number of courses and how these changes correlate with changes in overall student performance in DC courses.

Interim Recommendation—Wait and See

Given the significant gaps in our knowledge about DC programs and the fact that our research to date did not identify any pressing need for immediate policy action, our primary recommendation is to wait until findings from the next phase of our study emerge to make major changes to policy affecting DC programs in Texas. Findings from the second phase of the study will inform reasoned policy decisions that result in as many Texas students as possible benefiting from appropriately targeted, high-quality, and cost-effective DC programs.

APPENDIX A

Sample Selection Criteria and Process

Objective

The objective of this appendix to provide a summary of the criteria and the process RAND used to purposefully select a set of public HEIs to participate in the short-term qualitative DC study.[1]

Overview of Selection Criteria

The goal of the short-term qualitative DC study is to examine institutional policies and practices that affect how institutions teach DC courses, advise DC students, and determine student eligibility for DC courses. Since Texas HEIs vary in the way and the contexts in which they deliver DC education, RAND and the THECB pre-specified factors to select institutions that could elucidate how Texas HEI ensure quality of DC education across different delivery modalities and situations. Below are the factors RAND and the THECB identified to select HEI for the qualitative study:

1. Size of DC education programs
    a. Overall
    b. Academic DC education
    c. Career and technical DC education
2. Approaches to deliver DC education
    a. Mode of instruction (e.g., face-to-face, online, hybrid)
    b. Type of instructor (e.g., full-time faculty, adjunct faculty)
    c. Location of instruction (e.g., high school campus, college campus)
3. The rate of expansion of DC partnerships over time
4. Location of partnering high school
    a. Urban and suburban
    b. Rural
5. Demographic characteristics of DC student population being served
    a. Minority status
    b. Economically disadvantaged status.

[1] RAND worked in collaboration with the THECB to identify a broad set of criteria to select HEIs. However, RAND did not involve the THECB in defining the sampling strategy or technique, or explicitly selecting the HEI to participate in the study.

Data Used to Select Institutions: THECB and TEA Administrative Records

RAND drew on student-level administrative records from the THECB and the TEA to create a unique institution-level dataset for the purposes of sampling HEIs for the study.[2] RAND intentionally linked these records to identify the number of DC partnerships established by public four- and two-year HEIs throughout the state. RAND identified a DC education partnership between a public high school and a public HEI if a graduate from that high school earned any number of SCHs in DC education from that particular HEI. For every institution that delivered DC education, RAND calculated the following:

1. Number of DC education semester credit hours delivered in the academic year 2015 in:
   a. Total
   b. Career and technical education
   c. Urban and suburban high schools
   d. Rural high schools
2. Number of DC education partnerships that in the academic year 2015:
   a. Graduated students with more than 100 SCHs of DC education
   b. Delivered at least 75 percent of DC instruction (defined as semester credit hours) using an online approach
   c. Delivered at least 75 percent of DC instruction using a face-to-face approach
   d. Delivered at least 75 percent of DC instruction using a hybrid approach
   e. Delivered at least 90 percent of DC instruction on a high school campus
   f. Delivered at least 90 percent of DC instruction on a college campus
   g. Delivered at least 50 percent of DC instruction using adjunct faculty
   h. Delivered at least 50 percent of DC instruction using full-time faculty
   i. Delivered at least 50 percent of DC instruction to students of color
   j. Delivered at least 50 percent of DC instruction to economically disadvantaged students[3]
3. Number of DC partnerships in
   a. The 2012 academic year
   b. The 2015 academic year.

RAND transformed each of these variables into percentages of partnerships that deliver DC across these different dimensions to facilitate the comparison and selection of HEIs. For example, RAND calculated the percentage of partnerships by HEIs that delivered at least 75 percent of DC instruction using an online approach in the 2015 academic year. RAND also calculated growth in the number of partnerships each HEI delivering DC education established between 2012 and 2015.

[2] TEA data contain demographic data on Texas public high school graduates.

[3] RAND defines economic disadvantage by eligibility for free or reduced-price lunch.

Selecting Institutions

RAND used a three-step strategy to select HEI to participate in the qualitative study and determine the order in which they will be approached/recruited. Below are the specific steps RAND took to implement that strategy.

Step 1: First-Round Selection of Institutions Based on the Amount of DC Education Delivered in 2015

RAND chose an initial set of institutions based on the number of SCHs of DC instruction they delivered. RAND targeted institutions delivering large numbers of DC SCHs, since these institutions have the potential to provide insight into the effective scaling of DC education programs. While some selected institutions reported delivering large amounts of DC education overall, others reported delivering large amounts of DC education in urban or suburban high schools, or in rural high schools. RAND included institutions that cleared pre-established thresholds on the amount of DC SCHs delivered in the final sample.

Step 2. Second-Round Selection of Institutions Based on Whether They Delivered DC Education Using Specific Delivery Modalities and in Different Educational Contexts

To place RAND in a better position to be able to (1) detect common and unique patterns in institutional policies and practices across a range of delivery modalities and contexts, and (2) consider how these factors may affect how institutions teach DC courses, advise DC students, and determine eligibility for DC coursework across a range of DC education models, RAND intentionally sought at least five HEIs that delivered DC education according to each delivery or contextual criterion, which we describe in more detail below.[4]

Delivery and context selection criteria:

- Location of delivery: High school campus
- Mode of instruction: Online
- Faculty of instruction: Adjunct faculty
- Faculty of instruction: Full-time faculty
- Delivery of CTE DC education
- Minority student population
- Economically disadvantaged student population
- Substantial growth in number of DC partnerships between 2012 and 2015.

RAND examined whether the initial set of selected institutions satisfied delivery or contextual criteria, and by and large the institutions met the five-institution quota. On criteria where they did not, RAND randomly selected an additional set of institutions that qualified under each criterion to satisfy the criterion quota. These institutions did not report delivering large amounts of DC education.

An institution satisfied a specific criterion if it (1) delivered a significant proportion of DC instruction using a particular approach or within a particular context, *and* (2) partnered with

[4] RAND selected delivery and contextual criteria that would be able to illuminate how institutional policies and practices affect eligibility for, advising in, and teaching of DC education in cases where DC education is not implemented in a traditional college setting. RAND defines a traditional college setting as one that delivers academic courses on-campus, face-to-face, and to students who historically have had access to postsecondary education.

a large number of high schools to implement DC education using this particular approach or within a particular context. For example, an institution would be categorized under *Location of delivery: High school campus* if it taught 90 percent of its DC instruction on a high school campus and partnered with a large number of high schools to implement DC education on high school campuses.

In the end, this selection process yielded a total of 25 institutions. In cases where a selected college belongs to a district or system, Gibson first approached the overall college system to learn whether the system or the institution determines the policies and practices on DC education. If the system indicated that institutions had discretion over DC policies and practices, RAND provided the name of the institution it preferred to interview. Nevertheless, the district or system had latitude to decide which institution it wanted to include in the study.

Step 3. Recruitment of Institutions

Given the goal of recruiting at least 15 of the 25 selected institutions to participate in the study, RAND needed to determine the order in which the HEIs would be approached/recruited. RAND prioritized the recruitment of a set of selected institutions that cleared pre-determined thresholds on the amount of DC education delivered in the 2015 academic year (SCHs overall, SCHs delivered in an urban/suburban location, SCHs delivered in a rural location).

To round out the number of institutions the Gibson would recruit for the study to 15, RAND used a random number generator to prioritize the remaining selected institutions. Gibson sent recruitment emails to institutions who made the first 15 institution cut. Each of the 15 institutions met at least one delivery or contextual criterion.

If Gibson was unable to schedule interviews for any of these 15 institutions, it sent additional rounds of emails to more of the selected institutions based on descending rank until a total of 15 institutions are successfully recruited for the study. [5]

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[5] Based on the process RAND used to prioritize the order in which institutions will be approached to participate in the study, RAND cannot guarantee that a certain number of institutions will meet each delivery and contextual criterion.

APPENDIX B

Recruitment Email

[INSTITUTION] is invited to participate in Phase II of a study on dual credit education (DC) being conducted by RAND, Gibson Consulting Group, The Texas Higher Education Coordinating Board (THECB). This study is jointly funded by the Greater Texas Foundation, Houston Endowment, the Communities Foundation of Texas/Educate Texas, and the Meadows Foundation. Phase II will explore institutional policies and practices that affect how institutions teach DC courses, advise DC students, and determine student eligibility for DC courses. Phase II will also examine the perceived benefits and challenges of delivering DC education. The research in no way will be used to assess your institution's compliance with state policy on DC or for accountability purposes. The THECB fully supports this study and values your involvement (see attached letter).

Your institution's participation is vital for helping state and local policymakers identify best practices in DC education. With assistance from the THECB*, RAND identified staff participants at your institution who oversee or manage your DC program and know how your institution's policies and practices affect teaching, advising, and student eligibility within that program. The names and titles of identified staff appear at the end of this letter. Feel free to invite other staff for a group interview, if needed. To learn more about the study, contact Trey Miller, Full Economist at the RAND Corporation, at 310-503-5364, to set up an informational phone meeting.

Your institution's participation in this research is completely voluntary. If your institution participates in the study, we would like to conduct a 1.5-hour phone interview with identified staff, at their earliest convenience. **To schedule an interview for participating staff, please click here. If clicking above does not work, please copy/paste the following URL into your web browser:**

https://gcginterviews.acuityscheduling.com/schedule.php?appointmentType=1299951

The scheduling website will prompt you to enter a date and time that works best for the participants, and will request the best phone number and email address to reach them. We will use the phone number you provide to contact participants at the time of the interview. The email address you provide will be used to send a confirmation for the scheduled interview (from scheduling@acuityscheduling.com). The confirmation email will include a link for viewing the interview appointment details and rescheduling the interview if necessary.

When scheduling your interview, your institution will also be asked to answer a pre-interview questionnaire that captures descriptive information on how your institution delivers DC education. *You do not need to complete the questionnaire to schedule your institution's interview, but* **it should be completed by one participant before the time of the scheduled interview.** The scheduling website will provide a link to complete the pre-interview

questionnaire, and it can also be completed by clicking here or copying/pasting the following URL into your web browser: QUALTRICS LINK

We look forward to telling you more about this important study and potentially working with you.

The RAND Corporation
Gibson Consulting Group

*THECB staff may have been in communication with your colleagues about this research. Please note, however, that your institution and the names of all participants will be kept confidential from THECB staff to provide assurance that the information shared in the interview cannot be used for compliance or accountability purposes.

CC: DC Contact Person

APPENDIX C

Pre-Interview Questionnaire

1. Please provide some background to help us understand the context of your institution's dual-credit program help us understand the context of your institution's dual-credit program.

    a) How long has your institution offered dual-credit courses?

    _____ years

    b) How many school districts or high schools does your institution partner with to deliver DC courses?

    _____ districts
    _____ schools

    c) Approximately how many students enrolled in dual-credit courses this past academic year?

    _____ FTE students

    d) For which program(s) does your institution offer dual-credit courses? *(Select all that apply)*

    ___ Academic programs
    ___ Career and technical education programs

    e) In which subject areas does your institution offer DC courses? *(Select all that apply)*

    ___ Arts & Humanities (e.g., literature, foreign languages, history)
    ___ Social & Behavioral Sciences (e.g., psychology, political science, sociology)
    ___ Sciences (e.g., chemistry, biology, math)
    ___ Business & Economics (e.g., accounting, economics, marketing)
    ___ Fine Arts (e.g., creative writing, music)
    ___ Nursing & Medicine
    ___ Office Administration
    ___ Computer Sciences (e.g., programming)
    ___ Trades (e.g., welding)

2. Higher education institutions across Texas deliver dual-credit education in different ways. We would like to learn about how your institution delivers dual-credit courses to all partner districts and schools. If delivery varies by school district and/or program, please select all applicable responses.

    a) Where is dual-credit instruction delivered? *(Select all that apply)*

    ___ High school campus
    ___ College Campus
    ___ Other (specify)_____

    b) How is dual-credit instruction delivered? *(Select all that apply)*

    ___ Face-to-Face
    ___ Online
    ___ Hybrid
    ___ Other (specify)_____

    c) Who instructs dual-credit courses? *(Select all that apply)*

    ___ High school teacher
    ___ College faculty
    ___ Other (specify)_____

    d) What is the student composition of dual-credit courses?

    ___ Only dual-credit students
    ___ A mix of dual-credit and college-credit-only students

    e) Do any of the schools your institution partners with have acquired an official TEA Early College High School designation?

    ___ Yes (if yes, how many?) _____ schools
    ___ No

3. Please answer the following questions about advising dual-credit students.

    a) Who advises dual-credit students? *(Select all that apply)*

    ____ High school counselors
    ____ College counselors
    ____ College faculty
    ____ Other (specify)_____

    b) What types of advising or information does your institution provide to dual-credit students? *(Select all that apply)*

___ Academic *(Select all that apply)*
- ___ Course taking
- ___ Choosing a major/field of study
- ___ Transferring credit earned in academic dual-credit courses to a two- or four-year college
- ___ Information on campus resources (e.g., library, computer labs)
- ___ Admissions contacts at two- and four-year institutions

___ Career *(Select all that apply)*
- ___ Course taking
- ___ Choosing a career field/path
- ___Transferring credit earned in CTE dual-credit courses to a two- or four-year college
- ___ Information on high-wage, high-demand jobs, and the training programs associated with those jobs
- ___ Connections your institution has to local employers

___ Personal Support *(Select all that apply)*
- ___ Implications of dual-credit on financial aid eligibility and postsecondary finance
- ___ Resolving issues that may impact academic success
- ___ Information about counseling or mental health services
- ___ Information about social services agencies (e.g., welfare offices)

___ Other (specify) _____

APPENDIX D

Interview Protocol

Introductory Script [5 minutes]

[Note to interviewer: Say additional words/phrases in parenthesis if group interview format used.]

Thank you for submitting your answers to the pre-interview questionnaire and participating in this [group] interview. My name is [insert name]. I am a researcher with Gibson Consulting, a research consulting firm. We are partnering with RAND Corporation, an independent nonprofit research institute to conduct a study jointly funded by the Greater Texas Foundation, Houston Endowment, the Communities Foundation of Texas, and the Meadows Foundation. This study is being conducted for the Texas Higher Education Coordinating Board (THECB) to learn about DC policy and practice, and will not be used for compliance or accountability purposes. This study is an opportunity for stakeholders to gather information about institutional dual-credit policies and practices to identify and scale best practices around dual-credit education.

[Today, we have assembled several of you from [insert institution name] in hopes that you could provide some insights on this topic.]

Most of the questions ask about your institution in general, not about you specifically, and your participation in this [group] interview is voluntary. You may choose not to participate in the interview, decline to answer any question, or stop the interview at any time without penalty. Our study team will keep what you say confidential—we will not share information about you with anyone else outside of the research team in a way that might individually identify you or your institution. [However, because this is a group interview, please do not say anything you would not want others to know and talk about, as we cannot promise you that others on the line will keep what is discussed anonymous and confidential. We do ask that everyone on the line please respect the confidentiality of other participants and not repeat what we discuss outside of this interview.]

I estimate our conversation today will last about 90 minutes. [Because this is a group interview conducted by phone, speak clearly and one at a time so that we can hear everyone.] I will be jotting some notes so I can remember what you say. In addition, I would like to audio-record today's discussion to check the accuracy of my notes. The notes and the audio-recordings will be destroyed as soon as the research team has completed data collection and analysis. Is this alright with you? Do you have any questions for me at this point before we begin?

I. Context [Approximate length of time: 10 minutes]

1. For our notes, please state your name, title, and role in overseeing or managing dual-credit programs.

In the pre-interview questionnaire, you shared how your institution delivers dual-credit courses, whether they are on high school campuses, or on college campuses, and whether courses are delivered face-to-face, or online. We would like to learn more about how your institution decided on this delivery approach.

2. Could you please share the decisions that led your institution to adopt its approach to delivering dual-credit education?

Now, I'm going to ask you a series of questions about the following topics: 1) the advising of dual-credit students, 2) the teaching of and assessment in dual-credit courses, 3) and determining student eligibility for dual-credit education. The initial questions within each topic will start broad, but depending on your answer, I'll have a few follow-up questions.

We will then move on to getting your insights on the benefits and challenges of delivering dual-credit education, and how you think the state should reform dual-credit policy and practice.

II. Advising for Dual-Credit Courses [Approximate length of time: 15 minutes]

I want to start by asking a number of questions about how your institution advises dual-credit students.

3. What procedures/guidelines has your institution established for helping high school students select dual-credit courses?

[Ask ALL following probes]

a. How (if at all) do students' anticipated major/field of study/career trajectory play a role in the advising students receive about which dual-credit courses to take?
b. How (it at all) does credit transfer play a role in the advising students receive about which dual-credit courses to take?
c. Has our conversation made you think of any other ways in which your institution helps high school students select dual-credit courses?

4. What kinds of training (if any) does your institution provide to high school and/or college advisers who counsel dual-credit students?

III. Teaching of and Assessment in Dual-Credit Courses [Approximate length of time: 25 minutes]

Now I'd like to learn from you about teaching and assessment in dual-credit courses.

5. What policies or guidelines has your institution established for teaching dual-credit courses?
[Ask ALL following probes]

a. How do these policies/guidelines relate to the design of content or curriculum?
b. How do these policies/guidelines relate to who can act as an instructor of a dual-credit course beyond what is required by state rules?
c. How do these policies/guidelines relate to the types of instructional strategies that should be used in dual-credit courses?
d. Are there any other policies/guidelines related to the teaching of dual-credit courses that we haven't discussed?

6. What kinds of instructional training or support does your institution offer to high school teachers and/or college faculty teaching dual-credit courses?

a. How does this training or support differ from the training or support for instructors who teach college-credit-only courses?

7. What guidelines does your institution have in place to help instructors assess the academic performance of dual-credit students?

8. How (if at all) do you think assessment of student learning and performance in dual-credit courses differs from high school-credit-only courses?

IV. Eligibility for Dual-Credit Courses [Approximate length of time: 15 minutes]

Turning to another big topic, I'd like to hear from you about eligibility for dual-credit courses.

9. How does your institution determine a student's eligibility to participate in dual-credit education?
[Ask ALL following probes]

a. How does your institution consider the types of assessments used to determined eligibility for dual-credit courses?
b. How does your institution consider a student's grade level or age?
c. How does your institution consider the types of courses a student has previously taken in school?
d. How does your institution consider a student's previous academic performance in school?
e. How does your institution consider whether a student is enrolling in academic or career and technical dual-credit education?
f. Are there any other factors considered?

10. Could you please share the decisions that led to using the eligibility criteria you've identified?

11. Does your institution's approach for determining readiness for dual-credit courses differ from your institution's approach for determining readiness for credit-bearing college-level courses, in other words courses for regular college students? If yes, how? And why?

V. Benefits and Challenges of Dual-Credit Education [Approximate length of time: 15 minutes]

Thank you for your answers thus far. Now, we would like to get your thoughts about the benefits and challenges of delivering dual-credit courses.

12. From your institution's perspective, how do various stakeholders benefit from dual-credit education?

13. From your institution's perspective, what kinds of challenges does dual-credit education pose to various stakeholders?

VI. Ending [Approximate length of time: 5 minutes]

Now wrapping up our conversation, I have just two more questions for you.

14. What advice would you provide to other institutions about how to implement a high-quality DC program?

15. How do you think state policymakers should reform dual-credit policy and practice?

APPENDIX E

Data and Methods

In this appendix, we describe the data used in our quantitative analyses and provide additional details about specific methods used for particular analyses. We begin by describing the data and then describe different methods.

Data

In this section, we describe the administrative data files that we used to conduct our quantitative analyses, and how we linked them at the individual level and over time to create our analytic data files. We begin by describing the specific administrative data files that we used, and then we describe how we link them to create our analytic file.

Administrative Data Files

The data used for our quantitative analyses come from administrative records maintained by the THECB and the TEA. We draw on the following THECB administrative data files:

1. **CBM001: The Enrollment Report (2000–2015).** This file captures college enrollment at all HEIs in Texas, including public, private nonprofit, and for-profit two- and four-year colleges. The file captures the number of SCHs attempted each semester at all colleges in the state. Beginning in the 1999–2000 academic year, the file began distinguishing between DC and regular college SCHs. The file also captures demographic information about all college students in the state. We use this file to capture information about DC participation, college enrollment and persistence, and SCHs earned.
2. **CBM002: The TSI Report (2000–2015).** This file captures information about college readiness for all students enrolling in degree programs that require demonstrating college readiness. This includes all students enrolling in any program leading to an undergraduate degree (associate or bachelor's) or a Level II Certificate at Texas public two- or four-year HEI. We use this file to capture information about whether students enroll in college meet the state's college readiness standards.
3. **CBM009: The Graduation Report (2000–2015).** This file captures information about all degrees conferred at all HEIs in Texas, including public, private nonprofit, and for-profit two- and four-year colleges. We use this file to capture information about college degree completion.
4. **CBM00S: The Student Schedule Report (2012–2015).** This file captures detailed transcript-level information for all students enrolled at any public two- or four-year HEI

in Texas. We use this file to capture detailed information about course performance in DC, regular college, and follow-on courses. We also use this file to capture detailed information about course mode and location. Since THECB only began collecting this information in 2012, we can only examine these data for 2012–2015.

5. **CBM008: The Faculty Report (2012–2015).** This file captures detailed information about faculty members teaching courses at public two- or four-year HEI in Texas. We use this file to capture information about the rank, highest degree earned, and employment status (full time, part-time or adjunct) for the faculty member of record for each course delivered at Texas public two- and four-year colleges from 2012–2015.

We also draw on several administrative files from the TEA:

6. **TEA High School Graduate Cohort File (2000–2015).** This file captures basic information about all graduates of Texas public high schools. This includes demographic information and information about the high school that the student graduated from. We use this file to identify cohorts of high school graduates to track into Texas public colleges and to identify the grade during which students took DC courses, if any.
7. **TEA Employment Records (2015).** This file captures information about all employees of Texas public schools. We use this file to identify college courses delivered in 2015 whose faculty member of record was employed as a teacher in a Texas public school in 2015.

Finally, we also drew on a file that captures information about the date when each ECHS that was in operation in 2015 was first granted its status by the TEA. The file indicates the TEA high school code for the high school that operated each ECHS and an indicator for whether or not the ECHS was a stand-alone high school or embedded within a larger high school with the same TEA high school code. We use this file to develop indicators of enrollment in ECHSs.

We link the files above across time and at the individual student level using social security numbers to create two analytic files that we use in our quantitative analyses. Table E.1 describes the key variables included in each file and the cohorts for which each variable is available.

The first file, referred to as the "Student File," tracks cohorts 2000–2015 graduates of Texas public high schools, capturing DC SCHs up to four academic years prior to graduating from high school and college enrollment and degree completion up to eight years after graduating from high school. Since we have enrollment data only from 2000 through 2015, we are only able to create certain indicators for specific cohorts, as described below. The file captures detailed student information from the TEA graduate file, including race/ethnicity, free lunch status, an indicator for whether or not the student participated in a GT program, an indicator for whether the student was identified as an English language learner, and an indicator for whether the student was identified as a vocational education student. The file also captures information about whether the student graduated from a high school that was either a stand-alone ECHS or had an ECHS embedded within it. The file captures information about whether the high school the student graduated from was located in an metropolitan statistical area (considered urban) or not (considered rural). The file captures outcomes, including college enrollment (defined as enrolling full or part-time during the fall or spring semester immediately following high school graduation), enrolling not ready for college (defined as enrolling in a Texas public college in the spring or fall immediately after high school graduation in a program requiring demonstration of college readiness and not having met the state's college readiness standard at the time of enrollment), persistence (defined as still being enrolled in any

Table E.1
Key Variables by Analytic File

DC Participation	Student Info	Context	Outcomes	Efficiency
Student File—Variables Generally Available 2000–2015, Unless Otherwise Noted				
DC SCHs 9th–12th grade[a]	Race/ethnicity	ECHS	Enroll 2- vs. 4-year	SCH-to-degree[b]
DC SCHs 11th–12th grade[c]	Free lunch status	Urbanicity	Enroll not ready	
DC SCHs 12th grade	GT		Persist[d]	
	ESL status		Complete[e]	
	Vocational			
Additional Variables Available in Course File—Variables Generally Available 2012–2015, Unless Otherwise Noted				
Specific DC courses		Location	DC course performance	Retake[f]
		Mode	Follow-on course performance[g]	
		Faculty characteristic[h] Academic vs. CTE		

[a] Defined for 2003–2015 cohorts.
[b] Defined for 2000–2006 cohorts.
[c] Defined for 2001–2015 cohorts.
[d] Defined for 2000–2014 cohorts.
[e] Defined for 2000–2006 cohorts.
[f] Defined for 2012–2014 cohorts.
[g] Defined for 2012–2014 cohorts.
[h] High school teacher defined for 2015 cohort only.

college in Texas one year after high school graduation or having completed any postsecondary credential by that time point), and completion (defined as having completed any postsecondary credential within eight years of high school graduation). The file also has indicators for enrolling in a two- versus four-year college, and completing different postsecondary credentials. Finally, the file includes an indicator of the number of SCHs to degree for students enrolling in a HEI during the spring or fall semester immediately following high school graduation and completing a four-year degree within eight years of high school graduation.

Beginning in 2012, THECB began collecting detailed transcript-level information about all college courses taken at any public HEI in the state. The file includes detailed course and section identifiers that allow us to link courses to information about their faculty member of record from the CBM008. For the 2012–2015 cohorts, we link the student-level file above to additional course-level information about all college-level courses taken by graduates of Texas public high schools. The file includes information about enrollment and course performance for particular DC courses, information on location (high school versus college campus, mode of instruction (face-to-face, online, or hybrid), faculty characteristics (whether or not the instructor was employed as a public school teacher in Texas, rank, highest degree earned, full- or part-time status, and adjunct status. For two common DC courses (English 1301 and Math 1314/1414), we also capture information about performance in courses that require those

courses as a prerequisite. Finally, for all courses taken as DC in high school, we track college courses taken during the first two years of college to identify whether the student subsequently retook the same course after enrolling in college.

Table E.2 describes each outcome examined in our analysis. It details how each outcome is defined, the high school graduation cohorts that is examined for each outcomes, the number of the students in those cohorts, and the conditioning that is necessary to analyze each outcome.

Because many of the outcomes we examine cover different time periods, we present in Table E.3 the descriptive statistics for various time periods and samples. There is a consistent pattern of positive selection in all of the time periods and samples presented.

The first two columns give descriptive statistics for the years 2000–2006. This time period is presented because it is the time period viewed for the analysis on graduation rate. We also present the statistics for all of the other outcomes in this time period. It gives the percentages of characteristics like race and academic information broken down into two groups: those who took DC and those who do not.

The next two columns give the same breakdown for characteristics for the years 2000–2013. This time period is presented because it is the time period viewed for the analysis on persistence rate. We also present the statistics for all of the other outcomes in this time period excepting graduation rates since that outcome is only defined for the years 2000–2006.

Table E.2
Definition of Outcomes

Outcome	Definition	Cohorts Examined	Number of Students	Conditioning
Enroll 2-year	Student enrolls in a 2-year HEI directly after graduating high school	2000–2014	3,834,590	
Enroll 4-year	Student enrolls in a 4-year HEI directly after graduating high school	2000–2014	3,834,590	
Not college ready	Student does not reach a certain score threshold on the Texas Success Initiative for Math, Reading, or Writing	2000–2014	3,834,590	
Persisted	In any HEI two years after graduating high school	2000–2013	3,531,909	
Graduated 2-year	Graduated from a 2-year HEI within 8 years of graduating high school	2000–2006	1,612,495	
Graduated 4-year	Graduated from a 4-year HEI within 8 years of graduating high school	2000–2006	1,612,495	
Time to 4-year degree	Years between graduating high school and graduating from 4-year HEI	2000–2006	1,612,495	Conditioned on enrolling in 2- or 4-year school and graduating from 4-year school
SCHs to 4-year degree	SCHs to graduating from 4-year HEI	2000–2006	1,612,495	Conditioned on enrolling in 2- or 4-year school and graduating from 4-year school

Table E.3
Summary Statistics

	2000–2006		2000–2013		2000–2014		2000–2015		ENGL 1301	2012–2015	Math 1314/1414	2012–2015
Variable	No DC	Took DC	No DC	Took DC	No DC	Took DC	No DC	Took DC	Took Regular Course	Took as DC	Took Regular Course	Took as DC
White	47.16286	64.68125	41.8528	54.53918	41.05356	53.60517	40.24766	53.03776	36.39423	55.054	37.93621	49.42779
African-American	14.24705	5.69171	14.51838	7.15534	14.48067	7.18297	14.44335	7.17562	13.48066	5.5957	11.5208	3.73751
Asian	3.3893	3.88503	3.56853	3.94435	3.59879	4.00556	3.63516	4.05119	5.75538	3.99908	7.21123	3.94032
Hispanic	34.91428	25.43595	39.19445	33.17692	39.89327	33.91438	40.60112	34.3551	42.00292	33.02619	41.08684	40.95321
Other race	0.28652	0.30606	0.86583	1.18421	0.97372	1.29191	1.07271	1.38034	2.3668	2.32499	2.24492	1.94118
Male	50.08716	41.16231	51.11624	42.02065	51.2224	42.03315	51.2525	42.09764	42.91611	39.15718	47.9375	44.56034
Economically disadvantaged	30.86899	18.7543	37.43215	27.93147	38.318	28.68373	39.06662	29.02376	57.8688	41.92401	55.615	49.13681
At risk of dropping out	43.03833	15.02764	46.00867	18.59752	45.94751	18.5186	46.42637	18.77809	25.61175	11.9422	19.46158	9.18323
ESL	2.23367	0.17497	2.81519	0.34606	2.8366	0.34863	2.98735	0.38379	1.6233	0.07063	1.77566	0.17424
Limited English proficiency	3.27149	0.29835	3.41295	0.34708	3.41011	0.35291	3.54477	0.39346	1.15386	0.08221	1.52199	0.20328
Gifted	9.44242	28.63472	8.48901	23.59488	8.40229	23.16087	8.33563	22.902	9.70225	20.89803	11.56971	27.23973
Special education	11.80401	1.34345	12.18108	1.51272	12.06131	1.5014	11.89217	1.49916	2.17478	0.4284	1.26833	0.45012
Vocational education	69.2081	66.82365	72.96422	75.35944	73.52571	76.29753	74.12944	76.97988	80.90796	84.77015	84.62463	85.80327
Urban	85.49883	77.22108	87.19779	80.03433	87.39267	80.26776	87.57796	80.33944				
Enroll 2-year	29.81081	29.30319	30.77237	31.87548	30.76559	31.84188						
Enroll 4-year	18.37774	47.52367	17.05595	44.07504	17.06175	44.13562						
Not college ready	19.21983	8.68585	18.1808	8.20716	17.94219	7.97763						
Persisted	43.94712	73.88965	42.97208	71.89524								
Graduated 2-year	6.24995	10.0293										
Graduated 4-year	16.39367	45.51887										

The next two columns give the same breakdown for characteristics for the years 2000–2014. This time period is presented because it is the time period viewed for the analysis on enrollment rate and college readiness. We cannot present statistics on the other outcomes in these columns since they are not defined for the entire time period.

The next two columns give the same breakdown for characteristics for the years 2000–2015. This gives the aggregate descriptive statistics on the analysis examining who takes DC and those trends over time. We cannot present statistics on any outcomes in these columns since they are not defined for the entire time period.

The next two columns give the descriptive statistics for those taking English 1301 as a DC course and those taking the class as a regular course. This is defined for the years 2012–2015 and only for those who took a follow-on course to be consistent with the analysis presented in the report. The columns presents the percentages of characteristics like race and academic information broken down into two groups: those who took the course DC and those who do not.

The final two columns give the descriptive statistics for those taking Math 1314/1414 as a DC course and those taking the class as a regular course. This is defined for the years 2012–2015 and only for those who took a follow-on course to be consistent with the analysis presented in the report. The columns present the percentages of characteristics like race and academic information broken down into two groups: those who took the course DC and those who do not.

Methods and Results

In this section, we describe the quasi-experimental methods used in Chapter Five. We also present detailed findings and regression output. We begin by describing the linear probability models that we used to describe characteristics associated with DC participation and to assess changes in disparities over time. Next, we describe the linear probability models we used to describe how student characteristics are related to course delivery mode. Then, we describe linear probability models that relate student outcomes to DC participation. Finally, we describe OLS regression models we used to relate SCHs to degree to DC participation.

Linear Probability Models Describing Characteristics Associated with DC Participation and Increasing Disparities over Time

To see how different characteristics are associated with DC participation over time, we regressed various indicators variables on whether a student took a DC course in their senior year of high school. The coefficients can be thought of as how many percentage points having that characteristic affects the probability that a student took DC. For example, the coefficient on "male" is –0.0404, which would imply that about men took DC about 4 percentage points fewer than women, controlling for other characteristics.

To examine the effect over time, the same regression was run for different time periods: 2000–2006, 2007–2011, and 2012–2015, which correspond to regressions (2), (3), and (4), with the regression from 2000–2015 corresponding to regression (1). This allows for us to see whether there are trends to how the characteristics are associated with taking a DC course in a student's senior year.

The regressions also are absorbing year fixed effects. This is because a phenomenon may vary between years for reasons that are not properly captured by our data. Failure to include these time fixed effects could lead to an omitted variable bias and skew the results.

The regression specification is as follows:

$$Y_i = \beta_0 + \beta_1 X_{it} + \beta_3 Z_i + \gamma_t T_t + \varepsilon_{it},$$

where Y is the probability that a student took DC in their senior year, X is a matrix of time-variant student characteristics, Z is a matrix of time-invariant indicators for race and sex, T is a matrix of year fixed effects, with ε as an error term; i and t are individual and year indicators. Note that the outcome variable is time-invariant.

Regression output is given in Table E.4.

As discussed in the quantitative section, it appears that the coefficients on many of the regressors appear to be growing in absolute value over time, suggesting that the relationship between taking DC in senior year and these descriptive variables is growing stronger. This is notable in regressors: male, African-American, other race, economically disadvantaged, ESL, vocational education, and urban. All of the coefficients on the male race indicators are negative, suggesting that white females have the strongest association with taking DC in senior year.

Unsurprisingly, being economically disadvantaged is negatively associated with DC and being gifted is positively associated. This suggest that the students taking DC are more likely to be better performers in school and richer. The negative association between urban and DC further confirms that rural students are more likely to participate in DC.

While there are potential problems with linear probability models, these problems are most prominent near 1 and 0, which should not be an issue in this regression. Given that the average of the outcome variable is not close to 1 or 0, probit and logit models would have similar estimates of coefficients.

It is important to note that these estimates do not show a causal relationship. These regressions are meant to show how characteristics are associated with taking DC in a student's senior year.

There are potential issues in examining how the coefficient changes on race. This is due to changes in how the 2010 U.S. Census classified race and ethnicity. Before 2010, the Census required respondents to identify a single race/ethnicity category. Starting with the 2010 Census, the Census Bureau allowed respondents to identify multiple race and ethnicity categories. The THECB and the TEA adopted this convention in 2010 as well to be consistent with the Census.

To check that this change is not biasing these estimates downward overtime, the regressions were run again over four different time periods with two before the 2010 Census and two afterward. The before regressions examine 2000–2005 and 2006–2009 and correspond to regressions (5) and (6), respectively. The years are obviously not balanced among the two regressions, but given DC enrollment increased over time, the years were made to be unbalanced so that the observations would be relatively similar across the two regressions. This gives information on how the association between observable characteristics and taking DC in a student's senior year changes over time before the census change.

The after regressions examine 2010–2012 and 2013–20015 and correspond to regressions (7) and (8), respectively. These robustness checks are specifically on the race variables to show

Table E.4
Probability of Taking DC in 12th Grade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	**2000–2015**	**2000–2006**	**2007–2011**	**2012–2015**	**2000–2005**	**2006–2009**	**2010–2012**	**2013–2015**
Male	−0.0404***	−0.0264***	−0.0488***	−0.0499***	−0.0247***	−0.0437***	−0.0523***	−0.0488***
	(0.00101)	(0.00136)	(0.00161)	(0.00154)	(0.00124)	(0.00165)	(0.00164)	(0.00154)
African-American	−0.0787***	−0.0588***	−0.0915***	−0.0929***	−0.0582***	−0.0807***	−0.0905***	−0.0931***
	(0.00368)	(0.00410)	(0.00481)	(0.00482)	(0.00393)	(0.00523)	(0.00513)	(0.00485)
Hispanic	−0.0382***	−0.0255***	−0.0419***	−0.0465***	−0.0278***	−0.0377***	−0.0417***	−0.0489***
	(0.00411)	(0.00415)	(0.00526)	(0.00508)	(0.00409)	(0.00552)	(0.00547)	(0.00506)
Asian	−0.0446***	−0.0284***	−0.0458***	−0.0537***	−0.0274***	−0.0514***	−0.0569***	−0.0582***
	(0.00706)	(0.00667)	(0.00946)	(0.00995)	(0.00658)	(0.00832)	(0.0101)	(0.00959)
Other race	−0.0383***	−0.0130	−0.0345***	−0.0487***	−0.0255***	−0.0119	−0.0458***	−0.0514***
	(0.00287)	(0.00856)	(0.00544)	(0.00433)	(0.00769)	(0.00947)	(0.00495)	(0.00407)
Economically disadvantaged	−0.0333***	−0.0155***	−0.0351***	−0.0460***	−0.0177***	−0.0263***	−0.0424***	−0.0454***
	(0.00260)	(0.00282)	(0.00365)	(0.00310)	(0.00269)	(0.00380)	(0.00355)	(0.00310)
ESL	−0.0738***	−0.0429***	−0.0794***	−0.0880***	−0.0408***	−0.0715***	−0.0996***	−0.0835***
	(0.00313)	(0.00322)	(0.00562)	(0.00389)	(0.00307)	(0.00462)	(0.00476)	(0.00379)
GT	0.156***	0.117***	0.179***	0.162***	0.125***	0.162***	0.184***	0.159***
	(0.00699)	(0.00760)	(0.00837)	(0.00761)	(0.00786)	(0.00837)	(0.00815)	(0.00756)
Special education	−0.0986***	−0.0583***	−0.121***	−0.120***	−0.0607***	−0.105***	−0.133***	−0.117***
	(0.00228)	(0.00398)	(0.00298)	(0.00289)	(0.00229)	(0.00450)	(0.00312)	(0.00289)
Vocational education	0.0179***	−0.00178	0.0298***	0.0402***	−0.00280	0.0134***	0.0388***	0.0389***
	(0.00300)	(0.00298)	(0.00406)	(0.00424)	(0.00298)	(0.00408)	(0.00461)	(0.00430)
Urban	−0.0842***	−0.0437***	−0.0989***	−0.106***	−0.0559***	−0.0897***	−0.108***	−0.111***
	(0.00638)	(0.00643)	(0.00836)	(0.00770)	(0.00658)	(0.00839)	(0.00848)	(0.00791)
Constant	0.252***	0.149***	0.295***	0.305***	0.160***	0.267***	0.320***	0.307***
	(0.00684)	(0.00692)	(0.00908)	(0.00851)	(0.00701)	(0.00905)	(0.00926)	(0.00867)
Observations	4,138,912	450,836	530,386	605,136	449,830	502,603	572,033	613,903
R-squared	0.075	0.057	0.072	0.068	0.063	0.069	0.071	0.067

NOTE: Robust standard errors in parentheses and are clustered at the high school.

*** p<0.01, ** p<0.05, * p<0.1

that the associated coefficients are decreasing both before and after the 2010 Census change. It would be a problem if the coefficients stopped decreasing following the change, suggesting that the original race regression coefficients were sensitive to the change in 2010 Census definition. Fortunately, that is not case.

Linear Probability Models Relating Student Outcomes to DC Participation

We constructed indicators for various college outcome such as: enrolling in a two- or four-year school directly following high school graduation, being considered "college ready," persisting past the first year of college, and graduating from a two- or four-year school within eight years of graduating high school.

We regressed an indicator for ever taking a DC course on the outcome indicators using year fixed effects to see how taking DC is related to the various outcomes. There are two regressions for each outcome variable: one with no controls and another controlling for observable student characteristics.

These models were used to calculate probabilities of a student's outcome presented in Figures 5.22–5.26. The figures that show the probabilities without controls are taken from the coefficients in the model without any covariates. The probabilities with controls in the figures are calculated by taking the average value of each characteristic and multiplying it by the corresponding coefficient in the table. The multiplication of the coefficients and average values of characteristics are all added together excepting the value of taking DC, so this value would represent the average probability of a student to have a given outcome without taking DC. Then to find the average probability of a given outcome for a student taking DC, the coefficient value on taking DC is added to the probability of a student without taking DC.

The regression specification is as follows:

$$Y_i = \beta_0 + \beta_1 X_{it} + \beta_3 Z_i + \gamma_t T_t + \varepsilon_{it},$$

where Y is the probability that of a given outcome, X is a matrix of time-variant student characteristics, Z is a matrix of time-invariant indicators for race and sex, T is a matrix of year fixed effects, with ε as an error term; i and t are individual and year indicators. Note that these outcome variables are time-invariant.

Regression output is provided in Table E.5.

First, it is evident that the association between ever taking DC and various higher education outcomes becomes less evident in absolute value when controls are added. Second, ever taking DC is associated with positive student outcomes, which is showed by the coefficient on that regressor being significantly positive on the outcomes of enroll, persist, and graduate while being significantly and negatively associated with being not ready. When examining the signs on coefficients, there may be instances that do not seem intuitive. This suggests a need for more analysis but may also be a product of the way that the variables are constructed. For instance, the not ready indicator is constructed that to be considered not ready, one must enroll and be considered not ready. So there will be many instances of students who will show that they are not ready for college, but this is due to them not enrolling directly after high school.

It is important to note that these estimates do not show a causal relationship. These regressions are meant to show how outcomes are associated with taking DC while controlling for other factors.

Table E.5
Effect of Taking DC on Higher Education Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Enrolled in a 2-Year HEI		Enrolled in a 4-Year HEI		Enrolled in a 2- or 4-Year HEI		Not College-Ready		Persists Past First Year		Graduated from 2- or 4-Year HEI	
Variable	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2013	2000–2013	2000–2006	2000–2006
Took DC	0.0128***	0.00431	0.267***	0.200***	0.258***	0.186***	−0.105***	−0.0603***	0.274***	0.201***	0.301***	0.207***
	(0.00425)	(0.00409)	(0.00476)	(0.00430)	(0.00468)	(0.00418)	(0.00240)	(0.00207)	(0.00193)	(0.00403)	(0.00208)	(0.00463)
Male		−0.0322***		−0.0189***		−0.0489***		−0.0331***		−0.0536***		−0.0582***
		(0.00175)		(0.00129)		(0.00190)		(0.00127)		(0.00170)		(0.00137)
Economically disadvantaged		−0.0194***		−0.0316***		−0.0452***		−0.00425**		−0.0715***		−0.0492***
		(0.00262)		(0.00257)		(0.00312)		(0.00205)		(0.00307)		(0.00281)
African-American		−0.0445***		0.0361***		−0.00498		0.0810***		−0.00687		−0.0768***
		(0.00481)		(0.00481)		(0.00468)		(0.00328)		(0.00487)		(0.00404)
Hispanic		0.00644*		−0.0228***		−0.0106**		0.0435***		−0.0120***		−0.0617***
		(0.00369)		(0.00420)		(0.00462)		(0.00279)		(0.00456)		(0.00416)
Asian		−0.00764		0.181***		0.159***		0.0134***		0.178***		0.108***
		(0.00712)		(0.00734)		(0.00667)		(0.00436)		(0.00688)		(0.00733)
Other race		−0.0330***		−5.26e−05		−0.0299***		0.00687*		−0.0253***		−0.0661***
		(0.00546)		(0.00524)		(0.00622)		(0.00359)		(0.00603)		(0.0107)
At risk		0.0124***		−0.136***		−0.117***		0.0705***		−0.138***		−0.127***
		(0.00299)		(0.00259)		(0.00290)		(0.00241)		(0.00276)		(0.00253)
Limited English proficiency		−0.0565***		−0.0147		−0.0711***		−0.00394		−0.0684***		0.00708
		(0.0124)		(0.00955)		(0.0122)		(0.0126)		(0.0119)		(0.0108)

Table E.5—continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Enrolled in a 2-Year HEI		Enrolled in a 4-Year HEI		Enrolled in a 2- or 4-Year HEI		Not College-Ready		Persists Past First Year		Graduated from 2- or 4-Year HEI	
Variable	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2013	2000–2013	2000–2006	2000–2006
ESL		−0.00409		−0.0313***		−0.0331***		0.00726		−0.0279**		−0.0463***
		(0.0133)		(0.00958)		(0.0126)		(0.0124)		(0.0126)		(0.0110)
GT		−0.122***		0.179***		0.0528***		−0.0784***		0.0817***		0.124***
		(0.00427)		(0.00473)		(0.00491)		(0.00229)		(0.00516)		(0.00503)
Special education		−0.0871***		−0.115***		−0.194***		−0.0202***		−0.190***		−0.129***
		(0.00332)		(0.00234)		(0.00314)		(0.00312)		(0.00291)		(0.00308)
Vocational education		0.0745***		−0.0184***		0.0554***		0.0389***		0.0390***		0.00522**
		(0.00253)		(0.00293)		(0.00326)		(0.00174)		(0.00313)		(0.00259)
Urban		−0.0235***		0.0419***		0.0154***		−0.00327		0.0517***		0.0135***
		(0.00718)		(0.00622)		(0.00591)		(0.00374)		(0.00558)		(0.00450)
Constant	0.298***	0.309***	0.184***	0.234***	0.469***	0.525***	0.168***	0.109***	0.432***	0.488***	0.215***	0.330***
	(0.00279)	(0.00755)	(0.00347)	(0.00694)	(0.00360)	(0.00634)	(0.00235)	(0.00402)	(0.000740)	(0.00580)	(0.000659)	(0.00500)
Observations	515,131	514,552	515,131	514,552	515,131	514,552	515,131	514,552	513,333	512,768	452,385	450,836
R-squared	0.000	0.019	0.052	0.141	0.034	0.086	0.011	0.043	0.038	0.108	0.044	0.128

NOTE: Robust standard errors in parentheses and are clustered at the high school.

*** p<0.01, ** p<0.05, * p<0.1

OLS Models Relating SCHs to Degree to DC SCHs

We calculated the SCHs to degree and regressed an indicator for if a student ever took DC on the total credit hours to degree. This is a simple OLS regression with year fixed effects to examine what relationship taking DC courses has with credit hours to degree.

The regression specification is as follows:

$$Y_i = \beta_0 + \beta_1 X_{it} + \beta_3 Z_i + \gamma_t T_t + \varepsilon_{it},$$

where Y is the number of credit hours to degree, X is a matrix of time-variant student characteristics, Z is a matrix of time-invariant characteristics, T is a matrix of year fixed effects, with ε as an error term; i and t are individual and year indicators. Note that the outcome variables are time-invariant.

Regression output is provided in Table E.6.

There are several interesting things in this output. First, it is clear that the more DC SCHs that are taken, the higher the number of SCHs to degree is, which makes intuitive sense. However, simply having taken a DC course is associated with a fewer SCHs taken to degree. If total SCHs to degree is a function of taken DC SCHs, regression (4) implies that those who take DC have a lower intercept. This is likely due to the selection bias of students taking DC courses. As discussed in the qualitative and quantitative section, higher-ability and richer students are more likely to take DC courses. This is evident in these regressions as well, since the coefficient on gifted is negative, while the coefficient on economically disadvantaged and special education are positive and significant.

Second, it is clear from regressions (5) and (6) that there is a nonlinear relationship between total DC SCHs and SCHs to degree. Specifically, it is a convex relationship, implying the marginal effect of DC SCHs on total SCHs to degree is increasing. This suggest that further analysis is needed into the nonlinear aspects of DC SCHs.

It is important to note that these estimates do not show a causal relationship. These regressions are meant to show how credit hours to degree is associated with taking DC courses.

Table E.6
Determinants of SCHs to Four-Year Degree

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	**2000–2006**	**2000–2006**	**2000–2006**	**2000–2006**	**2000–2006**	**2000–2006**
Total DC SCH	0.0991***	0.206***	0.349***	0.377***	–0.0639	0.0817
	(0.0345)	(0.0275)	(0.0416)	(0.0287)	(0.0985)	(0.0938)
African-American		10.57***		10.48***		10.47***
		(0.436)		(0.440)		(0.440)
Hispanic		6.190***		6.169***		6.148***
		(0.353)		(0.353)		(0.353)
Asian		4.385***		4.343***		4.331***
		(0.514)		(0.514)		(0.514)
Other race		3.315**		3.334**		3.376**
		(1.677)		(1.674)		(1.675)
Economically disadvantaged		3.952***		3.961***		3.948***
		(0.345)		(0.346)		(0.346)
ESL		8.048***		7.911***		7.914***
		(1.697)		(1.698)		(1.699)
GT		–7.047***		–7.002***		–7.012***
		(0.261)		(0.261)		(0.261)
Special education		11.00***		10.77***		10.67***
		(1.028)		(1.094)		(1.144)
Vocational education		2.451***		2.441***		2.439***
		(0.234)		(0.235)		(0.235)
Urban		–1.353***		–1.429***		–1.451***
		(0.373)		(0.373)		(0.372)
Ever took DC			–3.790***	–2.626***	–1.698***	–1.132*
			(0.470)	(0.430)	(0.634)	(0.589)
Total DC SCHs squared					0.0141***	0.0101***
Constant	148.4***	146.2***	148.7***	146.6***	148.7***	146.6***
	(0.261)	(0.389)	(0.276)	(0.395)	(0.277)	(0.395)
Observations	84,351	84,306	84,351	84,306	84,351	84,306
R-squared	0.002	0.058	0.004	0.059	0.004	0.059

NOTE: Robust standard errors in parentheses and are clustered at the high school.

*** p<0.01, ** p<0.05, * p<0.1

APPENDIX F

Summary of Public Comments

We released a draft version of this interim report for public comment on March 17, 2017, and received public comments from then until April 17, 2017. Comments were compiled into a spreadsheet, which contained information on who sent the comment (name, email address, and title when possible), date on which the comment was sent, and content of the comment. These comments informed revisions made to the interim draft report, and also additional analyses that will be conducted for the second phase of the study on DC education in Texas.

In total, 11 individuals submitted comments on the interim report. These individuals include several faculty members, higher education administrators, parents, a director of an early college high school, a high school advisor, and a senior administrator at a regional chamber of commerce.

The comments that were made touched on five major themes: (1) selection into DC education, (2) financing of DC education, (3) efficiency of DC education (i.e., transfer, progression of DC students in college), and (4) academic preparation and emotional maturity of DC students. Highlighted below are key statements that support these themes.

1. **Selection into DC education:** Several individuals reported that students who enrolled in DC education would have been as academically successful without DC and that identifying the causal impact of DC on academic success is difficult to estimate. For example, one commentator stated the following: "It will probably still be difficult to determine if differences in the college performance of dual credit students compared to other students is caused by the dual credit courses or something else." This comment piggybacked on a statement that "DC seems to be growing into the new 'Honors' or "A.P.," and that DC is a program for a select group of high-achieving students. One commentator also mentioned that the results from the quantitative study mirrored results from a Texas State study, which found "that students earning AP credit for a pre-requisite course made higher grades in subsequent post-requisite courses than students who did not attempt AP credit for the pre-requisite, even when the AP score was a 3 rather than a 4 or 5." In contrast to these statements, one person wrote that ECHS were helping to reverse this trend, essentially democratizing DC education. In the second phase of the study, we intend to address selection issues by conducting a rigorous causal impact study of DC on a wide range of student success outcomes.
2. **Financing of DC education:** A significant number of comments were associated with a lack of data on how much DC costs the state, and how much of the state's investment generates cost savings to both students and the state. One commentator even stated that the way the state currently invests in DC creates perverse incentives for institutions

and high schools to enroll as many students as possible. Specifically, the commentator stated that "Dual Credit courses are too often being used to serve financial ends rather than educational goals" and that the admission of freshmen and sophomores to DC "can only be done for financial reasons." Another commentator suggested examining the financial arrangements high schools and colleges make to implement DC programs, noting that some colleges charge DC students tuition and fees while others do not. Along the same vein, another commentator suggested that the cost of a DC program will vary, depending on how and where the DC program is implemented (e.g., ECHS, on campus versus off campus). In the second phase of the study, we intend to examine these financial arrangements as part of our cost study, as well as the extent that costs vary across different implementation models.

3. **Efficiency of DC education:** A large number of comments related to the transfer of DC courses to college, specifically degree plans. These comments were made by parents, administrators, and faculty members alike. One commentator said that their grandchild "was able to complete several of her pre-requisites for college, saving money, time, and directing her to college without a bypass to work for a while before enrolling." However, others had questions about whether DC really helped students complete college at a faster rate. One parent stated that the majority of their child's DC courses counted as electives: "Unfortunately for my daughter, few of those classes counted towards her degree, they were almost all counting as electives." Another respondent specifically mentioned examining the extent that DC courses transfer specifically to degree plans should be investigated. Finally, one commentator stated that it would be fruitful to examine whether "investments in DC courses relative to investments in alternatives such as AP courses, remedial education, enhanced counseling, etc." produced different benefits in terms of efficiency. In other words, which program is generating more bang for their buck? We intend to investigate these issues in our cost analysis of DC programs.
4. **Academic preparation and emotional maturity of DC students:** The degree that students enrolled in DC were actually academically and emotionally prepared to take such coursework also emerged as a theme in the comments. Commentators expressed particular concern that some students might be underprepared to succeed in college-level courses in high school, and that this might have implications on post-graduate studies and future job placement, effectiveness, and prospects, even if they are successful in DC courses. One commentator suggested that there were very few students who were truly prepared for DC courses: "While there are students who can read and write at the college level, these students are far fewer than the number now offered dual credit courses." Similarly, another commentator stated "As a faculty member and dean of general education at a four-year university, my concern is the academic preparedness of these students when they move on to the university campus." One commentator even suggested that DC students should meet the TSI cut off even if they enrolled in a DC CTE course, a requirement that currently does not exist in THECB rules. We hope to learn more about this based on forthcoming focus groups conducted by the University of Texas System with students, college administrators, and faculty on the extent to which DC students were academically and emotionally prepared to succeed in college.

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