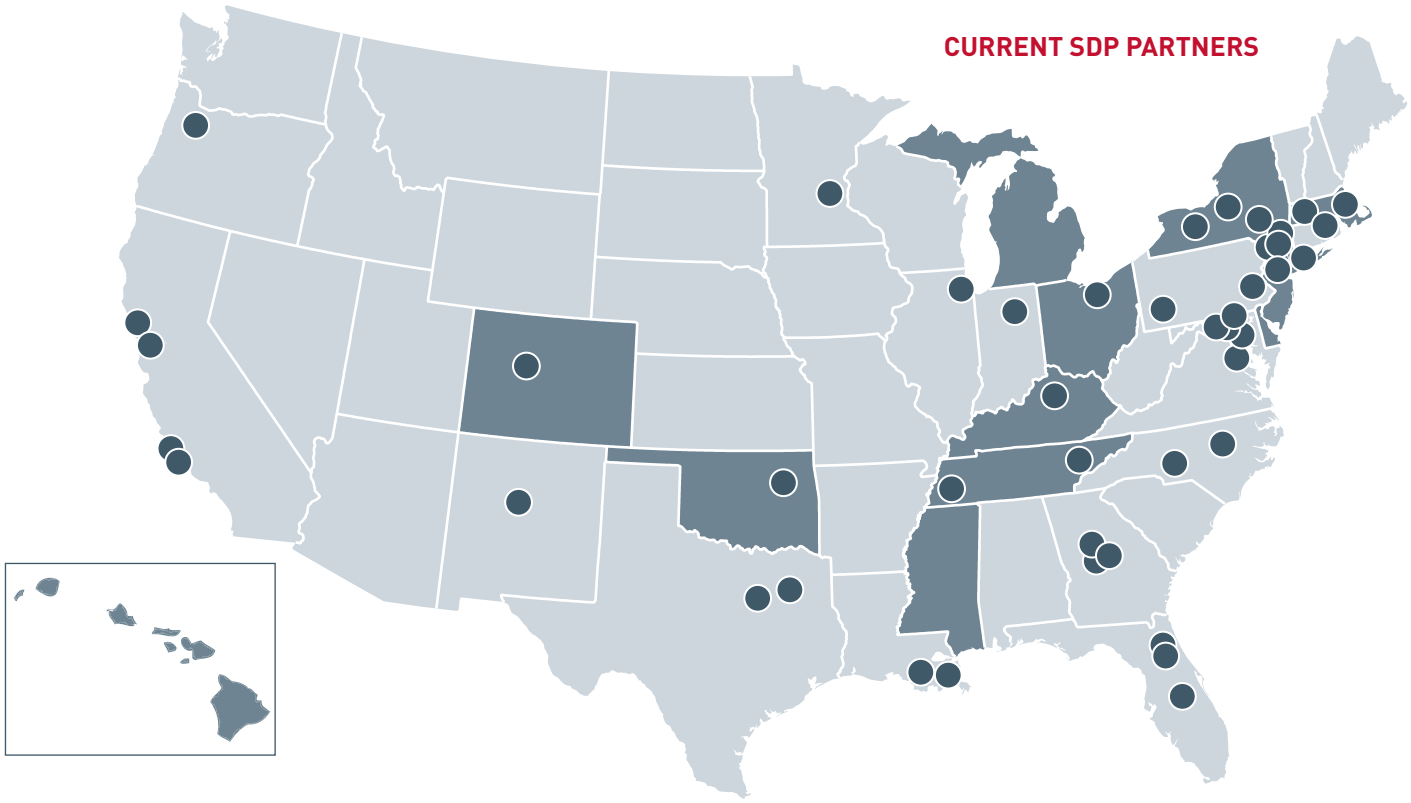
STRATEGIC DATA PROJECT

SDP COLLEGE-GOING DIAGNOSTIC

Colorado Department of Education

September 2014



THE STRATEGIC DATA PROJECT (SDP)

Since 2008, SDP has partnered with 56 school districts, charter school networks, state agencies, and nonprofit organizations to bring high-quality research methods and data analysis to bear on strategic management and policy decisions. Our mission is to transform the use of data in education to improve student achivement.

Part of the Center for Education Policy Research at Harvard University, SDP was formed on two fundamental premises:

1. Policy and management decisions can directly influence schools' and teachers' ability to improve student achievement.
2. Valid and reliable data analysis significantly improves the quality of decision making.

SDP's theory of action is that if we are able to bring together the right people, assemble the right data, and perform the right analysis, we can help leaders make better decisions—ultimately improving student achievement significantly.

To make this happen, SDP pursues three strategies:

1. Building a network of top-notch data strategists who serve as fellows for two years with our partners (e.g., school district, charter management organization, nonprofit, or state education agency).
2. Conducting rigorous diagnostic analyses of teacher effectiveness and college-going success using agency data.
3. Disseminating our tools, methods, and lessons learned to the education sector broadly.

The project is supported by the Bill & Melinda Gates Foundation.

SDP COLLEGE-GOING DIAGNOSTIC

Introduction and Background

In early spring of 2013, the Strategic Data Project (SDP) began its engagement with the Colorado Department of Education (CDE) and the Colorado Education Initiative (CEI) to execute the College-Going Diagnostic. In the context of a larger partnership between SDP, CDE, and CEI, the diagnostic was a research collaboration that documented patterns of high school students' college readiness, matriculation, and persistence in order to provide leadership with a clearer understanding of Colorado's current performance, an entry point for deeper investigation into the reasons for that performance, and a foundation for data-driven policy and management decisions.

Given related policy developments underway in Colorado, the focus and objectives of the College-Going Diagnostic were timely. Colorado adopted new, more rigorous academic standards in 2009 and new high school graduation guidelines in 2013. Schools and school districts are using new strategies to implement these new requirements, including a collaboration between 13 Colorado school districts, CDE, and CEI—the Colorado Integration Project—to pilot an integrated model of teaching and learning designed to significantly improve the number and rate of students graduating from Colorado high schools college and career-ready. The Colorado Integration Project includes providing teachers with instructional tools aligned to the Colorado Academic Standards, developing new measures of student learning and engagement, and ensuring that teachers receive effective feedback that can help them improve their practice and support students in mastering rigorous content.

In addition, there were numerous related initiatives underway that aspired to increase college enrollment and completion rates for Colorado students. In 2010, the Colorado Commission on Higher Education (CCHE) formally adopted Colorado's strategic plan for higher education, the Degree Dividend, as the foundation of higher education master planning in the state. That report articulated a need to reduce regional, income, and ethnic gaps in college admission, retention, and completion by focusing on the multiple access points to a college education and allowing for "flexible pathways" to completion of degrees and certificates. The plan also articulated a need to assess and enhance options for early access to college level coursework in high school and design consistent data collection standards statewide.

In October 2012, CCHE released an update to the 2010 master plan titled *Colorado Competes: A Completion Agenda for Higher Education.* This report articulated specific performance goals to address critical areas of need in the Colorado postsecondary education system, including increasing the attainment of high quality postsecondary credentials, improving students' college persistence and reducing the time taken by students to graduate, and eliminating disparities in college access and success between traditionally underserved students and other students.

Given Colorado's strategic focus on increasing college enrollment, persistence, and attainment rates, SDP designed a series of analyses to understand the post-secondary trajectories of Colorado high school graduates. These analyses provided the foundation from which CDE could investigate the extent to which Advanced Placement (AP) courses and concurrent enrollment—two high priority initiatives in Colorado's implementation of "flexible pathways"—could be effective strategies to increase college persistence. CDE, CEI, and SDP agreed that the diagnostic would focus on:

1) describing college enrollment and persistence rates of high school graduates across Colorado;

2) describing patterns in students' participation in college-level coursework (in particular, AP classes and concurrent enrollment participation) in high school; and

3) investigating the extent to which students' participation in AP classes and concurrent enrollment programs is associated with persistence at both two-year and four-year colleges.

This research report presents the results of the analytic work conducted by SDP, along with a discussion of its implications and key questions that readers and policymakers might ask themselves as they reflect upon the results.

SDP COLLEGE-GOING DIAGNOSTIC

The SDP Diagnostic Process

Since 2008, SDP has partnered with school districts, charter school networks, state education agencies, and nonprofit organizations to bring high-quality research methods and data analysis to bear on strategic management and policy decisions. SDP's mission is to transform the use of data in education to improve student achievement. To fulfill its mission, SDP believes that bringing together the right people, assembling the right data, and performing the right analysis can help leaders make better decisions—ultimately improving student achievement significantly.

THE RIGHT DATA: The analyses that comprised the College-Going Diagnostic drew from various datasets resident in a number of databases and tables within CDE. These files were combined with student college enrollment data from the National Student Clearinghouse (NSC), creating an analysis file that allowed the SDP research team to track students starting in eighth grade, through high school, and into (and through) college. This process of assembling a comprehensive analysis file layered with postsecondary data allowed for extensions of previous analyses of student experiences in high school and college in Colorado.

THE RIGHT PEOPLE: A broad-based, cross-functional advisory group guided the work of the College-Going Diagnostic and ensured that SDP received comprehensive feedback at each stage of the diagnostic process, so that the diagnostic could provide the state with the information it needed to inform the initiatives emerging from the CCHE strategic plan. The advisory group included representatives from CEI, CDE, and the Department of Higher Education (DHE). DHE participants included program directors from the following offices: Colorado Legacy Schools Program, Educator Effectiveness, Data Services, Postsecondary Readiness, Dropout Prevention and Student Engagement, and Research and Planning. SDP Fellows at CDE and CEI provided integral support for this work. Throughout the research collaboration, fellows reviewed emerging findings and provided feedback about how to revise analyses to make them more relevant to Colorado practitioners and policymakers. Fellows were also integral in pulling together the advisory group described above, which consisted of individuals from various agencies who were not accustomed to meeting regularly, despite their working on related initiatives.

THE RIGHT ANALYSIS: SDP researchers began by presenting a broad, descriptive overview of college enrollment and persistence in Colorado. Based on the discussions and feedback of the advisory group, deeper and more targeted investigations were conducted and presented. The initial analyses conducted by SDP and the analysis file compiled by SDP researchers enabled departments within CDE to build on the work started by the diagnostic and conduct their own deep-dive, root-causes analyses in house.

*"Had we not had the **support of the SDP** to run these analyses, we would have been forced to do them in house. Having this preliminary step accomplished for us with such clarity and thoroughness has provided us with the opportunity to begin a deeper analysis much earlier than would have been possible otherwise."*

Greg Hessee

Director – Initiatives, Colorado Legacy Schools (Colorado Education Initiative)

SDP COLLEGE-GOING DIAGNOSTIC

Key Findings

Summary of Key Findings

1. Students' eighth-grade test scores are associated with their high school graduation and college persistence outcomes up to six years later. On-time graduation from high school is associated with seamless enrollment into college, and seamless college enrollment is associated with college persistence—although college persistence rates also vary by college level (two year or four year), ownership (public or private), and geography (in state or out of state).

2. Students who seamlessly enroll in college have different demographic characteristics and academic achievement levels, on average, than students who delay their college enrollment. Similarly, there are some differences in the demographic characteristics and levels of academic achievement of students who enroll in AP courses, compared to (a) students who pursue concurrent enrollment courses and (b) students who pursue neither AP nor concurrent enrollment options, on average. Notably, these differences still exist even after accounting for the fact that districts offer different programs and, thus, enroll students with varying characteristics.

3. After statistically accounting for demographic characteristics and academic achievement, college success can be better predicted by on-time graduation and seamless college enrollment than by AP or concurrent enrollment coursework. However, participating in AP or concurrent enrollment coursework is still associated with statistically significant, higher-predicted probabilities of college persistence regardless of graduation or enrollment timing. College-level characteristics, such as level (two year vs. four year), ownership (public vs. private), and geography (in state vs. out of state), also have an impact on a student's predicted probability of persistence.

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 1

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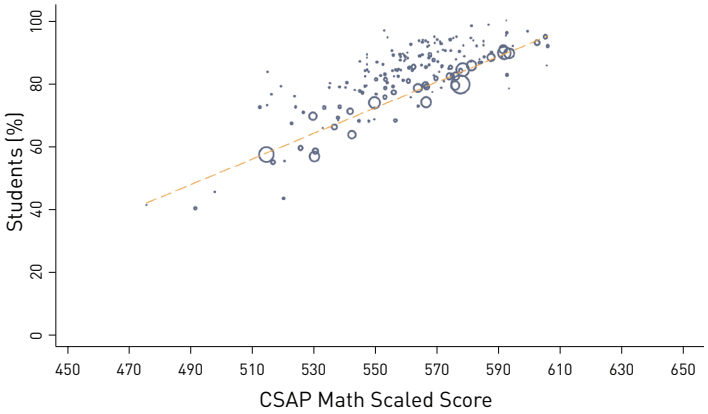
The pathway to college success starts well before students enter high school. It is built upon a foundation of sustained academic success in primary and secondary education and winds according to numerous factors both within and outside students' control (for example, the quality of academic preparation and support offered by their district and whether a student chooses to enroll in college immediately after graduating from high school). In order to appropriately contextualize Colorado high school students' college experiences, we must first understand their high school experiences as well as the implications of the key decisions they make as they transition from high school to college. In the following section, we examine patterns in college enrollment in Colorado and establish descriptive links between high school graduation, college enrollment, and college persistence for students in public school districts in Colorado.

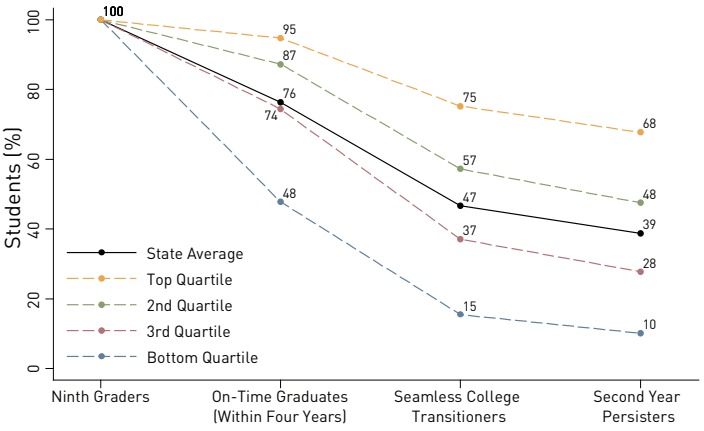
Figure 1 displays the relationship between the average eighth-grade CSAP math scores and graduation rates across districts within Colorado. Each point on the scatterplot is a different school district, and the size of the data point is proportional to the district size in terms of the average number of students in that district per year. As the dashed line indicates, there is a positive association between on-time graduation and the average academic achievement of incoming ninth graders—districts with students with higher average eighth-grade test scores, on average, have a higher proportion of their first-time ninth graders graduate high school within four years; however, there is still some variation in graduation rates among districts enrolling students with similar average eighth-grade scores. For example, among districts with an average CSAP math score around 530, graduation rates vary by as much as 15 percentage points, ranging from about 55% to 70% of ninth-graders who graduate within four years.

Figure 1. Percent of Eighth-Grade Cohort Graduating on Time, by District Average Grade CSAP Math Score



Note. The sample includes 305,205 first-time ninth graders from 2003–04 through 2008–09 with eighth-grade CSAP math scores. Each data point is scaled proportional to the number of students in the ditrict over the five years of data in the sample. All data are from state administrative records.

Figure 2. Student Progression From Ninth Grade Through College, by Students' Eighth-Grade CSAP Math Quartile



Note. The sample includes 202,252 first-time ninth graders from 2003–04 through 2006–07 with eighth-grade CSAP math scores. Postsecondary enrollment outcomes are from NSC matched records. All other data are from state administrative records.

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 1

In addition, students' academic achievement prior to high school is associated with academic outcomes well beyond high school—students' performance on their eighth-grade CSAP assessment is associated with their college persistence outcomes six years later. Figure 2 disaggregates first-time ninth graders into quartiles according to their performance on the eighth-grade CSAP math assessment; each quartile contains roughly the same number of students. By tracking these students through high school and beyond, we see that there are substantial differences in high school graduation and college persistence outcomes six years later.

Of every 100 first-time ninth graders in the top quartile of eighth-grade CSAP math scores, 95 graduate within four years, and 75 graduate within four years and enroll in college in the fall after they graduate. At the same time, only 48 out of every 100 first-time ninth graders in the bottom quartile of eighth-grade CSAP math scores graduate within four years, and only 15 graduate on time and enroll in college in the fall after they graduate.

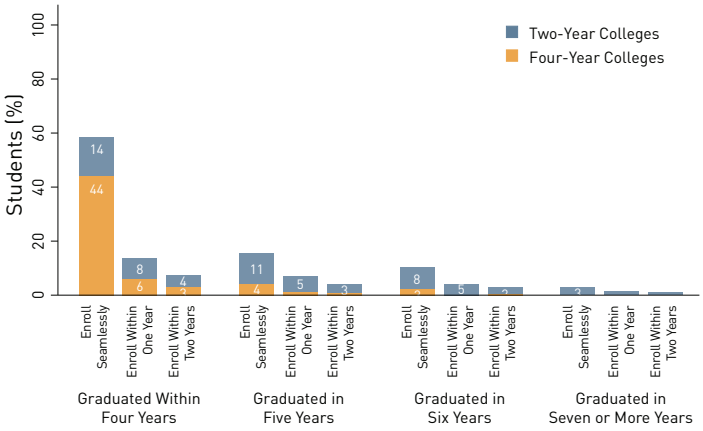
In terms of college persistence, out of the 95 on-time graduates in the top quartile of eighth-grade achievement, 68 (or 72%) enroll in college the fall after they graduate and stay enrolled in college through their second year. However, out of the 48 on-time graduates in the bottom quartile of eighth-grade achievement, only 10 (or 21%) enroll in the fall after they graduate and stay enrolled in college through the second year—the rest either do not enroll in college, or enroll but drop out before their second year in college.

Figures 3–6 investigate the relationships between high school graduation, college enrollment, and college persistence in greater detail. Figure 3 displays the rate of seamless and delayed enrollment at both two-year and four-year colleges for different groups of students organized by their time to high school graduation. The orange bars represent the share of students enrolling in four-year colleges, and the blue bars represent the share of students enrolling in two-year colleges, out of students in their group who have never enrolled in college before. For example, the second orange bar from the left shows that out of students who graduate high school on time but do not enroll seamlessly, only 6% enroll at a four-year college within one year.

As Figure 3 shows, students are most likely to enroll in a college if they graduate high school in four years. This timing effect is largest at four-year colleges but also exists for students enrolling at two-year colleges. Of students who graduate high school within four years, 44% enroll seamlessly at four-year institutions, compared to only 4% of students who graduate in five years and just 2% of students who graduate in six years. At two-year colleges, the magnitudes are somewhat smaller—14% of on-time graduates enroll seamlessly, compared to 11% of five-year graduates and 8% of six-year graduates.

Students are also unlikely to enroll in college if they do not enroll immediately after graduating from high school, both at two- and four-year colleges. Only 6% of on-time graduates who do not enroll seamlessly at a four-year institution do

Figure 3. Seamless and Delayed Enrollment, by Time to High School Graduation For Students Not Previously Enrolled



Note. The sample includes 97,842 first-time ninth graders from 2003–04 and 2004–05 with ninth-grade cohorts. The 'Enroll Within One Year' and 'Enroll Within Two Years' percentages are out of students not yet enrolled in postsecondary education. Postsecondary enrollment outcomes are from NSC matched records. All data are from state administrative records.

Figure 4. One-Year Postsecondary Outcomes for Students Enrolling in Four-Year Institutions, by Time to High School Graduation

Note. The sample includes 42,195 first-time ninth graders from 2003–04 and 2004–05 ninth-grade cohorts. Postsecondary enrollment outcomes are from NSC matched records. All other data are from state administrative records.

Key Finding 1

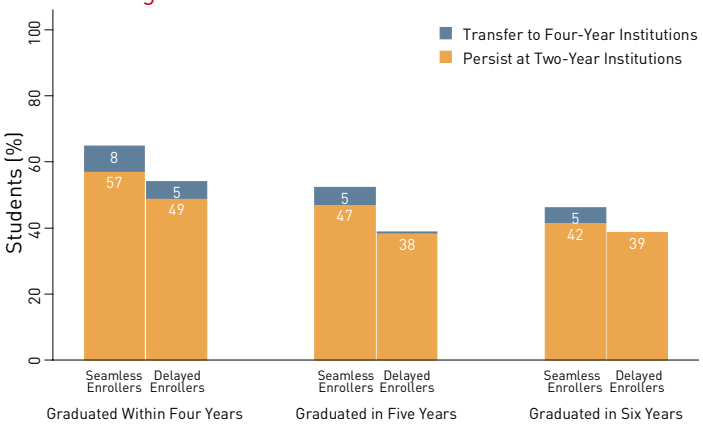
so within one year; of late graduates, the share of delayed college enrollers is lower than 1%. At two-year colleges, the absolute numbers of delayed enrollment are higher, but the trend remains the same. Of on-time graduates, 8% delay college enrollment by up to one year; among late graduates, the numbers are lower at 5% for five-year graduates and 4% for six-year graduates.

After looking at the relationship between high school graduation and college enrollment, we examine the relationship between on-time graduation and seamless college enrollment as they relate to college persistence. Figure 4 illustrates one-year persistence and transfer rates for students enrolling in four-year institutions; Figure 5 is an exact analogue for students who initially enroll at two-year institutions. At both two-year and four-year colleges, on-time high school graduates have higher persistence rates regardless of college enrollment timing. Among on-time graduates who enroll in four-year colleges, 84% of seamless enrollers and 70% of delayed enrollers persist through to their second year. Among five-year graduates who enroll in four-year colleges, 60% of seamless enrollers and 44% of delayed enrollers persist to their second year. At two-year colleges, the numbers are lower across the board, but the same trends are evident: 57% of seamless enrollers and 49% of delayed enrollers who graduate on-time persist to their second year, compared to 47% of seamless enrollers and 38% of delayed enrollers who graduate in their fifth year of high school. Interestingly, college transfer outcomes (represented by the blue bars in each figure) are relatively constant across both high school graduation timing and enrollment timing.

There are also differences in college persistence rates by the level (two year or four year), ownership (public or private), and geography (in state or out of state) of the college that a Colorado high school graduate attends. Figure 6 shows one-year persistence rates for Colorado high school graduates, disaggregated by when they went to college (seamless or delayed), where they went to college (in state or out of state), and which college they went to (public or private).

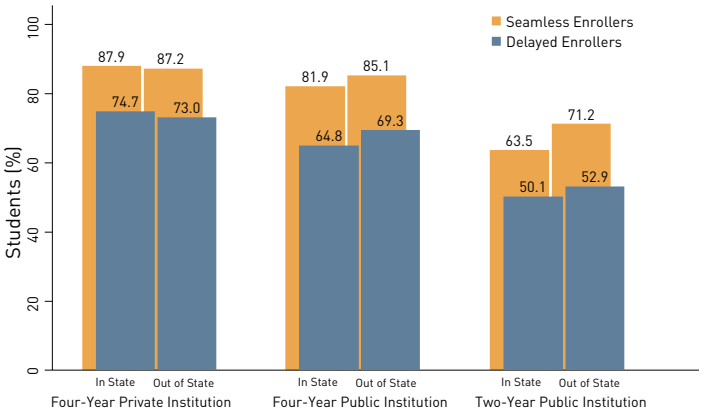
There are three major trends to note from this figure. First, by comparing the clusters of bars, we see that four-year colleges have higher persistence rates than two-year colleges for both seamless and delayed enrollers, regardless of ownership and geography. Second, comparing the leftmost cluster of blue and orange bars to the middle cluster of blue and orange bars, we see that private four-year colleges have, on average, higher persistence rates than public four-year colleges for both seamless and delayed enrollers. In particular, in-state, private, four-year colleges have the highest average persistence rate (87.9%) of any institutional category in this analysis. Finally, looking at the central and rightmost cluster of bars, we see that among students enrolling in public postsecondary institutions, out-of-state colleges (on the right in each cluster) have higher persistence rates than colleges in Colorado, both at the two-year and the four-year level.

Figure 5. One-Year Postsecondary Outcomes for Students Enrolling in Two -Year Institutions, by Time to High School Graduation



Note. The sample includes 16,865 first-time ninth graders from 2003–04 and 2004–05 ninth-grade cohorts. Postsecondary enrollment outcomes are from NSC matched records. All other data are from state administrative records.

Figure 6. One-Year College Persistence, by Enrollment Timing and College Characteristics



Note. The sample includes 155,486 first-time ninth graders from 2003–04 through 2008–09. All other data are from state administrative records.

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 1

Ask Yourself

For state-level administrators:

1) How can CDE facilitate sharing across districts of best practices for preparing students to enroll and persist in college? For instance, would identifying and pairing peer districts (i.e., districts that enroll similarly prepared students in high school but have different college enrollment and persistence outcomes) help promote constructive cross-district sharing of these practices?

2) How can CDE/DHE engage college-ready students who do not attend college immediately after high school to encourage them to enroll in postsecondary education?

3) Why do students leave the state for postsecondary education, particularly those students who attend public institutions out of state? How can CDE/DHE help these students utilize the benefits of in-state tuition and financial aid while designing programs to meet their needs?

For district-level administrators:

1) Given the positive persistence outcomes for on-time graduates who enroll seamlessly in college, what can my district do to support schools in increasing their on-time graduation rate?

2) To which colleges do my students apply and enroll, and how does that affect their postsecondary success? How can I help my students make good higher education choices?

3) Where do students that do not enroll in college after high school go, and what do they do?

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 2

Key Finding 2:

Students who seamlessly enroll in college have different demographic characteristics and academic achievement levels than students who delay their college enrollment on average. Similarly, there are some differences in the demographic characteristics and levels of academic achievement of students who enroll in AP courses, compared to (a) students who pursue concurrent enrollment courses and (b) students who pursue neither AP nor concurrent enrollment options. Notably, these differences still exist even after accounting for the fact that districts offer different programs and, thus, enroll students with varying characteristics.

One of CDE's key levers in increasing the rate of college enrollment and persistence in Colorado is increasing the number of students exposed to college-level coursework in high school. In keeping with CDE's "flexible pathways" approach to increasing college enrollment, CDE has focused on two approaches—increasing the number of students enrolling in AP coursework and expanding student participation in concurrent enrollment programs (offered by districts in conjunction with local community colleges). In thinking about how best to expand these programs such that they have the most impact on college enrollment, it is important to first understand which students enroll in college and where, as well as which students enroll in each program. Such analysis can help determine how the different programs can serve the needs of different kinds of students. In this section, we illustrate the similarities and differences between these groups of students in terms of demographic characteristics and levels of academic achievement, in order to better understand their needs for college-preparatory coursework.

Figures 7 and 8 present seamless enrollment rates at four-year and two-year colleges for each school district in Colorado. Districts across the state are divided into terciles (i.e., three groups of equal size) by their average seamless postsecondary enrollment rates over the school years in the sample; there are roughly 60 school districts in each tercile. Districts with the highest seamless enrollment rates are in blue, followed by districts in light grey. Districts with the lowest average seamless enrollment rates are displayed in orange. The locations of public four-year colleges in the state, as identified by the Integrated Postsecondary Education Data System (IPEDS), are indicated by black dots.

As Section 1 illustrated, most seamless enrollers in Colorado enroll in four-year colleges; in Figures 7 and 8 we see that there is some variation by district, some of which might be explained by geographic factors such as a district's proximity to four-year colleges. By comparing the blue regions to the orange regions in Figures 7 and 8, we see that more districts in the top tercile of seamless four-year enrollment are in the western part of the state, while

Figure 7. Colorado Districts' Average Seamless Enrollment in Four-Year Colleges

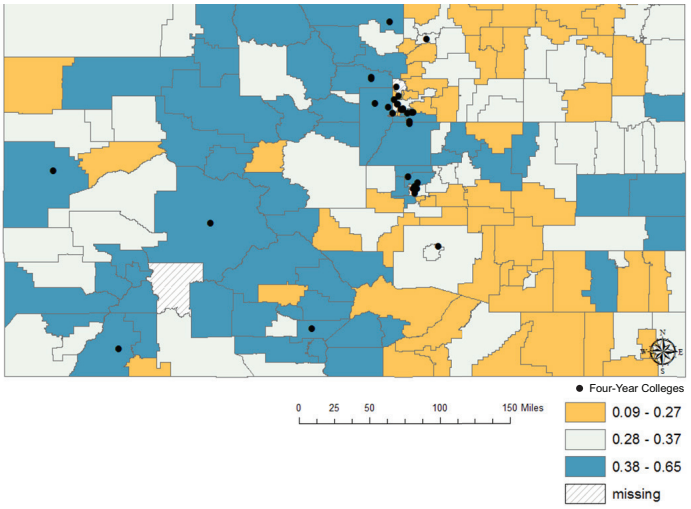
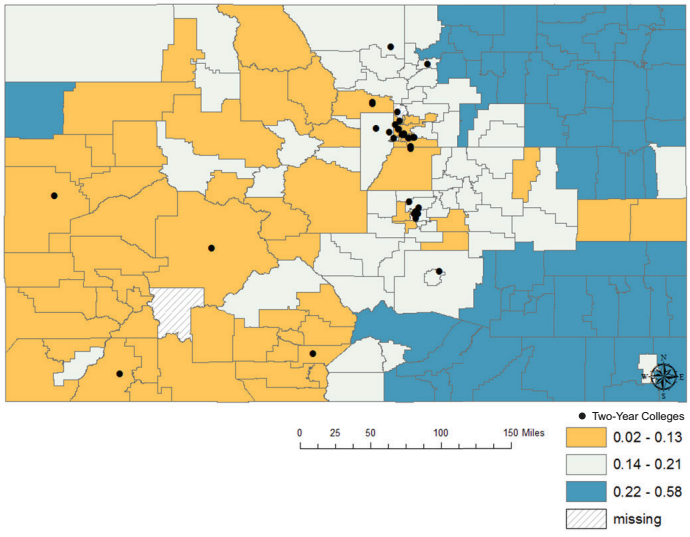


Figure 8. Colorado Districts' Average Seamless Enrollment in Two-Year Colleges



SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 2

nearly all districts in the top tercile of two-year seamless enrollment are located in the eastern half. This geographic split may be explained in part by the location of four-year colleges in Colorado. We notice that there are more four-year colleges located near the districts in the western rural half of the state as compared to the districts in the eastern rural half, which could play a role in explaining the higher four-year seamless enrollment rates in the western rural districts. As Figure 7 demonstrates, the black dots are typically surrounded by districts in blue, with the exception of the Denver metropolitan area (the cluster of dots towards the north of the state), the northeast quadrant of which has low rates of both two-year and four-year seamless enrollment.

Table 1. Characteristics of Students Enrolling in Four-Year Colleges

FOUR YEAR COLLEGES				
Variable	Overall Means		Within-District Means	
	Seamless	Delayed	Seamless	Delayed
Black	4	5	4	5
Asian	4	4	4	4
Hispanic	9	13	10	13
White	82	77	81	78
FRL-eligible (in HS)	11	19	12	18
ELL (in HS)	2	4	2	4
IEP (in HS)	2	4	2	4
CSAP 8 Math	604	588	555	548
CSAP 8 Reading	691	680	652	646
ACT Math	23	21	23	21
ACT Reading	23	22	23	22
Number of Students	116,496	9,442	116,496	9,442

Table 2. Characteristics of Students Enrolling in Two-Year Colleges

TWO YEAR COLLEGES				
Variable	Overall Means		Within-District Means	
	Seamless	Delayed	Seamless	Delayed
Black	6	7	6	6
Asian	3	3	3	3
Hispanic	18	20	17	19
White	72	68	74	71
FRL-eligible (in HS)	23	28	21	26
ELL (in HS)	5	6	5	6
IEP (in HS)	10	9	10	10
CSAP 8 Math	556	551	533	531
CSAP 8 Reading	650	648	633	632
ACT Math	18	18	18	18
ACT Reading	19	18	19	19
Number of Students	39,165	13,816	39,165	13,816

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 2

Figures 4 and 5 (in Section 1) show that the timing of a student's college enrollment is associated with college persistence outcomes, and Figures 7 and 8 show that there are differences across school districts in the level of seamless enrollment at both two-year and four-year colleges. These differences could reflect, for example, differences in college-preparatory coursework offered in each district or the districts' proximity to different postsecondary institutions. However, as Tables 1 and 2 demonstrate, even after we statistically account for the differences in students' school districts, we notice that students who enroll in college seamlessly have different characteristics from students who delay college enrollment on average.

As Table 1 shows, on average, among students enrolling in four-year colleges within a given district, seamless enrollers are more likely than delayed enrollers to be White, to be ineligible for free or reduced lunch (FRL), and to have higher average test scores in eighth and 11th grade (on CSAP and ACT, respectively). For example, looking at the two rightmost columns of Table 1, we see that within a given district, 12% of seamless enrollers are FRL-eligible, compared to 18% of delayed enrollers, and that the average seamless enroller scores, on average, 555 points on the eighth-grade CSAP Math assessment, roughly seven scaled score points higher than the average delayed enrollers. As Table 2 shows, these relationships are largely consistent among students enrolling in two-year colleges as well, although seamless and delayed enrollers at two-year colleges have smaller differences in eighth- and 11th-grade test scores than seamless and delayed enrollers at four-year colleges. These socioeconomic, demographic, and educational differences might have important implications for students' propensity to persist in college independent of their school district, high school coursework, and college characteristics.

Figures 9 and 10 present participation rates in concurrent enrollment and AP courses for each district in Colorado, defined by the borders on the maps. Districts are divided into terciles by the percentage of students taking and passing at least one AP class (Figure 9, top) and the percentage of students participating in at least one concurrent enrollment program (Figure 10, bottom). There are roughly 60 school districts in each tercile; districts with the highest participation rates are in dark blue, followed by districts in middle-blue, and districts with the lowest participation rates are in the lightest blue. Four-year institutions are displayed as black dots in both figures; public two-year institutions are shown as orange stars in Figure 10.

Figure 9. Percent of High School Students Passing at Least One AP Course, by School District

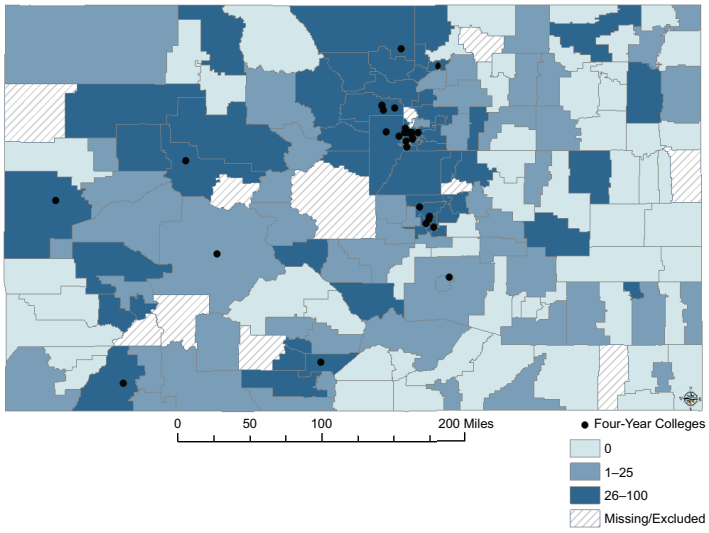
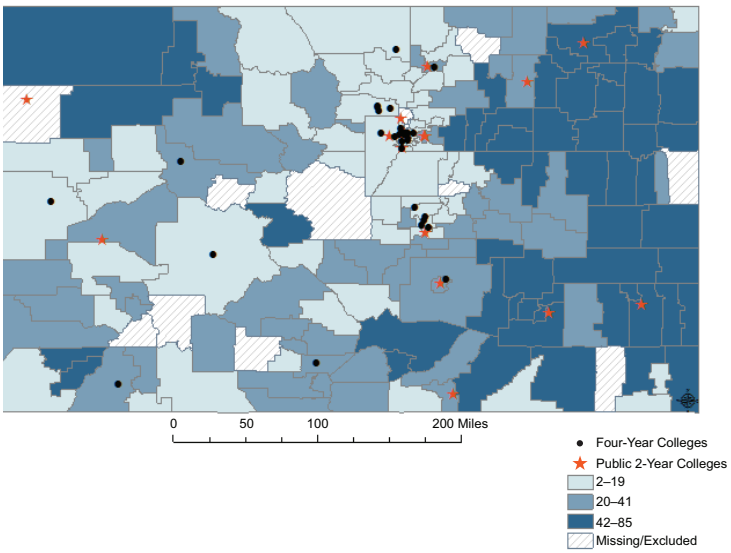


Figure 10. Percent of High School Students Participating in Any Concurrent Enrollment, by School District



SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 2

Similar to Figures 7 and 8, which show geographic variation in seamless enrollment, we see geographic variation in concurrent enrollment and AP participation as well. Figures 9 and 10 show that the districts with the highest rates of AP participation tend to be in the northern and western parts of the state, particularly the districts around Denver; these also happen to be the largest and most urban districts in Colorado. Furthermore, these same districts have comparatively low rates of participation in concurrent enrollment (Figure 9). Conversely, the districts in the eastern part of the state have comparatively low rates of AP participation but high rates of participation in concurrent enrollment coursework; these districts tend to be smaller and more rural, on average.

As with seamless enrollment, there could be a spatial relationship between AP course-taking and concurrent enrollment and the location of postsecondary institutions. High AP districts are located closer to four-year colleges; conversely, high concurrent-enrollment districts are located farther away from four-year colleges and nearer to two-year colleges (outside the Denver area). However, it is also possible that concurrent enrollment occurs online in rural areas.

Table 3 displays the average characteristics of students who enroll in AP or concurrent enrollment coursework after accounting for the differences in the school districts in which they are enrolled. As the table shows, students who participate in either AP or concurrent enrollment coursework are less likely to be FRL-eligible, are less likely to be English language learners (ELLs), and have higher test scores, on average, than students who participate in neither program. These student-level characteristics likely have independent effects on postsecondary enrollment and persistence, so it is important to account for these when investigating the relationships between on-time graduation, seamless enrollment, AP/concurrent enrollment coursework, and college persistence.

Interestingly, looking across the top row of the table, there appears to be a gender gap in participation—although the state gender distribution is 50% male and 50% female on average, 45% of students who participate only in AP coursework and 46% of students who participate in only concurrent enrollment are male; only two out of every five (41%) students who participate in both programs simultaneously are male. Since participation in AP or concurrent enrollment coursework is linked to positive college persistence outcomes (as we shall see in the next section), the gender gap in AP/CE participation could foreshadow a gender gap in college persistence as well .

Table 3. Characteristics of Students Enrolling in AP Coursework and Concurrent Enrollment

Variable	State Average	AP Only	Concurrent Only	None	Both
Male	50	45	46	54	41
White	67	72	71	63	75
Hispanic	22	18	19	26	14
FRL	33	24	28	40	20
ELL	8	1	7	14	1
IEP	9	1	7	14	1
CSAP 8 Math	576	602	577	552	610
ACT Math	20	23	20	18	23
Number of Students	150,748	47,093	13,139	79,756	10,760

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Key Finding 2

Ask Yourself

For state-level administrators

1) To what extent is student mobility a factor in the geographic trends in college enrollment?
   - What factors could explain relatively low four-year college participation in the eastern part of the state?

2) What factors could explain the cross-district differences in AP and concurrent enrollment participation?
   - How does a district's proximity to, and relationship with, local colleges affect the kinds of programs (AP, concurrent enrollment, etc.) offered?

3) What factors could explain the differences within districts in AP and concurrent enrollment participation?
   - Why are female students more likely to enroll in AP/CE programs than male students?
   - What can the differences in the composition of students who take AP coursework vs. CE coursework tell us about those students' needs and which needs are met by each program?

For district-level administrators

1) What types of colleges do students who take AP courses, students who participate in concurrent enrollment, and students who do neither apply to, and how does that relate to their probability of college persistence and degree attainment?

2) What factors might explain the student-level differences (i.e., by gender, FRL eligibility) in AP/concurrent enrollment participation in my district? What is my district doing to encourage AP/concurrent enrollment participation among all students?

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An Overview Of Regression Methods

As Colorado looks to expand their AP and concurrent enrollment programs, it is important to understand what association, if any, these programs have with increased college persistence rates, independent of other observable factors that are linked to college persistence. For example, students from high-income families who do well in eighth grade might be more likely to enroll in AP classes or concurrent enrollment coursework, seamlessly enroll into a four-year college, and have the financial resources to persist through four years of college. In order to determine the role of college-preparatory coursework in these students' college success, it is important to disentangle the interrelationships between economic status, seamless enrollment, college-preparatory coursework, and college persistence. To better understand how each factor is related to college persistence, the following section presents results from a series of multivariate regressions that take into account students' background characteristics and academic achievement and predict students' probability of persisting in college.

In determining the relationship between any two variables, the goal of multivariate regression analysis is to identify and isolate the different observable characteristics of students and school districts (for example, FRL status and prior academic preparation) that may predict variation in the outcome variable (in this case, college persistence). Partitioning the variation in college persistence in this manner allows us to generate independent estimates of the non-experimental impact on college persistence for each of the observable characteristics for each student.

In presenting our results, however, it would be cumbersome to report different results for each individual student or each individual district. Therefore, we present our results in terms of predicted probabilities of persistence for prototypical students—students with average characteristics on each of the observable variables in the data set. It is important to note that these prototypical students do not actually exist, in that these students are part male and are part female, part FRL-eligible and part ineligible, and have a foot in every school district in the state. However, presenting results like this allows us to think about what average results in Colorado might look like.

In interpreting the results of the regression analyses, we must stress that the relationships displayed in the graphs below are not causal estimates of the relationship between the outcome and input variables. While regression analysis accounts for the relationship between observable predictor variables and an observable outcome variable, it does not establish a causal link. We cannot, for example, conclude from these analyses that concurrent enrollment causes better persistence outcomes because students who enroll in concurrent enrollment coursework may be more motivated to attain a college degree in the first place, and we cannot observe, nor account for intrinsic motivation. What we can say, however, is that students who participate in concurrent enrollment coursework are associated with higher rates of college persistence.

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Key Finding 3

Key Finding 3:

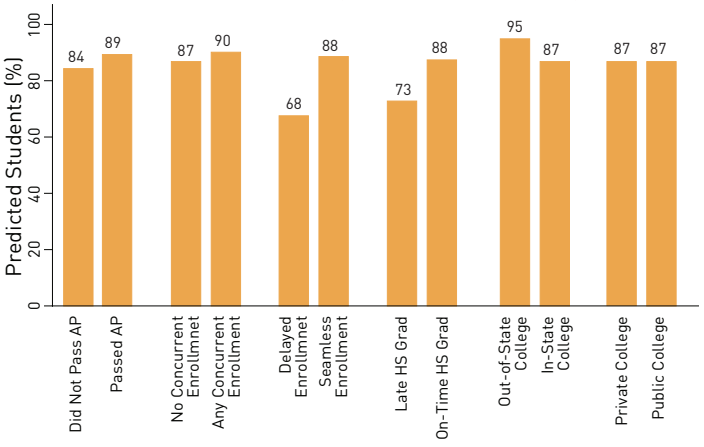
After statistically accounting for demographic characteristics and academic achievement, college success can be better predicted by on-time graduation and seamless college enrollment than by AP or concurrent enrollment coursework. However, participating in AP or concurrent enrollment coursework is still associated with statistically significantly higher predicted probabilities of college persistence regardless of graduation or enrollment timing. College-level characteristics, such as level (two year vs. four year), ownership (public vs. private), and geography (in state vs. out of state), also have a positive and statistically significant relationship with students' persistence in college.

Figure 11 presents the predicted persistence rate for the prototypical student in Colorado public school districts under a variety of "all else equal" scenarios. Each pair of bars in the figure displays the predicted persistence probability (expressed as a percentage) of a student with average characteristics in each situation, all else equal. There are three main points of analysis. First, of all the observable characteristics examined, seamless enrollment in college has the largest direct association with college persistence—if the prototypical student in Colorado were to enroll seamlessly, the predicted persistence rate (88%) would be 20 percentage points higher than that of a prototypical student who delays college enrollment by up to one year (68%), all else equal. Second, the predicted persistence rate for the prototypical student who graduates on time is fifteen percentage points higher than that of a late graduate. Combined, these two numbers reiterate the notion introduced earlier in the brief—on-time high school graduation and seamless enrollment have the largest positive associations with college persistence.

Beyond seamless enrollment and on-time graduation, we see that college-preparatory coursework (AP and concurrent enrollment) and college choice (in particular, college location) are positively associated with college persistence. For example, we see a five percentage point difference in persistence probability for the prototypical student who passes an AP class, compared to the prototypical student who does not pass at least one AP class, all else equal, and a three percentage point increase for the prototypical student who enrolls in concurrent enrollment coursework compared to one who does not. We note that although the observed effects for passing AP classes and enrolling in concurrent enrollment are comparatively smaller, they could be associated with positive externalities; for example, students could benefit from the increased rigor in the coursework or being in the company of more motivated, higher achieving peers in ways that are not reflected in the regression analysis presented above.

Figure 12 is the analogue to Figure 11 for students enrolling in two-year colleges. As before, each pair of bars in the figure displays the predicted persistence probability (expressed as a percentage) of a student with average characteristics in each situation, all else equal. At first glance, the figure shows that the predicted probabilities of persistence across the board are lower than in Figure 11, which comports with the descriptive analyses presented in the previous sections of the brief. However, the general pattern of persistence is the same as with the four-year colleges—the largest direct increase in college persistence is associated with seamless enrollment, with a twenty-nine percentage point increase for the prototypical student who enrolls seamlessly versus one who delays enrollment, all else equal. On-time graduation also has a positive association (ten percentage points), as does passing at least one AP class (four percentage points) and participating in concurrent enrollment coursework (five percentage points).

Figure 11. Predicted One-Year Persistence Rates for Students Enrolling in Four-Year Colleges



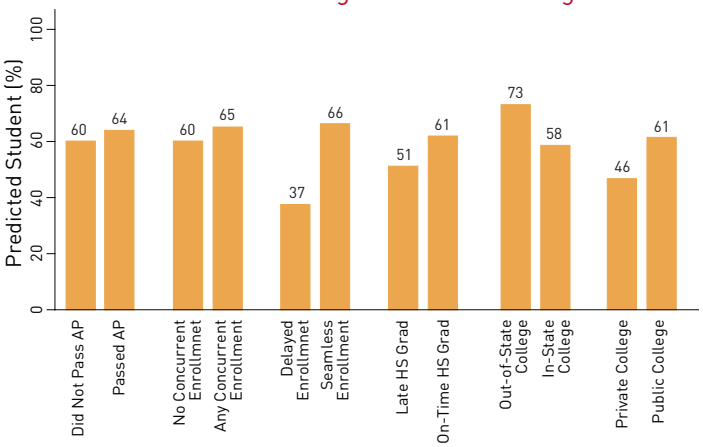
Note. The sample includes 42,557 college enrollers who graduated high school in 2008–09 and 2009–10, for whom AP and concurrent enrollment data were available. Postsecondary enrollment outcomes are from NSC matched records. All other data are from state administrative records.

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 3

However, the relationships between the college-level predictor variables and college persistence have substantially larger magnitudes for students who enroll in two-year colleges than for students who enroll in four-year colleges. First, the prototypical student who enrolls in a public two-year college over a private-two year college has a fifteen percentage point higher predicted persistence rate (46% for private colleges vs. 6 1% for public colleges). Some of this variation might be explained by the fact that public two-year colleges are typically community colleges while private two-year colleges can include for-profit institutions, which typically charge significantly higher tuition and fees for their degree programs; the financial difference might explain some of the difference in the persistence rates by college ownership. Second, we see that the prototypical student who leaves the state to attend a two-year college has a higher (73%) probability of persistence than a student who attends a two-year college in state (58%). At face value, this might seem a little counterintuitive, particularly given that students who leave the state pay out-of-state tuition to their colleges. It is, however, possible that students who go to two-year colleges out of state might be more motivated to attend college or might attend a specialty program not offered within Colorado. More research would be required on these students to understand who they are and why they leave the state to attend two-year colleges.

Figure 12. Predicted One-Year Persistence Rates for Students Enrolling in Two-Year Colleges



Note. The sample includes 8,780 college enrollers who graduated high school in 2008–09 and 2009–10, for whom AP and concurrent enrollment data were available. Postsecondary enrollment outcomes are from NSC matched records. All other data are from state administrative records.

Ask Yourself

For state-level administrators:

1) What might be the relative effects of expanding AP/concurrent enrollment programs across the state on student enrollment and persistence in postsecondary colleges?
   - How would those effects be different for districts with higher community college enrollment, compared to districts with higher enrollment at four-year colleges?
   - How are districts implementing these two programs and with what purposes? Does one program fit a certain type of district better?
   - What might be the benefits of student participation in AP/concurrent enrollment programs on nonparticipating students? How might CDE measure these benefits?

For district-level administrators:

1) What might be the effects of introducing or expanding AP/concurrent enrollment participation in my district?
   - How would those effects be different for students with different kinds of postsecondary ambitions?

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 3

Investigating Changes in Colorado's High School Graduation Guidelines

In 2007, the state of Colorado adopted H.B. 071118, setting forth a process for developing statewide high school graduation guidelines that local boards of education must meet or exceed. In May 2013, the State Board of Education adopted a comprehensive set of guidelines used by each school district board of education in establishing local high school graduation requirements. Local school boards may use their own locally developed high school graduation requirements so long as they "meet or exceed" any minimum standards or core competencies/skills adopted by the state board. Notably, these guidelines emphasized multiple measures of competency across each content area, with a focus on both college and career readiness. A table of minimum competency measures for each content area, as of May 2013, is presented below for reference.

Given this context, stakeholders at CDE and CEI asked SDP to conduct a counterfactual analytic exercise to answer this question: How many former CDE high school students would meet the benchmarks that we are planning to set for future high school students? This section highlights some of the results from SDP's ensuing analysis.

Data Limitations

Given the data that SDP had acquired throughout the course of its engagement with Colorado, reliable data going back multiple years were only available for the CSAP (which transitioned to TCAP in later years) and ACT assessments in math and reading, so those were the only dimensions of the new graduation rates investigated. Under the new graduation guidelines, each student would only have to meet one of the benchmarks for each subject, so it is possible that some students who did not meet the CSAP/TCAP and ACT benchmarks met other benchmarks for graduation (i.e., SAT scores or concurrent enrollment courses). Without SAT or course-level data, however, these dimensions were excluded from the analysis. Consequently, the hypothetical graduation rates are almost certainly an undercount of the true graduation rate of former students under the current graduation benchmarks.

New Insight: Nearly 80% of prior ninth graders would meet the new CSAP or ACT English benchmarks if they were to graduate today, but only 50% would meet the math benchmarks.

Figures 13 and 14 illustrate the percent of students, across three former ninth-grade cohorts, who would have demonstrated competency in English (Figure 13) and mathematics (Figure 14). For each competency category (ACT, CSAP, either, and neither), the bars display the share of former nongraduates, former graduates, and the state average, among students who met the benchmark for that given competency category.

As Figure 13 illustrates, approximately 80% of ninth graders between 2005–06 and 2007–08 who graduated high school would meet one of the new benchmarks for competency in English if they were to be in high school today. In addition, approximately 20% of ninth graders who did not graduate high school would also meet the competency benchmarks. Nearly 25% of former ninth graders who graduated high school would not have met either benchmark in English. We note that among both former graduates and nongraduates, the rates of passing the CSAP benchmark are higher than the rates of passing the ACT benchmark.

Figure 14 displays a similar trend in mathematics, although the magnitudes are slightly lower. On average, only 50% of ninth graders between 2005–06 and 2007–08 who graduated high school would meet the new benchmarks in mathematics if they were to be in high school today; fewer than 10% of former nongraduates would meet the new benchmarks. Unlike the distribution for English benchmarks, however, across all student subgroups, the rates of meeting the ACT benchmark were higher than the rates of meeting the CSAP benchmark.

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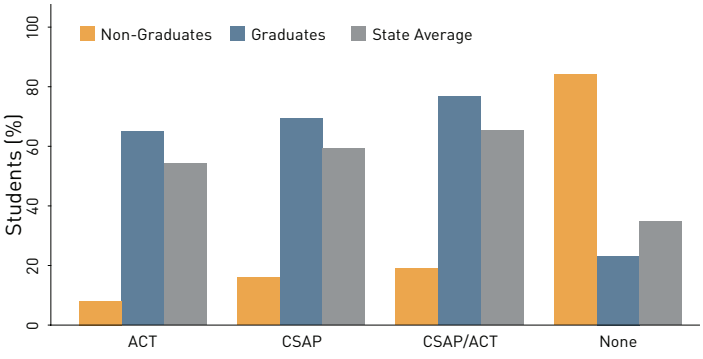
Key Finding 3

Table 4. New Colorado State High School Guidelines, May 2013

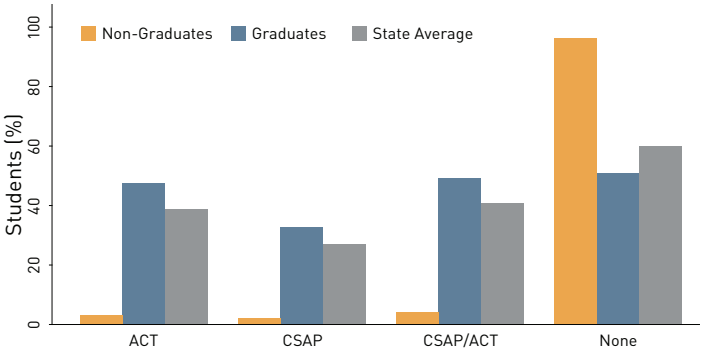
COMPETENCY DEMONSTRATION	ENGLISH	MATH	SCIENCE	SOCIAL STUDIES
TCAP (2013–14 Only)	663	627		
State Test (2013–14 onward)			TBD	TBD
ACT[1]	18	19	TBD	
SAT[1]	430	460		
International Baccalaureate	3 or higher	3 or higher	3 or higher	3 or higher
Advanced Placement	3 or higher	3 or higher	3 or higher	3 or higher
Verified District Capstone[2] (Start 2015–16)	TBD	TBD	TBD	TBD
Concurrent Enrollment College Course	C- or higher	C- or higher	C- or higher	C- or higher
ASVAB (Military) Preferred AFQT score for entry-level jobs	50	50		
Select, Earned Industry Certificate	Awarded (Depending on the certificate, may qualify as interdisciplinary proofs; list of eligible certificates will be developed in 2013–14)			
Additional Demonstrations of Student Competency Approved by State Board	Additions will be made as advances in competency demonstrations become more standardized			

Figure 13. Percent of Ninth-Grade Cohort Demonstrating English Competency for Graduation



Note. The sample includes 187,575 students from the ninth-grade cohorts of 2005–06 through 2007–08. All other data are from state administrative records.

Figure 14. Percent of Ninth-Grade Cohort Demonstrating Mathematics Competency for Graduation



Note. The sample includes 187,575 students from the ninth-grade cohorts of 2005–06 through 2007–08. All other data are from state administrative records.

SDP COLLEGE-GOING DIAGNOSTIC

Key Finding 3

Next Steps/Ask Yourself

1) Given CDE's emphasis on college and career readiness, how can CDE track the workforce outcomes of students who join the labor market immediately after high school?

2) What kind of metrics would be useful in order to measure whether a student is career ready and is having success in a chosen field?

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Conclusion

Agency Partner Note/Response

When SDP, CDE, and CEI began their engagement around the College-Going Diagnostic in early 2012, CDE was in the process of designing and scaling up initiatives around two major strategic goals: reducing achievement gaps and increasing graduation and college enrollment rates across the state. The SDP team tailored the design of the diagnostic analyses, with feedback from the advisory group, so that they would be of immediate use to the state as it worked to achieve those goals. In the months since the completion of the diagnostic, CDE, DHE, and CEI have leveraged the analysis to drive both internal and external agendas. This section describes a few of the ways in which the analysis has helped inform initiatives within Colorado.

Colorado Department of Higher Education

During the course of the diagnostic engagement, DHE was in the process of preparing analyses to support the next round of legislative reporting. DHE was able to leverage the College-Going Diagnostic to help define areas to consider when reporting on student transitions from K–12 education into higher education—particularly as it relates to reporting on delayed enrollment—and the link between concurrent enrollment, AP classwork, and postsecondary success. In addition, the diagnostic findings have generated discussion around the content in reports pertaining to high schools and remedial and concurrent enrollment.

Colorado Department of Education

CDE has used analyses from the diagnostic to directly inform their strategies to drive improvements in reducing achievement gaps and increasing graduation rates. Additionally, the secondary initiatives team within CDE has used the work begun in the diagnostic to support initiatives focusing on dropout prevention, graduation guidelines rollout, counselor corps, and concurrent enrollment. CDE also disseminated the findings of the diagnostic beyond the advisory group, using subsets of the SDP analysis to inform presentations across the state to regional superintendent advisory councils, when presenting on the new high school graduation guidelines.

Colorado Education Initiative

The Colorado Education Initiative has leveraged the areas of the diagnostic related to AP coursework to directly inform initiatives around expanding student enrollment in AP coursework. Specifically, the findings have been critical in developing a nuanced understanding of the benefits of taking AP classes, particularly in terms of understanding that expanding enrollments to AP classes across the state might not have the same impact across the board. In response, CEI has begun collaborative work with CDE and CDHE to pilot a study tracking some students through high school into college and the workforce in order to determine the impact, if any, that participating in well-supported AP programs has on students who do not earn qualifying scores when compared to their peers.

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Appendix

Technical Appendix 1: Data Source

How does SDP know about the college enrollment outcomes of high school students in Colorado?

In partnership with CDE and CEI, SDP obtained college enrollment data by linking the state's administrative student records to postsecondary enrollment data from the National Student Clearinghouse (NSC). NSC is a national nonprofit organization that provides postsecondary enrollment verification for colleges and universities. It maintains student enrollment records for over 3,400 institutions of higher education throughout the United States, including career and technical training institutes, as well as two- and four-year colleges and universities. The analyses presented in this brief are based on data provided by NSC on Colorado students enrolling in postsecondary institutions covered by NSC between 2003–04 and 2009–10.

What are the data limitations that are important to keep in mind?

The colleges included in the analyses: The National Student Clearinghouse data cover only colleges that participate in the NSC program. Although most public and not-for-profit private colleges participate in the Clearinghouse, NSC data cannot be considered a census of postsecondary enrollment. In the Colorado context, this means that students who enrolled in colleges that did not participate in the National Student Clearinghouse are not counted as postsecondary enrollers in the College-Going Diagnostic. Consequently, the enrollment rates presented in this brief are likely an undercount of the students actually enrolled in postsecondary education.

The AP data included in the analyses: Data on AP coursework only includes students who took and passed an AP class at their high schools. Due to the way the data were collected, it was impossible to distinguish between students who took but did not pass AP classes and students who did not take AP classes at all. Note also that AP coursework here refers to taking and passing the school-based class, and not the AP exam as administered by The College Board.

Which students are included in these analyses?

The analyses presented in this brief are a subset of a much larger set of analyses presented to the advisory group during the course of the College-Going Diagnostic. These analyses are based on data provided by CDE, including CDE's October snapshot and end of year snapshot of students between 2003–04 and 2011–12, student ACT and CSAP test scores between 2002–03 and 2010–11, data on students who had taken and passed AP classes between 2003–04 and 2011–12, and data on students enrolled in concurrent enrollment programs between 2008–09 and 2010–11. SDP researchers assembled these data into a student-level analysis file, which organized students into ninth-grade cohorts and examined the trajectories of students through high school and into college, pooling across multiple cohorts of analysis.

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