HIGHER EDUCATION

Advancing by Degrees

A Framework for Increasing College Completion

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Higher education leaders need to understand what really drives student success. Tracking six-year graduation and annual retention rates isn't enough. By monitoring a set of milestones and on-track indicators—measurable educational achievements and academic and enrollment patterns—institutional leaders can learn which groups of students are making progress and which are not—and why. Data college officials gather in this process can inform changes in policies or practices and help struggling students get the help they need.

Advancing by Degrees

A Framework for Increasing College Completion

BY JEREMY OFFENSTEIN, COLLEEN MOORE, AND NANCY SHULOCK

The United States is becoming less globally competitive as other nations move aggressively to educate their populations. To lead the world once again in educational attainment—President Obama's goal by 2020—more Americans will need to enter college. But our biggest challenge isn't college going; it is college completion.

Low-income students and students of color—a large and growing population—complete college at especially low rates. At many institutions, though, graduation rates are not high for any group of students.

Around the country, higher education leaders who want to help increase the number of graduates in their communities and states are all asking the same questions: To improve student success, where should we focus? And how will we know if what we do is working?

- At one major state university system, leaders are concerned that black and Latino students are earning bachelor's degrees at far lower rates than white and Asian students. They find the extensive research literature about student success more overwhelming than helpful. Moreover, their budget has just been cut, and they have to be sure that the steps they take address the root of the problem. Where should they start?
- At a large community college system, leaders know that most students never advance to the point of passing a college-level mathematics course and thus never earn a college degree. System leaders have observed how certain "boutique" programs have helped students succeed in math, but they cannot afford to offer these programs to all students. What changes in institutional practice or policy would help eliminate barriers to success and give students the best chance of passing college-level math?

Experience has taught us that the answers to these questions often lie buried in the reams of data that most colleges routinely produce but rarely analyze. Drawing on our analyses of data from two large postsecondary systems, this report aims to help system and campus leaders use their data to (1) deepen their understanding of what really aids student success and (2) produce a set of timely, "on track" indicators that can rapidly gauge the impact of efforts to produce change.

Timely indicators are hugely important if institutional leaders are to know whether things are on track or off track—before it's too late. Monitoring six-year graduation rates, in other words, doesn't come close to being good enough. Neither does simply monitoring annual retention rates because there is so much more that can help leaders understand what's going right or wrong on the road to college success.

We've provided some examples of how to analyze institutional data and create more useful indicators by drawing on data sets from one public university system and one large community college system. The answers you get may vary somewhat from these, for some things may be more (or less) important in certain types of institutions or for certain types of students.

Regardless of the circumstances, however, there are two things institutional leaders should *never* do as they learn more about the students who don't succeed. They shouldn't lower standards, and they shouldn't excuse low graduation rates for some groups of students because "students like these" supposedly cannot be expected to graduate at higher rates.

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WHAT THE RESEARCH SHOWS

Although students surely must be held accountable for doing their part to prepare for and succeed in college, most institutional leaders know that their colleges could work a lot better for today's students. Fortunately, the research literature is encouraging in this regard. Much is known about factors that lead to student academic progress and degree completion. And much of this is within the power of institutions to affect.

Available research tells us a lot about what matters in efforts to improve student success. Although each study approaches the issue a little differently, most point in the same general direction. And the findings about what matters hold up across different groups of students entering at very different levels of preparation.

Remediation

Many students enroll in college academically unprepared for college-level work. This makes the need for remediation a major barrier for students and suggests the successful completion of remediation as a possible indicator of momentum. Some students who need extra help do not enroll in the appropriate remedial courses, which complicates efforts to evaluate the effectiveness of specific remedial programs. Some research has found that students who successfully complete remedial coursework have persistence and success rates similar to those who start directly in college-level courses, while other studies find little evidence that remediation improves rates of success. A number of researchers have found that students who enroll in remedial coursework immediately upon entering college have better outcomes than those who delay needed remediation.

Gateway Courses

Research in both two-year and four-year colleges points to the importance of enrolling in and completing college-level math early in a student's college career. Some studies also suggest that early completion of science courses can serve as an indicator of likely success. The importance of college-level English courses as an indicator is not as clear: Some studies find a positive relationship between completing college-level English early and degree completion; other studies show no effect.

Credit Accumulation and Academic Behaviors

Research points to the importance of early accumulation of credits as a means of creating momentum toward degree completion. Research on students in both two-year and four-year institutions indicates that earning fewer than a particular number of college-level credits in the first year (typically, 20 to 30) is negatively related to completion. Accumulating additional credits during summer terms is associated with increasing the likelihood of degree completion. This may reflect an impact of summer school attendance per se or the fact that summer provides an opportunity for students to make up for low credits in an earlier term or to retake failed courses. There are also patterns of enrollment that make it difficult to accumulate credits, most notably part-time attendance and stopping out, both of which are consistently found to reduce the likelihood of retention and degree completion.

Studies also have found that students who withdraw from a substantial share of courses (with common measures being 10 percent or 20 percent) reduce their chances of degree completion. This holds true for students in two-year and four-year institutions alike. And in community colleges, research on the impact of registering late for classes has generally concluded that late registrants have higher course-withdrawal rates, lower grade-point averages (GPA), and lower retention rates.

Academic performance in college, usually measured as GPA, provides another important indicator of progress. Indeed, studies find substantial increases in the chance of retention and degree completion with every one-grade increase in college GPA, after controlling for high school preparation and other factors. Other research has emphasized the importance of the trend in a student's GPA. Students with rising GPAs over some number of terms are more likely to earn a degree than students with GPAs that either remain constant or decline over time.

A FRAMEWORK FOR IMPROVING AND MONITORING STUDENT SUCCESS

Institutional leaders who want to do more than monitor year-to-year retention rates and six-year graduation rates may find it helpful to think about things this way:

- **Milestones** are measurable educational achievements that students reach along the path to degree completion.
- **On-track indicators** are measurable academic and enrollment patterns that, if followed, give students a

good chance of reaching key milestones and earning a degree.

By monitoring on-track indicators, institutional leaders can better understand not only which milestones students are failing to reach but *why* they are not reaching them. This knowledge can help leaders design interventions or policy changes to increase student success. Continued monitoring of on-track indicators relative to milestones can help leaders gauge the impact of interventions.

The framework is intended to help leaders understand the problem of insufficient graduation rates, diagnose the reasons behind the problem, and target their responses accordingly. The indicators can form the foundation for an early warning system that can help identify students who are struggling and get them the advice and help they need. Our purposes here, however, are different: to help leaders within an institution look beyond individual students to see general patterns among large groups of students and to use those data to reflect on policies or practices that need attention. These data, in turn, can become a means for measuring the impact of changes in policy and practice.

As we show in the subsequent analyses of data from two large postsecondary systems, the framework can be applied as follows:

- Obtain institutional data with student-level transcript data.
- Analyze student achievement of various milestones by subgroup to identify places where progress stalls.
- Investigate these stall-spots by using on-track indicators to learn which students are not following successful enrollment patterns, where they are stalling, and what they are doing instead.
- Explore the relationships between current institutional policies and practices and the patterns revealed in the analysis.
- Decide on interventions—that is, changes in policy and/or practice—and agree on the most critical on-track indicators to measure in order to monitor the impact of any changes implemented.

Table 1 displays the two key components of the framework derived from a comprehensive review of the literature on postsecondary student success.[1] The research points to milestones, or measureable intermediate outcomes, that vary by institutional type. For example, for students beginning their study in a community college, transferring to a university represents a milestone on the pathway to earning a bachelor's degree. (The degree of progress it represents depends on whether the student transfers after completing all lower division requirements or some lesser amount of transferable coursework.) For students beginning in a university, completing general education coursework would be a milestone achievement.

The research also points to "on-track indicators" related to three categories of student academic patterns:

1. **Remediation**—the importance of addressing any remedial needs immediately on enrollment.
2. **Gateway courses**—the benefit of early enrollment in and completion of certain gateway courses.
3. **Credit accumulation and related academic behaviors**—the importance of building academic momentum through academic behaviors that lead to the timely earning of college credits.

Table 1: Potential Milestones and On-Track Indicators

Milestones	On-Track Indicators
• Return for subsequent terms (retention) • Complete needed remediation • Begin college-level coursework in math and English • Earn one year of college-level credits • Complete general education coursework • Complete a community-college transfer curriculum • Transfer from community college to a university - after completing transfer curriculum - without completing transfer curriculum • Complete a certificate or degree	**Remediation:** • Begin remedial coursework in first term, if needed **Gateway Courses:** • Complete college-level math and/or English in the first or second year • Complete a college-success course or other first-year experience program **Credit Accumulation and Related Academic Behaviors:** • Complete high percentage of courses attempted (low rate of course dropping and/or failure) • Complete 20-30 credits in the first year • Earn summer credits • Enroll full time • Enroll continuously, without stop-outs • Register on time for courses • Maintain adequate grade-point average

The remainder of this report describes our use of data from two large higher education systems to confirm the patterns of student progress and success noted in the research literature and to demonstrate the value of using milestones and on-track indicators to identify points where students are falling "off track." By doing so, college leaders will be able to use that information to change policies and practices to better support student success.

TOO FEW STUDENTS REACH MILESTONES ON THE ROAD TO DEGREE COMPLETION

To examine patterns of student progress in different types of institutions with different levels of admissions selectivity, we obtained data from both a community college system and a university system.

The largest system of its kind in the country, the California Community College system (CCC) has 112 open-admissions campuses. The State University System of Florida (SUSF) is fairly selective in its admissions relative to other public four-year systems. Both CCC and SUSF maintain student-level tracking data at the system offices, and both are large enough to allow for disaggregating data for subgroups of students. Each system provided data to track a cohort of new students over time (see "Data and Methods" on page 7 for more details). Although little remediation occurs in the SUSF, and the CCC did not have good data on remedial placements, their data systems had virtually all of the other elements necessary to track progress.

Milestone Achievement in the California Community Colleges

Figure 1 shows the percentage of degree seekers in a cohort of CCC students who achieved different milestones within seven years.

Among degree seekers in the CCC:

- 74 percent returned for a second semester, and
- 58 percent returned for a second year.

Even within seven years of entry, large numbers of students didn't complete the courses or programs that would make a significant difference in their lives. For example:

- Of entering degree seekers, 38 percent failed to complete even the 12 college credits that researchers generally associate with the achievement of genuine "college pathway" (nonremedial) status.[2]
- A majority—58 percent—failed to earn the one year of college-level credits (30 semester hours) often associated with increased earnings.[3]

Moreover, indicators of completion rates remained low:

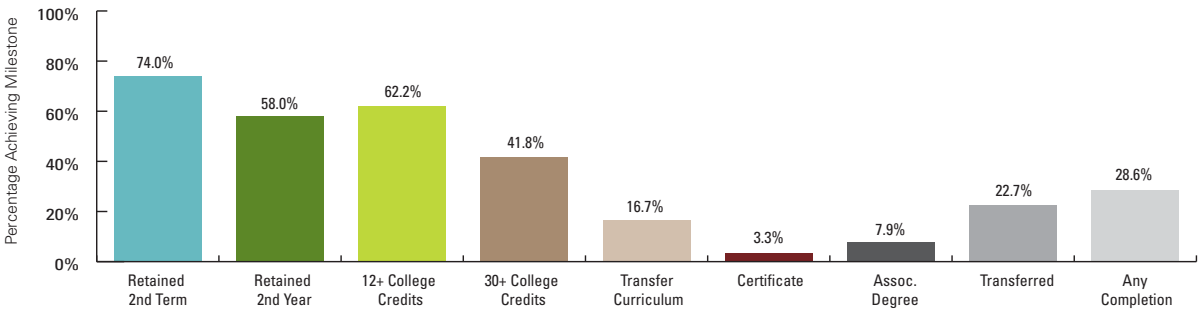
- About 23 percent transferred to a four-year college.
- Roughly half of those who transferred to a university completed a transfer curriculum (not shown), indicating that many transfer students from California community colleges are not entering universities as upper division students.
- Only 3 percent completed a certificate, and about 8 percent completed an associate's degree.

In sum, only about 29 percent of entering degree-seeking students completed *anything*—that is, a certificate, a degree, or transfer to a four-year college.[4]

Given the large number of nontraditional students in community colleges, it is important to examine outcomes by age and attendance status.[5] And indeed, we found some significant differences. Full-time students and those of traditional college age are more likely to reach each of the milestones (see Figure 2) than part-timers and older students. Further, students of traditional college age were more likely to complete a transfer curriculum before transferring to a university (not shown).

Racial and ethnic disparities in outcomes are important to consider, especially given the growing populations of underrepresented minority students in higher education. Among the CCC cohort, white and Asian students were more likely to reach each of the milestones than black and Latino students (see Figure 3). Intriguingly, Latino

Figure 1: Milestone Achievement Among Degree Seekers in the CCC Cohort (within seven years)



students were about as likely as white students to persist to the second term and the second year (not shown), but they were less likely to reach the other milestones.

Black transfer students were far less likely to have completed a transfer curriculum. Indeed, 70 percent of black transfer students moved to a university without having completed such a curriculum (not shown). Related to this lower likelihood of completing a transfer curriculum, black students were considerably less likely to transfer to one of California's public universities, with only 44 percent of black student transfers moving on to one of these institutions, compared with 68 percent of all students.[6]

Figure 4 shows the percentage of degree seekers completing a certificate or degree or transferring to a university by year. The largest numbers of completions occurred in the third and fourth years.

Milestone Achievement in the State University System of Florida

As expected, levels of milestone achievement were higher for students initially enrolling in a four-year institution (see Figure 5). Among the cohort of first-time freshmen in the SUSF:

- By the second semester, 94 percent were still enrolled.
- More than eight in ten students were retained to the second year; nearly 85 percent completed at least one year of college credits.
- Some 70 percent completed at least 15 lower division courses, intended as a measure of completing a general education curriculum.
- Nearly 64 percent completed a bachelor's degree.

Interestingly, there were marked variations in these patterns by race. Black and Latino students were about as likely to complete 30 credits or a general education curriculum, but the likelihood of degree completion was lower, especially for black students. Among white students, for example, almost all of the students who completed 15 lower division courses also completed a bachelor's degree (68.6 percent versus 67.7 percent). Black and Latino students completed 15 lower division courses at rates slightly higher than those of white students, but their rates of degree acquisition were significantly lower—54 percent and 61 percent, respectively (see Figure 6).

Figure 7 shows the percentage of SUSF students completing a bachelor's degree by year. While the largest number of completions occurred in year four, only 32 percent of students had received a degree by that year, half the

Figure 2: Milestone Achievement Among Degree Seekers by Age and Enrollment Status in the CCC Cohort (within seven years)

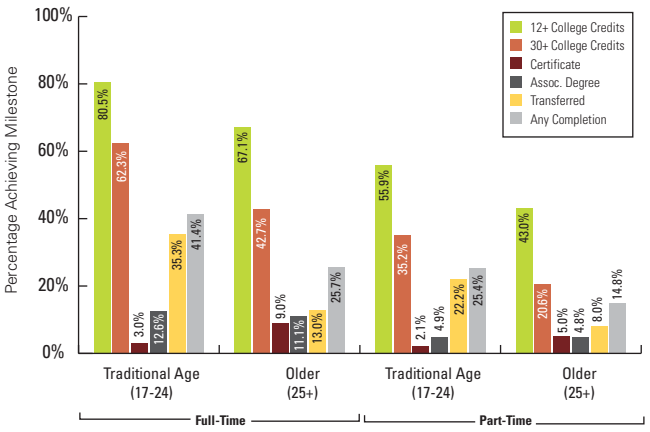


Figure 3: Milestone Achievement Among Degree Seekers in the CCC Cohort by Race/Ethnicity

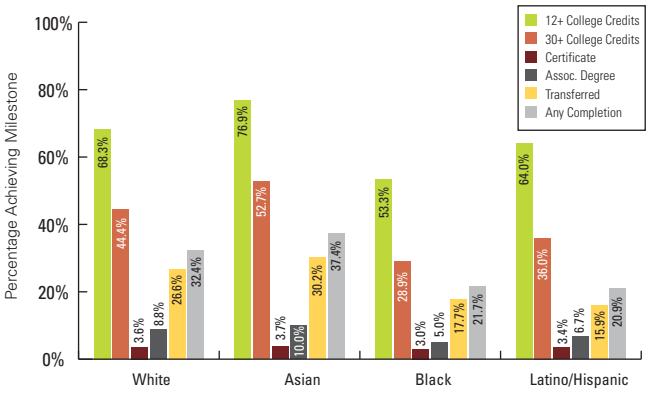
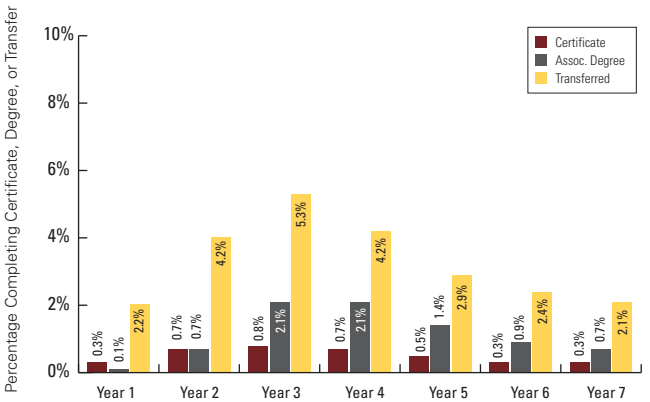


Figure 4: Percentage of Degree Seekers Completing a Certificate, Degree, or Transfer in the CCC Cohort by Year



number who would eventually finish within the eight-year tracking period.

We now turn to the relationship of on-track indicators in Table 1 to the likelihood of completion (of a bachelor's degree in the SUSF and of a certificate/associate degree/transfer in the CCC). Data limitations in each of the systems preclude analysis of some of the on-track indicators, particularly those related to remediation.[7] Nevertheless, what we learned provides some helpful clues about success patterns.

When we began our examination of system data, we knew from previous research that certain things seemed to matter in student success. But we didn't know exactly how they would play out in these very different systems or whether there would be similarities across the systems. An overview of what we learned follows.

ON-TRACK INDICATORS: WHAT DID WE LEARN ABOUT GATEWAY COURSES?

Taking college-level math and English early.

Students in both the CCC and the SUSF cohorts were more likely to "complete"—in the CCC, that means earn a degree, a certificate, or transfer, and in the SUSF it means earn a bachelor's degree—if they completed college-level math and English early in their enrollment with a grade of C or better (see Figure 8).

CCC students who completed a college-level math course within two years of initial enrollment were nearly three times as likely to complete as students who did not complete college-level math in that time period. Similarly, four-fifths of SUSF students who completed a college-level math course in their first year earned a bachelor's degree, compared with fewer than half of students who did not complete a college-level math course in their first year.[9]

Taking "success" courses.

Many colleges offer courses designed to help students achieve in college and in their careers. We call these "success" courses. Completing a success course appears to help many students earn a degree or certificate or to transfer.

Our analysis suggests, however, that it is important to look underneath these overall averages. For example, older students and traditional-age part-time students who completed a success course had higher completion rates in the CCC (see Figure 9). Interestingly, black students in the CCC who completed a success course were less likely to complete than black students who did not. And for Asian students, completing a success course was unrelated to completion.[10]

Figure 5: Milestone Achievement in the SUSF Cohort (within eight years)

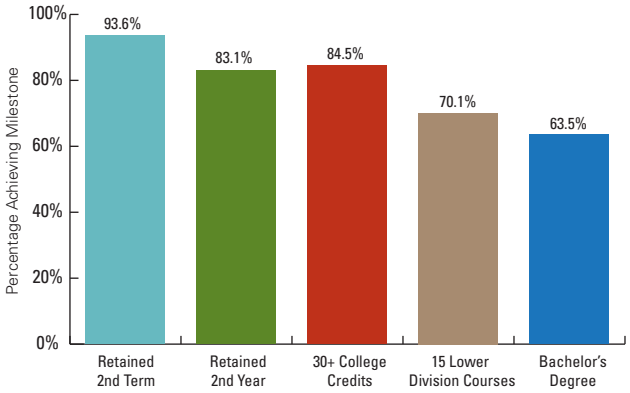


Figure 6: Milestone Achievement in the SUSF Cohort by Race / Ethnicity

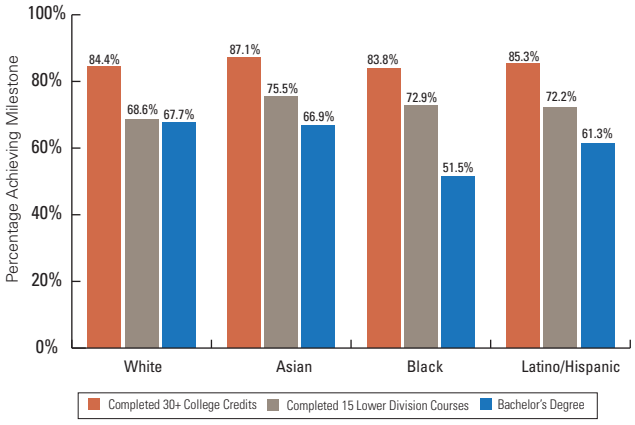
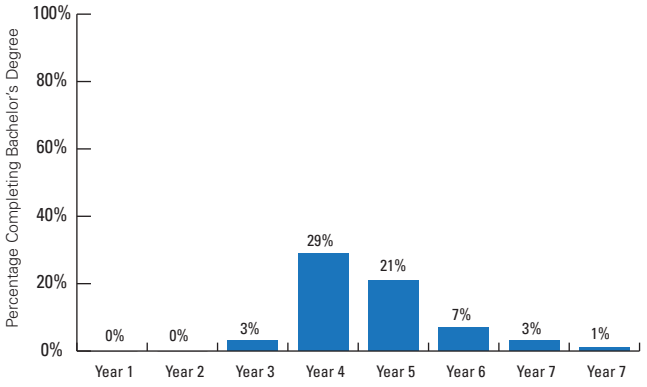


Figure 7: Percentage of Students Receiving a Bachelor's Degree by Year in the SUSF Cohort



DATA AND METHODS

Data Source 1: California Community Colleges Chancellor's Office

The student-unit records (SUR) data include demographic information, courses taken, degrees/certificates earned, and transfers to four-year universities, based on matches to the state's public universities and to the National Student Clearinghouse. We analyzed data for the entering cohort of first-time California Community College students who enrolled in one or more credit-bearing courses during the 2000-01 academic year. Noncredit students and high school students concurrently enrolled in community college were excluded. We tracked the students over a seven-year period, through 2006-07. Data limitations include lack of information on the following: student income or other measures of socioeconomic status and assessment-test scores, placement recommendations, or other indicators of academic preparation for college-level study.

The analyses focus on a subset of students identified as "degree seekers" (a term that includes both degrees and certificates) based on their having enrolled in more than six units during the first year. This definition is based on a recent suggestion by Clifford Adelman as part of national discussions about revising the federal methodology for calculating graduation rates.[8] Using Adelman's suggested criterion, 63 percent of students in the cohort were identified as degree seekers (N=247,493). These students were somewhat younger, with an average age of 24, compared with 26 for the entire cohort of students. Fifty-three percent of degree seekers were younger than 20, and 10 percent were age 40 or older, compared with 45 percent and 17 percent, respectively, for the entire cohort. The gender and racial/ethnic distributions were about the same.

Data Source 2: Florida Board of Governors

The SUR data include demographic information, course-taking records, and records of degrees earned. We analyzed data for the entering cohort of all first-time freshmen in all ten universities in the State University System of Florida in the 1999-2000 academic year. We tracked the students over eight years through 2006-07. Limitations of the data include a lack of information on student income and on credits earned through Advanced Placement exams, concurrent enrollment, or high admission-test scores. All students in the cohort were included in the analyses, as it was assumed that all students enrolled intending to pursue a bachelor's degree (N=30,497).

Methods

We calculated the percentage of students who reached milestones and the rates of milestone achievement for different groups of students. To gauge the probability of degree completion, we examined whether students met the on-track indicators. We used regression analysis to test whether the on-track indicators predicted completion after controlling for other factors and whether the relationships held across all groups of students (such as racial/ethnic groups, age groups, and students who received need-based aid). More details about the statistical analyses are described in the appendix.

In Florida, differences surfaced among campuses. In nine of the ten universities first attended by SUSF students, students who completed a success course were more likely to earn a bachelor's degree than students who did not complete a success course. (see Figure 10).[11]

ON-TRACK INDICATORS: WHAT DID WE LEARN ABOUT CREDIT ACCUMULATION?

Accumulating first-year and second-year credits.

Choosing on-track indicators for credits earned involves several considerations:

- whether to track only college-level credits or to track all credits (including developmental/remedial),
- whether to track only first-year credits or to track credits in subsequent years,
- whether to track credits for all students or separately for full-time and part-time students (note that students often change their attendance status across terms), and
- the appropriate threshold of accumulated credits.

Our research did not find a threshold number that was associated with a substantial jump in the completion rate. Rather, in both the CCC and the SUSF cohorts, we found a fairly linear relationship between the number of credits a student earned and the probability of completion: The more credits earned in the first year, the higher the chance of completing (see Figure 11).

That said, the impact of early credit accumulation was clear in both systems. We set the threshold at 20 credits (of any kind) in the first year for the CCC cohort and 24 credits in the first year and 48 credits through the second year for the SUSF cohort.[12] Fifty-eight percent of CCC students who earned at least 20 credits in the first year completed—three times as many as those who did not earn 20 credits in the first year (see Figure 12). We found a similar pattern for SUSF students. Three-quarters of students who completed at least 24 credits in the first year earned a bachelor's degree, compared with 38 percent of students who did not meet that threshold.

Figure 8: Probability of Completion Based on Early Completion of College-Level Math and English

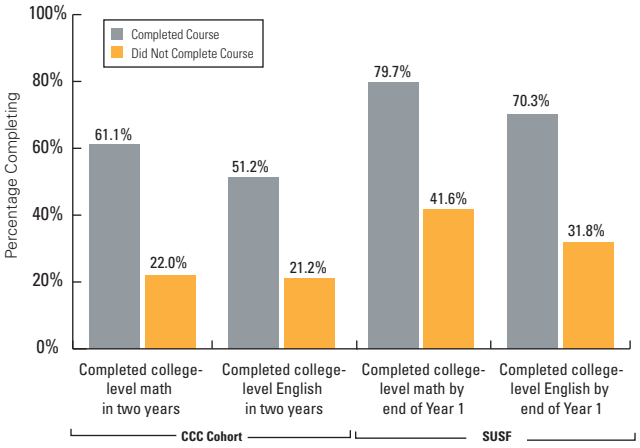
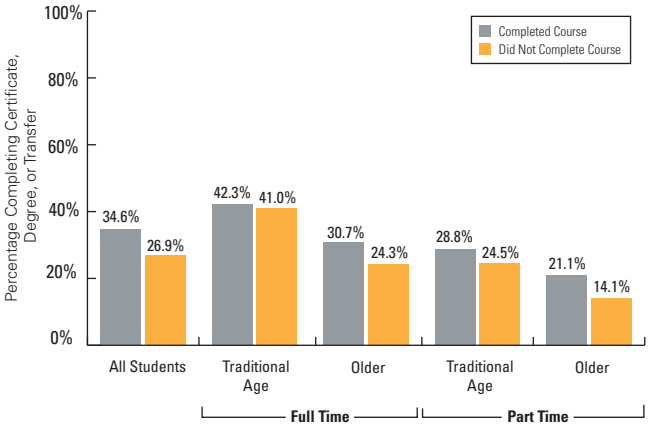


Figure 9: Probability of Completion at CCC Based on Finishing a Success Course, by Attendance Status and Age Group



Completing summer credits.

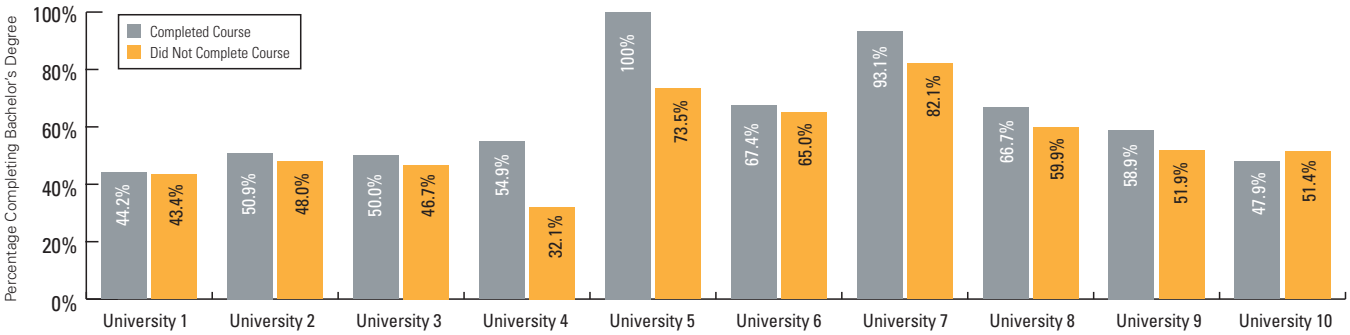
In both the Florida and California systems, students who earned summer credits completed at a higher rate (see Figure 13). The difference in the rate of earning a bachelor's degree between SUSF students who earned summer credits and those who did not was particularly large (75 percent versus 12 percent).

However, before acting on this information, it may be important to understand what it means and what it doesn't. The strong relationship between earning summer credits and completion may not mean that it is summer attendance per se that helps students complete their degrees. Students who attend regularly and persist over a number of years are likely as well to take summer classes.[13] Therefore, summer attendance is in part an indicator that students are being retained and taking a continuous progression of courses. However, summer terms also provide students with an opportunity to build and sustain progress by earning additional credits and retaking courses not completed during other terms.[14]

Completing most courses attempted.

To accumulate credits and build momentum toward completion, students need to complete their courses. We calculated credit-completion ratios as the number of credits earned divided by the number of credits attempted, so that either failing or withdrawing from a course led to noncompletion of credits. We found that rates of earning a degree, attaining a certificate, or transferring were 24 and 40 percentage points higher in the CCC and the SUSF systems, respectively, for students who completed at least 80 percent of the credits they enrolled in during the first year, compared with those who completed a smaller percentage of first-year credits (see Figure 14).

Figure 10: Probability of Bachelor's Degree Completion at SUSF Based on Finishing a Success Course, by First University Attended



Enrolling continuously and full-time.

Obviously, students who attend full time and enroll continuously can accumulate credits faster than students who enroll part time and stop out. What may be surprising is how big those differences are. In the CCC, students who enrolled full time in their first term were almost twice as likely to complete as students who enrolled part time (see Figure 15). Continuously enrolled CCC students had a completion rate that was seven percentage points higher than students who stopped out. Both factors were associated with higher rates of earning a bachelor's degree in the SUSF, although far fewer students enroll part time or stop out in that system.

Once again, there are some differences underneath these averages. In the CCC, for example, continuous enrollment did not correlate with completion for students 25 and older. Similarly, continuous enrollment did not predict completion for Asian students in either system.[15] In the CCC, late registration for courses affected the probability of completion: The likelihood of completion declined as the share of courses a student enrolled in late increased. ("Late registration" was defined as enrolling in a course after the start date of the term.[16]) Students who registered late for no more than one in five of their courses had a completion rate of 32 percent, compared with 24 percent for students who registered late more often. Late registration affected completion for all student groups; nearly half (47 percent) of all CCC students registered late for at least one in five of their courses.

USING MILESTONES AND ON-TRACK INDICATORS TO INCREASE DEGREE COMPLETION

How can our two postsecondary systems use the framework of milestones and on-track indicators to identify problems and design institutional interventions to boost degree completion? As they flag problems and plan interventions, systems like these can take the following steps:

1. Collect data on student progress along the milestones to degree completion.
2. Note at what milestone points student progress is stalling.
3. Analyze on-track indicators to understand what successful patterns are not being followed, leaving students off track for a degree.
4. Intervene through changes in policy or practice that address the problem and increase student success.

Figure 11: Probability of Completion by First-Year Credits Earned

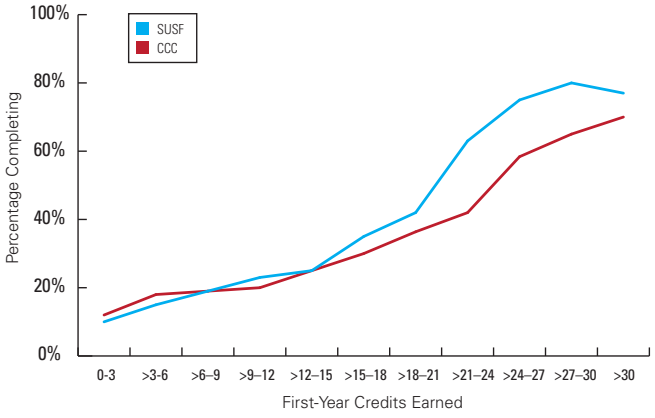


Figure 12: Probability of Completion Based on Early Accumulation of Credits

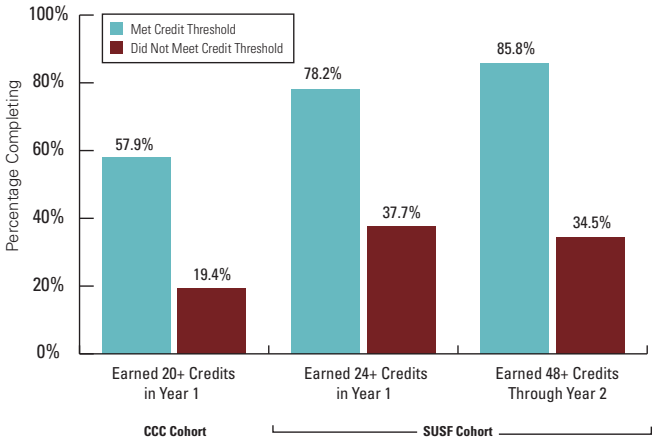
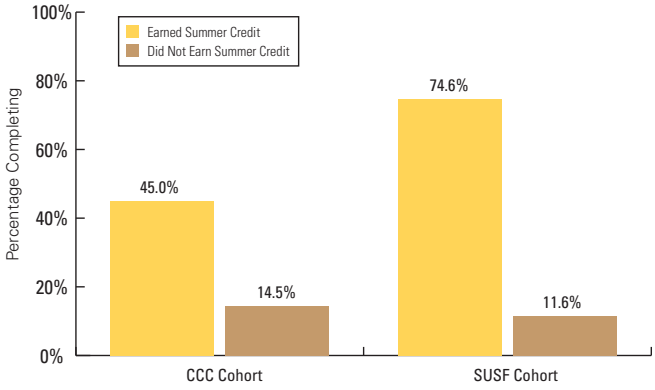


Figure 13: Probability of Completion Based on Earning Summer Credits



5. Monitor the impact of these changes on milestones and on-track indicators.

As an example, we analyzed patterns related to two important on-track indicators: early completion of college-level math and credit accumulation during the first year of enrollment. Figure 16 displays some patterns related to college-level math for CCC students. It shows a large percentage of CCC students did not complete college-level math within two years of entry. About half of those students had not enrolled in any math course within two years. (Further analysis could reveal more about these students, including whether they remained enrolled for the two years or dropped/stopped out.) The other half enrolled in math, with some students taking only remedial courses and others attempting but not successfully completing college-level math.

Figure 14: Probability of Completion Based on Credit-Completion Ratios

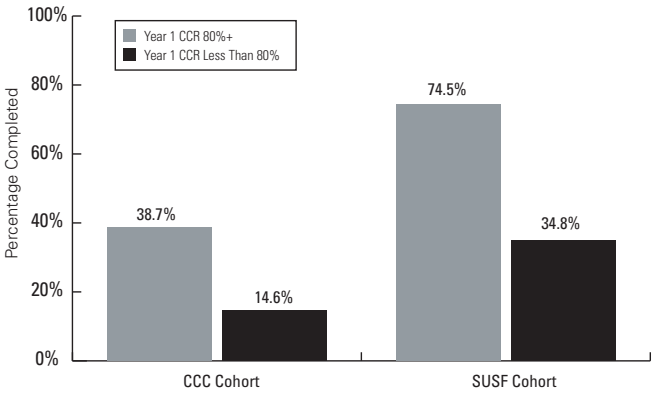
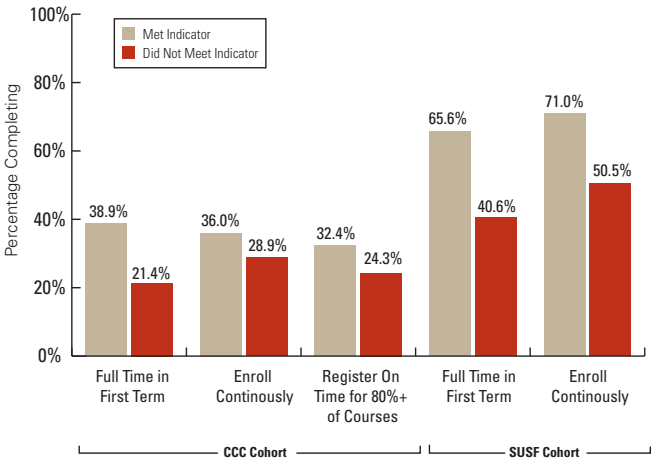


Figure 15: Probability of Completion Based on Attendance Patterns



College officials could change certain policies and practices to increase the share of students completing college-level math, depending on the largest source of the problem in a particular system or institution. Figure 17 displays a similar analysis of patterns related to early credit accumulation for SUSF students.

DIAGNOSING WHY PROGRESS OF BLACK AND LATINO STUDENTS STALLS BEFORE DEGREE COMPLETION

Our analysis shows that it often is important to disaggregate the data and look beneath campuswide or systemwide averages at the performance of certain groups of students. For example, our analysis of milestone completion at SUSF found that black and Latino students completed 30 credits and 15 lower division courses at rates similar to white and Asian students, *suggesting that they were on track to graduate*. But they earned bachelor's degrees at lower rates. So while these students were on track for the first two milestones, they failed to complete the journey—at least by the end of eight years.

Why was this the case? To understand this finding, we took a closer look at the patterns for those black and Latino students who completed the earlier milestones but did not earn a degree. We began by looking at how far these students progressed towards completion. We found that 17 percent of black students and 19 percent of Latino students earned fewer than 60 units and that a larger group of black (45 percent) and Latino (36 percent) students earned at least 105 credits. Although students in neither of these groups completed a degree, their enrollment patterns differed markedly and suggest different problems requiring different institutional actions.

Some of the students who earned fewer than 60 credits may have dropped out of school entirely or stopped out for extended periods of time, but others may have transferred to other colleges, for-profit institutions, or historically black colleges and universities. Perhaps minority students found that the state's public universities did not provide a welcoming climate or did not meet their needs.

With additional data, college leaders could examine a variety of possible explanations for why these students did not progress beyond 60 units. Additional data—such as records of student enrollments at other institutions from the National Student Clearinghouse or qualitative data from interviews or focus groups with students who stopped attending—would provide additional information to help shape policy and practice.

Figure 16: Patterns Related to Early Completion of College-Level Math (CCC Students)

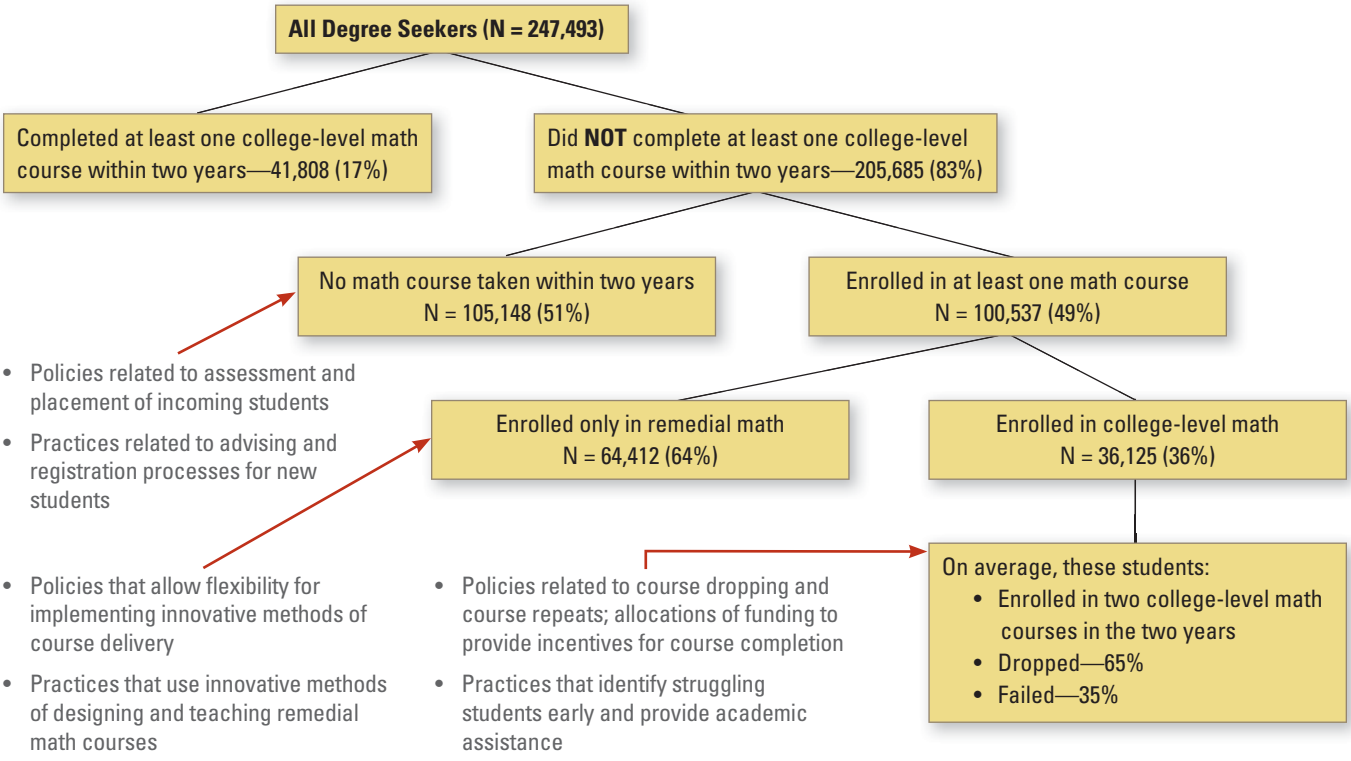
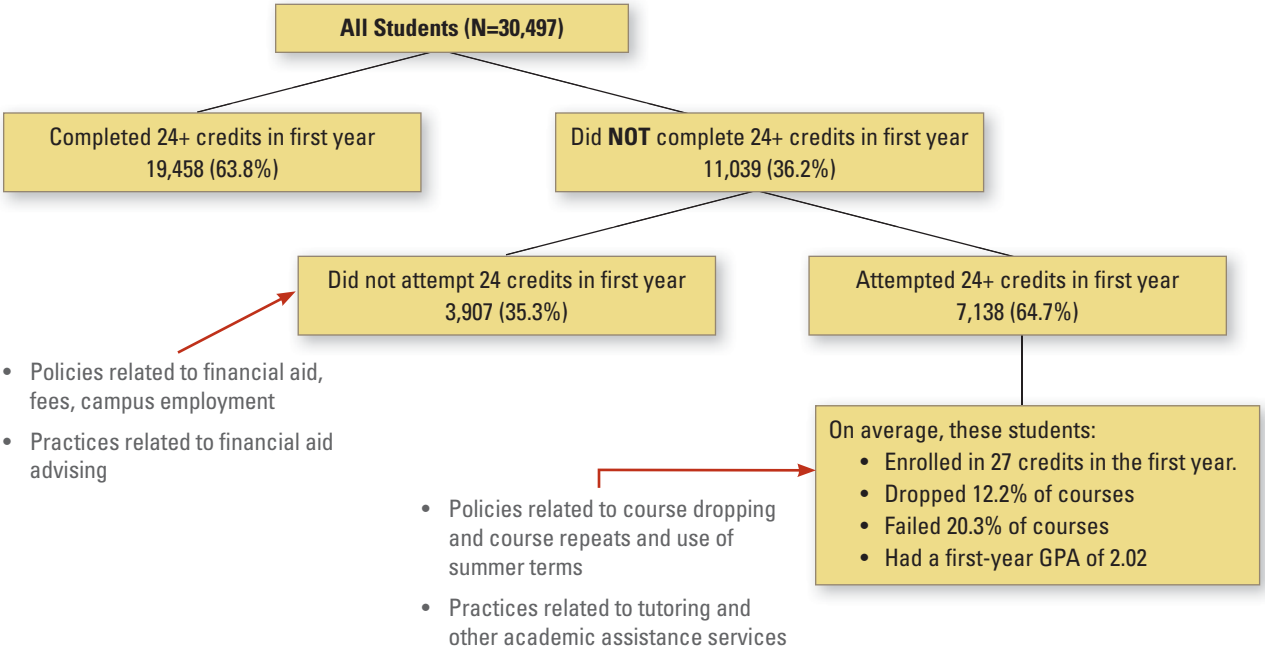


Figure 17: Patterns Related to Early Credit Accumulation (SUSF Students)



In contrast, students who earned 105 credits were well on their way to completion, and additional years of data might reveal that some eventually completed a degree. But experience elsewhere suggests that many may well have simply disengaged. Fortunately, many institutions are finding these students easy to attract back to campus—when they are invited back and their reenrollment is expedited with attentive service. Again, institutions would be wise to supplement quantitative findings of this sort with interviews and other information to learn what they might do to speed the progress of these students.

However, even without additional data, we can use the on-track indicators in our framework to help diagnose why these students failed to move beyond the initial milestones. To illustrate, we compared black and Latino students who did not earn a bachelor's degree with black and Latino students who did earn a bachelor's degree on the on-track indicators. As Table 2 shows, the primary factors that distinguish students who earned a bachelor's degree from those who did not were related to credit accumulation, particularly completing courses and enrolling continuously.

Interestingly, a higher percentage of students who did not complete a degree took a success course than those who did complete. One likely explanation of this finding is that students are either directed towards success courses or choose to enroll in success courses if they are at higher risk for not completing, so the findings reflect enrollment in the course more than the impact of the course. We also found that completion of gateway courses—college-level math and English—did not appear to explain why these students did not earn a bachelor's degree.[17] A large majority of students who did not earn a bachelor's degree did complete these courses. Consequently, this analysis suggests that the appropriate institutional response would be to help students complete a higher percentage of courses and enroll continuously. Interventions might include integrating supplemental instruction into courses with high failure rates, instituting "early alert" systems to identify students having trouble in particular courses, limiting the number of course withdrawals, and examining the adequacy of financial aid policies.

RECOMMENDATIONS

The purpose of this report is to give institutional leaders a new set of tools for diagnosing institutional barriers to degree completion and targeting institutional changes to remove those barriers. This section summarizes the data-collection capacity that institutions need to use these tools and offers a guide for using findings from analyzing the data to improve degree completion.

Data System Requirements

States and institutions must be able to collect basic data to track student progress across milestones and link that progress to the academic patterns that indicate success or lack thereof.

Collect data on students' course enrollments.

Course-enrollment data are necessary to analyze the milestones and on-track indicators discussed in this report. Some higher education systems may only be collecting information on whether particular students enrolled in a specified term, how many units they completed, their grade-point average, or other aggregated information about their experiences. Such data are not sufficient for monitoring the progress and behaviors that our framework comprises. Term-by-term information on individual course enrollments adds a level of detail about students' patterns of enrollment that is very useful for diagnosing where students are falling off track, which in turn points to ways to target changes to policies and practices.

Collect data to analyze important subgroups of students.

To ensure that all students are making progress towards completion, states and institutions should be able to disaggregate data as follows:

- Age
- Race/ethnicity
- Gender
- Income
- Academic preparation (entrance test scores, placement exam scores)

Develop data elements to match milestones and on-track indicators.

Table 1 on page 3 shows a good set of milestones and on-track indicators that institutions should be able to monitor. Tracking some of the elements might require some adjustments, such as adding an element to flag when

Table 2: Analysis of Black and Latino Students Who Completed Intermediate Milestones at SUSF

	Black Students		Latino Students	
	Completed 30 credits, 15 lower division courses, and bachelor's (n=2,625)	Completed 30 credits, 15 lower division courses, but no bachelor's (n=1,315)	Completed 30 credits, 15 lower division courses, and bachelor's (n=2,460)	Completed 30 credits, 15 lower division courses, but no bachelor's (n=751)
Gateway Courses				
Completed Gateway Math*	91.5%	84.3%	88.7%	87.9%
Completed Gateway English*	89.8%	94.1%	89.6%	95.5%
Completed a success course	27.4%	36.7%	47.0%	67.2%
Credit Accumulation				
Earned summer credits	96.1%	85.9%	99.1%	91.1%
Credit-completion ratio of >80%	92.6%	53.0%	94.4%	57.5%
Enrolled continuously	81.3%	58.7%	83.1%	51.3%

* Not all students who earned a bachelor's degree completed gateway English and math courses because some students earned credit for these courses through other means, such as Advanced Placement tests.

a student has completed general education or has transitioned from developmental to college-level coursework. Participation in the National Student Clearinghouse is also necessary to track student transfers into other institutions. Absent that tracking, a dropout cannot be distinguished from a successful transfer.

Collect data on student use of campus services and participation in special programs.

Many institutions implement special programs or services to help students, but they fail to collect student-level data associated with those programs and services or to integrate that information with other data. Without such data, it is impossible to evaluate the effectiveness of programs and services in improving student outcomes.

Simplifying Data Collection

Some of the on-track indicators that we looked at are similar and may be interchangeable. For example, first-year GPA, first-year credit-completion ratio, and the number of credits accumulated in the first year are all interrelated. Systems and institutions may want to reduce the number of on-track indicators they track by eliminating those that do not appreciably improve the statistical prediction of completion.[18]

For example, our analysis of the data from Florida indicated that the number of credits students earn in the first year is an adequate predictor of completion without adding first-year GPA and first-year credit-completion ratio. Furthermore, we found that two of the first-year indicators—credits accumulated in the first year and completion of college-level math—predicted completion about as well as using all of the on-track indicators that we identified from the research literature.

It is important to keep in mind while conducting this type of analysis that results may differ from state to state and from year to year within a state. Therefore, we believe it is best to monitor more than this minimal set of on-track indicators, if institutional resources and data systems permit such an approach.[19]

Use Data to Target Institutional Changes

Table 3 on the next page lists some specific actions institutions may consider in response to findings that emerge from their data monitoring and analysis.

Table 3: Using Indicators of Success to Make Changes in Institutional Policies and Practices

Problem Identified	Possible Changes to Policy or Practice
Remediation	
Low percentage of developmental education students complete remediation.	• Ensure that policies support innovative practices such as intensive summer-orientation programs for new remedial students. • Contextualize basic-skills instruction into content courses. • Implement learning communities for developmental students. • Adopt systemwide definitions of college readiness. • Incorporate incentives for institutions to increase success in remedial coursework. • Redesign developmental courses into modules so students only repeat needed sections. • Require early completion of remedial coursework. • Provide brief brush-up courses for students who test near proficiency levels. • Enroll students in college-level courses; provide supplementary instruction and/or summer sessions for nearly proficient students.
Gateway courses	
Low percentage of students complete college-level math course in their first year.	• Better align curriculum and assessment with high schools to improve college readiness. • Require entering students to take first credit-bearing math and English courses immediately (after completing any required developmental courses)—or at least ensure that early advising stresses the importance of taking a math course early in the college career.
Low percentage of students complete a "success" course in the first year *(among part-time and older students)*.	• Ensure adequate course offerings and flexible scheduling. • Better advising for new students about the advantages of such courses. • Require degree-seeking, nontraditional students to enroll in a success course.
Credit accumulation	
Low percentage of first-year students reach a threshold of credit accumulation in their first year *(20-30 semester credits)*.	• Increase use of college success courses, early advising, and similar programs. • Improve financial aid counseling to emphasize benefits of full-time enrollment. • Charge lower per-credit fees for enrolling with a full-time credit load. • Encourage full-time attendance by providing financial aid and other incentives. • Provide financial aid for enrollment in summer terms. • For four-year students, facilitate summer enrollment in community college "back home." • Offer online summer courses. • Require enrollment in at least one summer term.
Low credit-completion ratio in first year.	• Use "early alert" systems and improved tutoring services to provide more academic assistance. • Limit course drops and repeats or impose extra fee for course withdrawal past a certain date or for repeating a course.
High percentage of course enrollments for which students registered late *(after a course begins or within less than some number of days before a term starts)*.	• Limit late registration or impose an extra fee for registering late. • Use success courses to teach students effective enrollment patterns.

APPENDIX

Table A-1: Milestone Achievement by Indicator Attainment for the CCC Cohort

SUCCESS INDICATORS	Retention to second term (74%)	Retention to second year (58%)	Earned 12+ college-level credits (62%)	Earned 30+ college-level credits (42%)	Completed transfer curriculum (17%)	Earned certificate (3.3%)	Earned associate degree (8%)	Transferred (23%)	Any completion (29%)
College-Level Math									
Completed Within Two Years (21%)	92.8%	86.7%	95.9%	83.4%	50.4%	3.2%	20.6%	53.1%	61.1%
Did Not Complete Within Two Years (79%)	70.1%	52.2%	55.4%	33.3%	9.9%	3.4%	5.3%	16.9%	22.0%
College-Level English									
Completed Within Two Years (28%)	91.4%	84.0%	92.4%	76.1%	37.9%	3.5%	17.0%	43.7%	51.2%
Did Not Complete Within Two Years (72%)	68.2%	49.5%	52.3%	30.4%	9.7%	3.3%	4.9%	16.2%	21.2%
Success Course									
Completed (22%)	83.7%	72.6%	76.6%	58.6%	26.1%	3.4%	11.8%	26.9%	34.5%
Did Not Complete (78%)	71.2%	53.8%	58.1%	36.9%	14.0%	3.3%	6.8%	21.4%	26.8%
First-Year Credits									
Earned 20+ Credits (any) (24%)	99.3%	89.0%	97.7%	86.5%	44.2%	6.2%	20.6%	46.4%	57.9%
Did Not Earn 20 Credits (any) (76%)	66.0%	48.3%	51.1%	27.7%	8.1%	2.4%	3.9%	15.7%	19.4%
Summer Credits									
Completed Any (46%)	84.5%	75.4%	85.9%	67.6%	30.7%	4.9%	13.9%	36.5%	45.0%
Did Not Complete Any (54%)	64.9%	43.1%	41.9%	19.6%	4.7%	2.0%	2.8%	10.8%	14.5%
First-Year Credit-Completion Ratio									
Completion Ratio >80% (62%)	80.5%	66.6%	73.8%	52.0%	21.9%	4.5%	10.9%	27.8%	38.7%
Completion Ratio < 80% (38%)	63.4%	44.1%	43.3%	25.1%	8.2%	1.5%	3.0%	15.2%	14.6%
Full-Time Attendance									
Full Time in First Term (41%)	81.6%	69.2%	78.3%	59.1%	27.3%	3.8%	12.3%	31.8%	38.9%
Part Time in First Term (59%)	68.6%	50.3%	51.0%	29.7%	9.3%	3.0%	4.8%	16.9%	21.4%
On-Time Course Registration									
On Time for >80% of Courses (53%)	75.1%	60.3%	65.3%	46.3%	20.0%	3.8%	9.9%	26.1%	32.4%
On Time for < 80% of Courses (47%)	72.6%	55.4%	58.8%	36.6%	13.0%	2.8%	5.6%	19.6%	24.3%
Continuous Enrollment									
Continuously Enrolled (40%)	100.0%	68.8%	68.2%	48.7%	23.3%	3.9%	12.1%	29.1%	36.0%
Not Continuously Enrolled (60%)	77.3%	67.5%	73.8%	49.1%	17.1%	3.7%	7.3%	22.9%	28.9%

Table A-2: Milestone Achievement by Indicator Attainment for the SUSF Cohort

SUCCESS INDICATORS	Retention to second term (94%)	Retention to second year (83%)	Earned 30+ credits (85%)	Completed 15 lower division courses (70%)	Completed baccalaureate (64%)
College-Level Math					
Completed in First Year (58%)	98.0%	91.9%	94.9%	81.3%	79.7%
Did Not Complete in First Year (42%)	87.8%	71.3%	70.9%	55.3%	41.6%
College-Level English					
Completed in First Year (84%)	96.9%	88.1%	90.3%	76.4%	70.3%
Did Not Complete in First Year (16%)	78.2%	59.6%	58.2%	41.2%	31.8%
Success Course					
Completed in First Year (19%)	95.0%	84.5%	85.8%	74.9%	54.7%
Did Not Complete in First Year (81%)	93.3%	82.8%	84.5%	69.2%	65.6%
First-Year Credits					
Earned 24+ Credits (64%)	100.0%	94.9%	97.7%	86.2%	78.2%
Did Not Earn 24 Credits (36%)	82.5%	62.5%	62.1%	43.0%	37.7%
First-Year and Second-Year Credits					
At Least 48 Credits (57%)	99.9%	99.9%	100.0%	92.5%	85.8%
Less Than 48 Credits (43%)	85.4%	61.3%	64.9%	41.9%	34.5%
Summer Credits					
Completed Any (83%)	96.9%	91.0%	94.9%	81.1%	74.6%
Did Not Complete Any (18%)	78.1%	46.2%	36.2%	19.1%	11.6%
First-Year Credit-Completion Ratio					
Completion Ratio >80% (72%)	97.1%	91.8%	94.6%	82.4%	74.5%
Completion Ratio < 80% (28%)	84.5%	60.4%	59.2%	39.6%	34.8%
Full-Time Attendance					
Full Time in First Term (92%)	94.6%	84.4%	86.4%	72.4%	65.6%
Part Time in First Term (8%)	82.2%	68.4%	66.3%	50.1%	40.6%
Continuous Enrollment					
Continuously Enrolled (77%)	100.0%	90.8%	87.8%	76.3%	71.0%
Not Continuously Enrolled (23%)	89.4%	72.9%	89.8%	62.8%	50.5%

REGRESSION RESULTS

Using data for the CCC and SUSF systems, we ran two logistic regression models for all students and for each of several subgroups for each cohort. Each model included demographic variables, and the first model added first-year success indicators; the second model included indicators from the second year as well as indicators based on the students' full enrollment period. Dummy variables were used in all models to control for institutional effects. For simplicity, we have included tables summarizing the findings that use a "+" to indicate a statistically significant positive relationship and a "-" to indicate a statistically significant negative relationship with completion.

Table A-3: Regression Models on the Likelihood of Completing a Certificate/Degree/Transfer | CCC Cohort

	All Degree Seekers	Full-Time Traditional Age	Part-Time Traditional Age	Full-Time Older	Part-Time Older	White	Asian	Black	Latino
First-Year Indicator Models									
Demographic and Attendance Characteristics									
Female	+	+	+	+	+	+	+	+	+
Age 25+	-					-	-	-	-
Asian	+	-	+	ns	ns				
Black	ns	ns	-	+	-				
Hispanic	-	-	-	-	-				
Other/Unknown Race/Ethnicity	ns	ns	ns	ns	ns				
Ever Received BOG Waiver	+	+	+	ns	+	+	+	ns	+
Success Indicators									
Full-Time (based on first term)	+					+	+	+	+
Year 1 Credits Earned	+	+	+	+	+	+	+	+	+
First-Year GPA	+	+	+	+	+	+	+	+	+
Complete Success Course	+	ns	+	+	+	+	ns	-	+
First-Year Credit-Completion Ratio	+	+	+	+	+	+	+	+	+
Completed College-Level Math in Year 1	+	+	+	+	+	+	+	+	+
Completed College-Level English in Year 1	+	+	+	+	+	+	+	+	+
Second-Year and Beyond Indicator Models									
Demographic and Attendance Characteristics									
Female	+	+	+	+	ns	+	+	+	+
Age 25+	-					-	-	-	-
Asian	-	-	ns	ns	-				
Black	ns	ns	ns	-	+				
Hispanic	-	-	-	-	-				
Other/Unknown Race/Ethnicity	ns	ns	ns	ns	ns				
Ever Received BOG Waiver	+	ns	+	-	+	ns	+	-	ns
Success Indicators									
Full Time (based on first term)	+					+	+	+	+
Year 2 Credits Earned	+	+	+	+	+	+	+	+	+
Second-Year GPA	+	+	+	+	+	+	+	+	+
Completed Success Course	+	+	+	+	+	+	+	+	+
Percentage of Courses Registered Late	-	-	-	-	-	-	-	-	-
Summer Credits (yes/no)	+	+	+	+	+	+	+	+	+
Continuous Enrollment	+	+	+	ns	ns	+	ns	+	+

\+ Indicates a statistically significant (.05 level or better) positive correlation between the indicator and the likelihood of completion.
\- Indicates a statistically significant (.05 level or better) negative correlation between the indicator and the likelihood of completion.
ns Indicates no statistically significant relationship | Shaded cells are not applicable to the student group.

Table A-4: Regression Models on the Likelihood of Bachelor's Degree Completion | SUSF Cohort

		Need-Based Aid		Race/Ethnicity			
	All Students	Need-Based Aid	No Need-Based Aid	White	Black	Latino	Asian
First-Year Indicator Models							
Demographic and Attendance Characteristics							
Female	+	+	+	+	+	+	+
Age	-	ns	-	-	ns	-	ns
Asian	ns	-	ns				
Black	-	-	-				
Hispanic	ns	ns	ns				
Other/Unknown Race/Ethnicity	-	ns	-				
Ever Received Pell	+			ns	ns	ns	ns
HS GPA	+	+	+	+	+	ns	ns
SAT Score	-	-	-	-	-	ns	ns
Credit Hours at Entry	+	+	+	+	+	+	+
Success Indicators							
Full Time (based on first term)	ns	ns	ns	ns	ns	ns	ns
Year 1 Credits Earned	+	+	+	+	+	+	+
First-Year GPA	+	+	+	+	+	+	+
Completed College/Career Success Course	ns	ns	ns	ns	ns	ns	ns
First-Year Credit-Completion Ratio	ns	ns	ns	ns	+	ns	+
Completed College-Level Math in Year 1	+	+	+	ns	+	+	ns
Completed College-Level English in Year 1	ns	ns	ns	ns	ns	ns	ns
Second-Year and Beyond Indicator Models							
Demographic and Attendance Characteristics							
Female	+	+	+	ns	+	+	ns
Age	-	ns	-	-	ns	ns	ns
Asian	-	-	ns				
Black	-	-	-				
Hispanic	ns	ns	ns				
Other/Unknown Race/Ethnicity	ns	ns	ns				
Ever Received Need-Based Aid	ns			ns	ns	ns	-
HS GPA	+	+	+	+	+	ns	ns
SAT Score	-	-	-	-	-	ns	ns
Credit Hours at Entry	+	+	+	+	ns	+	+
Success Indicators							
Year 2 Credits Earned	+	+	+	+	+	+	+
Second-Year GPA	+	+	+	+	+	+	+
Second-Year Credit-Completion Ratio	+	+	+	+	+	+	+
Summer Credits (yes/no)	+	+	+	+	+	+	+
Continuous Enrollment	+	+	+	+	+	+	ns

\+ Indicates a statistically significant (.05 level or better) positive correlation between the indicator and the likelihood of completion.
\- Indicates a statistically significant (.05 level or better) negative correlation between the indicator and the likelihood of completion.
ns Indicates no statistically significant relationship | Shaded cells are not applicable to the student group.

Note: Some of the first-year indicators were not statistically significant. However, this was because of the strong relationships between the indicators and the comparatively smaller sample (the CCC cohort was more than eight times as large). When separate models were run for each indicator and the demographic and attendance characteristics, all of the first-year indicators were significant positively related to completion.

ANALYSES TO SIMPLIFY DATA COLLECTION WHILE PREDICTING SUCCESS

In order to choose a subset of predictors, we compared several models using the first-year predictors from the Florida data in terms of practical and statistical significance. Specifically, we compared models in terms of statistical significance on the basis of the change in the likelihood-ratio statistic and compared the practical significance of the models using an approximation of the R^2 statistic in linear regression, the correlation between the observed outcome, and the predicted probability of the outcome.[20]

We also examined the statistical significance of the individual predictors in the model using the Wald statistic and the practical significance by looking at the size of the odds ratio associated with the predictor.

We found that each predictor or set of predictors we added to the model resulted in a statistically significant improvement in the fit of the model. However, we found that one or two predictors were about as useful in predicting completion as including additional predictors. Table A-5 shows the summary statistics for three of the models we examined. As shown, the model that only included Year 1 credits earned as a predictor was nearly as useful for predicting completion as a model that included all of the first-year predictors. Although adding completion of math in the first year did not lead to a dramatic improvement in the ability of the model to predict completion, the size of the odds ratio suggests that it is practically significant. Therefore, the data from this cohort of students in Florida's four-year system suggest that tracking only first-year credits earned, or tracking first-year credits earned and completion of math in the first year, would be nearly as useful as tracking all four predictors. We found similar results with the data from the California Community Colleges.

Table A-5: Comparison of Three First-Year Predictor Models on Summary Measures of Model Fit

VARIABLES INCLUDED IN MODEL	Squared Correlation Between Predicted and Observed	df	-2 LL
Florida			
Background Characteristics + Year 1 Credits Earned	0.278	20	29801.17
Background Characteristics + All Year 1 Credit-Accumulation Predictors	0.304	23	28945.86
Background Characteristics + Year 1 Credits Earned + Completed College-Level Math in Year 1	0.282	21	29662.01
Background Characteristics + All Year 1 Predictors	0.306	26	28873.79
California			
Background Characteristics + Year 1 Credits Earned	0.180	124	216257.26
Background Characteristics + All Year 1 Credit-Accumulation Predictors	0.201	127	211886.28
Background Characteristics + Year 1 Credits Earned + Completed College-Level Math in Year 1	0.192	125	213922.14
Background Characteristics + All Year 1 Predictors	0.218	130	208432.76

NOTES

1 For a literature review, titled "Student Progress Toward Degree Completion: Lessons From the Research Literature," visit *www.csus.edu/ihe/publications*.

2 Horn, L. & Lew, S. (2007). "California Community College Transfer Rates: Who is Counted Makes a Difference." Berkeley, Calif.: MPR Associates, Inc.

3 For example, see Marcotte, D.E. (2006). "The Earnings Effect of Education at Community Colleges." Baltimore: University of Maryland.

4 We recognize that transferring to a university is not really "completion," given that the goal of those students is a bachelor's degree, and many students do not complete an associate degree before transferring (81 percent of transfers in the CCC cohort did not earn an associate degree). However, transfer is commonly used as a completion measure for community colleges. We were not able to track student outcomes after transfer, but we recognize that a substantial number of students who transfer to universities do not ultimately earn a baccalaureate.

5 For example, see: Adelman, C. (2005). "Moving Into Town and Moving On: The Community College In The Lives of Traditional-Aged Students." Washington, D.C.: U.S. Department of Education; Achieving the Dream Cross-State Data Work Group (2008). Test drive: Six states pilot better ways to measure and compare com-

munity college performance. Boston: Jobs for the Future.

[6] The University of California (UC) and California State University (CSU) generally require students to finish all transfer requirements at the CCC before moving on to one of their campuses. Some lower division transfers are accepted at UC /CSU campuses that have enrollment space available, but lower division transfer students must have completed the 15-course college-preparatory curriculum required for freshman admission (known as A-G) while in high school or must have made up the deficiencies while attending a CCC. Some campuses impose other requirements on lower division transfers, and some take no lower division transfers at all.

[7] There is little remediation done in the SUSF. Florida students who require developmental courses are generally referred to community colleges for those courses, and no records of course enrollments or outcomes are included in the SUSF data. The CCC data do not include any information on assessment tests or placement recommendations in order to identify students who need remediation. The CCC data do include information on remedial course enrollments, but course enrollment does not serve as a valid proxy for "need" for remediation. Many students who need remediation fail to enroll in developmental courses and are therefore misclassified as college ready. The result is an overestimate of the success of "remedial" students and an underestimate of the success of "college ready" students. This problem has also been noted by other researchers using data from other state community college systems (Achieving the Dream Cross-State Data Work Group, 2008).

[8] Adelman, C., "Proposed Amendment for the Student Right-To-Know and Campus Security Act of 1990" (P.L. 101-542) to produce a full and honest account of college completion rates. Obtained through personal communication on June 2, 2008.

[9] Students in Florida's public universities must earn college-level credits in English and math in order to earn a bachelor's degree, but they can earn those credits while in high school (for example, Advanced Placement exams). In this cohort, there were several thousand students who earned a bachelor's degree but never enrolled in college-level math or English at the university. If we counted those students as "not completing college-level math/English by Year 1," it would seriously understate the importance of that indicator in predicting degree completion, since these students did earn college-level credits. Instead, we have counted those students in the "yes" group (completing CL math/English by end of Year 1). Unfortunately, we cannot identify those students who entered with those prior college credits but who did not graduate. Such students are unavoidably counted as not having completed college-level English/math by Year 1 because we have no way to identify them and move them to the "yes" column. Since the overall Florida graduation rate is 64 percent, we believe it is safe to assume that the rate is far higher for students who enter the university having completed college-level English and/or math. Therefore, the number of students miscategorized as "no" should be relatively small (since it is limited to those who came in with college credit but did not graduate in eight years). This unavoidable error does overstate the positive impact of taking math/English by the first year on graduation rates, but we are convinced that it is an important indicator of success since before making this adjustment, completion of college-level math and college-level English were statistically significant predictors of completion.

[10] It could be the case that success courses in the CCC are aimed at students with more risk factors, complicating the relationship of taking a success course and completion. Also, the CCC does not have a code to identify success courses, so we relied on a combination of Taxonomy of Program (TOP) code and course title. We could have misclassified some courses, affecting the results. Better data are needed to accurately identify these courses.

[11] We broke these results down by university because, for this indicator, aggregating across universities misrepresented the relationship. Specifically, aggregating the data across institutions resulted in a higher rate of degree completion for students who did not take a success course than for students who did take a success course. This reversal of the relationship occurred because very few students completed a success course at two of the largest universities, and these universities had relatively high graduation rates. The effect of this was to inflate the overall number of students who did not take a success course and graduated. Furthermore, the small number of students at some universities can lead to some unlikely findings such as the 100 percent completion rate for students taking a success course in University 5. The perfect completion rate occurred because only two students who first attended University 5 completed a success course in their first year, and both happened to complete.

[12] The different credit thresholds reflect the different students served by these types of institutions (that is, community colleges have a larger percentage of part-time students than is typically found in four-year institutions, and more students who are not college-ready and require remediation).

[13] On average, SUSF students who did not earn any summer credits were enrolled for less than four terms (fall/spring), while students who did earn summer credits were enrolled for an average of more than eight terms.

[14] Adelman, C. (2006). "The Toolbox Revisited: Paths To Degree Completion From High School Through College." Washington, D.C.: National Center for Education Statistics.

[15] A smaller sample size for Asians (5 percent of the sample was Asian) limited the ability to detect the relationship and could explain the lack of relationship between continuous enrollment and completion for Asian students.

[16] Some courses in the CCC are offered on a compressed schedule and may start sometime after the beginning of the term. Unfortunately, there is no indication in the data for "late start" courses. With input from internal CCC researchers, rules were developed for identifying circumstances where registrations that occurred more than a certain number of days into the term were probably an indication of "late start" courses. These were excluded from the analyses. Data were not available to measure late course registration for the SUSF cohort. Other research has found that late registrants have higher course-withdrawal rates, which would affect credit accumulation (Freer-Weiss, D. [2004]. "Community College Freshmen: Last In, First Out? Journal of College Student Retention," 6[2], 137-154).

[17] We modified the gateway-course completion indicators to cover the entire period of enrollment, instead of just the first year. We were interested in finding out whether failure to complete these courses at any time during their college careers was preventing students from earning a bachelor's degree.

[18] This can be done by examining measures of practical and statistical significance of individual predictors and the overall model. See the appendix for details on this analysis.

[19] An additional concern is that fitting multiple regression models to the data in order to reduce the number of predictors of success runs the risk of choosing a subset of predictors based on some random aspect of the sample cohort.

[20] See Hosmer, D. W., and Lemeshow, S. (2000). "Applied Logistic Regression." 2nd ed. New York: John Wiley & Sons, Inc. for a discussion of summary measures that approximate variance explained.

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