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STUDENT PROGRESS TOWARD DEGREE COMPLETION:

LESSONS FROM THE RESEARCH LITERATURE

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Efforts Growing to Monitor Student Success

There is a growing recognition of the need to increase the number of Americans earning college degrees as evidence mounts that the country's economic competitiveness is declining. A telling indicator of declining fortunes is that the country is doing less well in educating new generations than are many other nations. While the U.S. is first among the 29 Organisation for Economic Co-operation and Development (OECD) nations in the percent of its population ages 55 to 64 with an associate's degree or higher, its ranking falls to 10th for the younger population ages 25 to 34.[1] Recently, President Obama raised awareness of the serious deficiency in education levels and called for the nation to once again lead the world, by 2020, in the share of the population with college degrees.[2] But without intervention, the trend of declining educational attainment will continue as better-educated older workers retire and are replaced by individuals with lower levels of education and skills, placing the economic health and social fabric of the nation at risk (Kirsch, Braun, Yamamoto, & Sum, 2007).

The OECD data show that the U.S. is still near the top in college participation rates but ranks near the bottom among OECD nations in college completion rates. Low rates of completion have increased interest in monitoring student progress and success with a goal of improving outcomes. The former U.S. Secretary of Education's Commission on the Future of Higher Education (2006) recommended formation of a national database to track student success. While concerns over privacy and other issues have made development of such a student-level data base unlikely at the national level, many state governments are developing student unit record systems and accountability programs to monitor student outcomes in their public colleges and universities.[3]

Foundations are also sponsoring a number of efforts aimed at developing better ways of measuring and monitoring student success. The Cross-State Data Work Group, a collaboration of seven states participating in the Lumina Foundation's *Achieving the Dream* initiative, recently developed some measures of student outcomes in community colleges and tested them with data from several states (Jobs for the Future, 2008). Funding through both the *Achieving the Dream* initiative and the Ford Foundation's Bridges to Opportunity project was used by the Community College Research Center to develop a set of student success measures for community colleges (Leinbach & Jenkins, 2008).

Challenges of Measuring Student Progress and Success

Efforts to measure student success have generally been limited to retention, graduation, and transfer rates (see Table 1), but these measures are inadequate to fully understand student progress and degree completion. They are especially inadequate in providing guidance as to how to *improve* student progress and degree completion. These measures have traditionally examined only full-time students beginning in a fall term, and have only tracked retention and graduation within the institution where a student first enrolled.[4] But attendance patterns have

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[1] Organisation for Economic Co-operation and Development, *Education at a Glance 2008*
[2] Field, K. (2009). Obama pledges to support education, urging all Americans to get 'more than a high school diploma.' *The Chronicle of Higher Education*, February 25.
[3] Information on the status of Student Unit Record (SUR) systems by state is available from the National Center for Higher Education Management Systems at http://www.nchems.org/c2sp/sur/.
[4] For example, the graduation rates calculated as part of the U.S. Department of Education's Integrated Postsecondary Education Data System are based on a cohort of first-time/full-time degree-seeking students completing a program within 150% of the normal time at the original institution.

changed. More students are attending college part time, and are enrolling in multiple institutions along the path to a degree (Adelman, 2006).

Traditional measures are particularly difficult to apply to community college students, given both the greater likelihood of non-traditional attendance patterns (Adelman, 2005) and the multiple missions of community colleges that make it a challenge to identify students who are enrolling for the purpose of completing a college credential. There is a special challenge in measuring the success represented by transferring from a community college to a university. Some students complete all lower-division requirements before transferring. Other students may complete only a few courses at a community college before moving on to a four-year institution. While both of these circumstances represent a "transfer," they are not equivalent in terms of the degree of progress they represent toward completion of the baccalaureate.

Finally, traditional measures of success ignore the intermediate outcomes that students must achieve on the path to degree completion, including finishing any needed remediation and completing particular courses or sets of courses (i.e., general education requirements or coursework needed for transfer from a community college to a university). By ignoring these intermediate outcomes, traditional measures fail to provide any guidance for interventions to increase degree completion.

Table 1
Traditional Measures of Student Success

Ultimate Outcomes	Intermediate Outcomes
▪ Graduation rates ▪ Degrees awarded	▪ Term-to-term retention ▪ Year-to-year retention ▪ Transfer from community college to four-year institution 　o without completing two-year transfer curriculum 　o after completing two-year transfer curriculum

The research literature on postsecondary student success points to achievements along the college pathway that may give students momentum toward successful degree completion. Tracking these intermediate outcomes would allow institutions to identify where student progress stalls, and would point them toward administrative and curricular reforms that could increase degree completion. Federal and state governments could use the information to set better policies that would enable institutions to help more students succeed. Accountability systems that recognize intermediate outcomes may also reduce institutional resistance to measuring student success, particularly among community colleges who serve the students with the most challenges to overcome on the path to degree completion.

Lessons from the Research Literature

There is a general consensus among researchers that college students are more likely to complete a degree if they come from higher-income families, have parents who went to college, have stronger academic preparation in high schools, enroll in college shortly after high school

graduation, are committed to a goal of completing a degree, and attend college full time without interruption (Adelman, 2006; Calcagno, Crosta, Bailey, & Jenkins, 2006). These factors, while well understood, do not provide institutions or governments with specific guidance on measuring student progress toward a degree or intervening with new policies and procedures to increase student success. In fact, understanding these factors really just tells us that "traditional" students are more successful, likely because our postsecondary institutions were designed at a time when most students fit that profile. Given the growing populations of non-traditional students, we need to redesign our institutions and educational programs to be effective with today's students.

There has been considerable attention paid to addressing some of the factors that affect college success by, for example, improving preparation through better alignment across K-12 and postsecondary education and by doing early outreach to families around college preparation, admissions, and financial aid. A more recent and growing part of the literature is aimed at helping institutions and policymakers deal with the realities of non-traditional student populations through identifying at-risk students and developing policies and procedures to foster their success.

Credit Accumulation

Much research has emphasized the importance of early accumulation of college credits as a means of providing momentum toward degree completion. Adelman's (1999) analyses of national data for students intending to complete a bachelor's degree indicate that earning fewer than 20 units in the first year of enrollment is negatively related to completion. Other research supports this finding, with one study demonstrating that, among students beginning their enrollment in a 4-year institution, only 45 percent of those completing fewer than 20 units in the first year went on to complete a degree compared to 91 percent completion among students with 30 credits in the first year (McCormick & Carroll, 1999). An analysis focused on first-generation students found that they earn fewer credits in the first year than other students (Chen & Carroll, 2005). Completing 30 credits in the first year was positively related to degree completion among these students.

While the studies cited above focused primarily on students enrolled in four-year institutions, other research has confirmed the importance of early credit accumulation for community college students. In an analysis of students beginning in community colleges, Adelman (2005) found that bachelor's degree attainment was 15 percent lower for students who earned less than 20 credits in the first calendar year of enrollment compared to students who earned 20 or more credits. A recent analysis of first-time, degree-seeking students in Florida's community college system found that reaching each of three credit thresholds - 24, 36 and 48 semester units – was associated with a higher likelihood of transferring to a university (Roksa & Calcagno, 2008). Another study of Florida's community college students found that reaching the point of earning 20 non-remedial credits increased the odds of graduating (Calcagno et al., 2006). An analysis of older and low-skill students in Washington's community and technical college system found fairly low rates of completion, but identified the accumulation of one-year of college credits (30 semester units) and some kind of credential to be the "tipping point" that resulted in wage gains (Prince & Jenkins, 2005).

An analysis of community college students, using data for all Florida colleges and for institutions in other states participating in *Achieving the Dream,* points to the importance of monitoring credit accumulation over time (Marti, 2007). The study identified sub-groups of students based on their attendance patterns over three years. The results indicate that students who accumulated credits at a declining rate over successive terms (labeled "long-term decliners" in

the study) were less socially and academically engaged in college according to their responses to the Community College Student Report.[5] These students were notably less engaged than students who attended only part-time but accumulated credits at a steady pace across terms, suggesting that the decline in credit accumulation was a marker of limited engagement and of being at high risk of dropout.

Some research also suggests that accumulating credits during summer terms increases overall credit accumulation (McCormick & Carroll, 1999) and the likelihood of degree completion (Adelman, 2005; 2006). The impact of summer term credits may be especially high among African-American students. In one study, among black students who initially enrolled in four-year colleges, the rate of degree completion was 78 percent for those who earned more than four summer-term credits, compared to 21 percent for students who earned no credits during the summer (Adelman, 2006). Among students initially enrolling in community colleges, Adelman (2005) found that earning any credits during summer term increased the probability of bachelor's degree completion by 20 percent.

Gateway Courses

Many studies also suggest the importance of completing certain gateway courses, especially math, early in their college career. Using data from the National Education Longitudinal Study (NELS:88), Adelman (2006) found that, among students who began their studies in either a community college or a university and completed a bachelor's degree, more than 70 percent had successfully completed credits in math courses during the first two years of enrollment. About half as many of the students who did not complete a degree had earned credits in college-level math in the first two years. Another study using similar data from an earlier national survey (High School & Beyond [HS&B]) found that completing college-level math courses increased the probability of bachelor's degree completion, with the largest effect for completion of three math courses, which increased the chance of degree completion by 42 percent (Cabrera, Burkum, & La Nasa, 2005). And an analysis of data in one large public university found that freshmen who took no math courses were five times less likely to return the following year, and that performance in the first-year math course was the second strongest predictor of retention after first-year GPA (Herzog, 2005).

A number of studies have found the probability of transfer and degree completion to be related to math course-taking for community college students. Cabrera and his colleagues (2003; 2005) found that community college students who completed two math courses were 19 percent more likely to transfer. An analysis of students initially enrolling in community colleges found that the number of credits earned in college-level math was a significant predictor of both transfer to a university and earning an associate degree (Adelman, 2005). Each step up the three levels of math credits earned (none, 1 to 4, more than 4) increased the probability of transfer by 22.7 percent and the probability of earning an associate degree by 11.5 percent. A recent analysis of first-time, degree-seeking students in Florida's community college system found that students who passed a college-level math course were more than twice as likely to transfer as those who did not (Roksa & Calcagno, 2008). The effect was even stronger for students who had been academically unprepared for college at the time of enrollment. An academically unprepared student who passed a college-level math course was more than four times as likely to transfer as a similar student who did not.

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[5] The CCSR, the survey instrument for the Community College Survey of Student Engagement (CCSSE), asks students about their college experiences — how they spend their time; what they feel they have gained from their classes; how they assess their relationships and interactions with faculty, counselors, and peers; what kinds of work they are challenged to do; and how the college supports their learning. See www.ccsse.org.

Some studies suggest that completion of courses other than math can also serve as indicators of success. In their analysis of HS&B data, Cabrera and his colleagues (2005) found that students who took one science course were 20 percent more likely to complete a bachelor's degree, and students who took three science courses were 27 percent more likely to complete. Among community college students, those who took two science courses were 33 percent more likely to transfer and, among the lowest-income students, those who took only one science course were 55 percent more likely to transfer. The importance of college-level English courses as an indicator is not as clear. Adelman (2006) found a statistically significant difference in the percent of students who completed credits in college-level writing between students who successfully completed a bachelor's degree (85%) and those who did not (69%), but the difference was much smaller than for math. Roksa and Calcagno (2008) found no increase in the likelihood of transfer for community college students who passed a college-level reading course.

Academic Performance

The overwhelming consensus in the research literature is that students' academic preparation in high school is strongly related to college outcomes (Adelman, 1999; Altonji, 1996; Berkner, He, Cataldi, & Knepper, 2002; Hoachlander, Sikora, Horn, & Carroll, 2003). However, some research suggests that the predictive strength of high school preparation declines when variables representing college academic performance are included in the models. DesJardins and his colleagues (2002) used HS&B data to replicate Adelman's (1999) influential *Answers in the Toolbox* study. Using a method that accounts for events taking place over time, they found that the predictive strength of high school academic resources declined when college GPA was included in the model. The authors argue that this finding demonstrates that high school preparation is important because it affects college GPA, which in turn predicts completion. In fact, every one-grade increase in college GPA doubled the chance of bachelor's degree completion, after controlling for high school preparation and other factors.

Other researchers have also noted the importance of college GPA as a predictor of student success. Cabrera and his colleagues (2003) found that every one-point increase in GPA increased the chance of bachelor's degree attainment by 32 percent. Adelman (1999) found that the probability of earning a degree among students who ever attended a four-year college increased by nearly 22 percent if their first-year GPA fell in the top 40 percent among their cohort. The first-year GPA of students initially enrolling in four-year universities has been found to be predictive of both second-year persistence (Herzog, 2005) and degree completion (McCormick & Carroll, 1999; Chen & Carroll, 2005; Herzog, 2005).

Adelman (1999) has emphasized the importance of the *trend* in a student's GPA. He measured GPA at three points in time (first year, first two years, at end of undergraduate career) and found that students with rising GPAs were more likely to earn a bachelor's degree than students with GPAs that either remained constant or declined over time.

Course Completion

A number of studies have concluded that excessive course withdrawals have a negative impact on degree completion (Adelman, 1999, 2005, 2006; Cabrera et al., 2005; Chen & Carroll, 2005; Summers, 2000), making measures of a student's rate of successfully completing courses an important indicator of likely success. Adelman (2006) found that withdrawing from or repeating 20 percent or more of courses decreased the probability of bachelor's degree completion by

nearly half. In a study of community college students, he found that the same level of course withdrawal reduced the probability of transfer by 39 percent (Adelman, 2005).

Others have found somewhat smaller but still substantial effects of excessive course withdrawal. In analyses by Cabrera and his colleagues (2005), students who dropped 10 to 20 percent of courses were 13 percent less likely to complete a degree, and those who dropped 20 percent or more were 27 percent less likely to complete. In examining the success of first-generation students, Chen and Carroll (2005) found that students who withdrew from or repeated less than 10 percent of their courses were more likely to earn a bachelor's degree. Using administrative data for a large cohort of students attending California's community colleges, Moore and Shulock (2007) confirmed the results of the studies that used national survey data sets. As the percentage of courses dropped increased among community college students, the likelihood of completion declined after controlling for other factors, an effect that held for full- and part-time students and for students of all racial/ethnic groups.

Support Programs for New Students

There is a considerable amount of research indicating that a variety of programs intended to provide students with early support are associated with better student outcomes, making participation in such programs a potential indicator of momentum toward completion.

First-Year Experience Programs
Several reviews of the literature on first-year experience programs have noted that much of the research is characterized by self-selection into programs, making it more difficult to attribute positive outcomes to the services received (Bailey & Alfonso, 2005; Muraskin and Wilner, 2004; Pascarella & Terenzini, 1991). However, some contend that "the consistency of the findings gives more weight to the positive conclusions" (Bailey & Alfonso, 2005, p. 15). Studies demonstrate that first-year experience programs increase persistence and success by emphasizing social integration with faculty and peers and by offering academic help and advising to new students (Pan, Guo, Alikonis & Bai, 2008). A recent study of more than 20,000 students in 45 four-year universities indicates that intent to persist in college increases along with students' ratings of first-year seminars as more effective in imparting good study skills, providing information about campus policies, and increasing engagement with peers and co-curricular activities (Porter & Swing, 2006).

Orientation Courses
In research related to first-year experience programs, a number of studies have demonstrated the benefit to students of taking an orientation or "college success" course upon enrollment in college. These courses are intended to provide students with information on study skills, goal setting, and campus facilities and support services. Studies done in both four-year universities (Boudreau & Kromney, 1994; Sidle & McRenolds, 1999) and community colleges (Derby & Smith, 2004; Glass & Garrett, 1995; Scrivener, Sommo, & Collado, 2009; Stovall, 1999; Zimmerman, 2000) indicate that students who take an orientation course upon enrollment in college complete their courses at higher rates, earn more total credits, maintain higher GPAs, and are more likely to persist and graduate. There is some indication that the positive effects are particularly strong for under-represented minority students (Stovall, 1999; Strumpf & Hunt, 1993) who often enroll with less "college knowledge" than other students.

Much of the evidence supporting the value of orientation courses is based on single-institution studies, making it difficult to generalize the findings to the broader population of college students. However, two recent studies examined the impact of a "student life skills" (SLS)

course for large numbers of students attending Florida's community colleges. Descriptive analyses by the Florida Department of Education (2006) found that students who completed an SLS course were more likely than students who did not complete such a course to persist, to earn a certificate or degree, or to transfer to the state's university system. Zeidenberg and his colleagues (2007) used similar data in statistical models to study the impact of SLS courses after controlling for student characteristics and academic preparation. They found that students who enrolled in a SLS course were eight percent more likely to complete a credential, three percent more likely to transfer, and eight percent more likely to remain enrolled after five years. The effects held for both remedial and non-remedial students.

Learning Communities

Learning communities generally involve a group of new students taking several classes together as a cohort, with the instructors of those classes coordinating course outlines and jointly reviewing student progress. A recent review of the literature on learning communities in four-year institutions concluded that, while the research is weakened by self-selection issues, most studies demonstrate a positive impact of learning communities on academic achievement as measured by GPA, credit accumulation or self-reported learning (Andrade, 2007). Other positive outcomes noted in the studies reviewed include increased persistence, greater engagement, and higher student satisfaction. Using self-reported data for more than 80,000 students who took the National Survey of Student Engagement,[6] Zhao and Kuh (2004) found that participation in learning communities was associated with better academic integration, more interaction with faculty, more active and collaborative learning, greater satisfaction with the college experience, and gains in self-reported learning outcomes.

A number of studies have suggested that learning communities produce positive outcomes for community colleges students as well. Tinto (1997) evaluated the course success and retention rates of community college students in learning communities, finding that these students were more likely to pass a set of courses than were other students enrolled in those courses, and they were more likely to re-enroll the following year. A more recent study conducted in 13 community colleges found that students in learning communities had more positive views of peers and instructors, spent more time with other students on academic activities, felt more supported and encouraged by the college community, and were more likely to believe that their coursework emphasized higher order thinking skills (Engstrom & Tinto, 2007). Students in learning communities were five percentage points more likely to persist one year later, leading the authors to conclude that learning communities had modest effects on academic outcomes but more substantial effects on social integration and engagement. Minkler (2002) also found that community college students in learning communities had higher rates of retention and earned the same or better grades than students taking similar stand-alone courses.

The Opening Doors Demonstration Project[7] recently examined the impact of learning communities in a community college using random assignment, overcoming the typical problems of self-selection. A preliminary evaluation found that students assigned to learning communities were more likely to pass their first semester courses and less likely to drop courses than were similar students in a control group, although second-term retention rates did

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[6] The National Survey of Student Engagement (NSSE) is a survey of four-year college and university students nationwide about student participation in programs and activities that institutions provide for their learning and personal development. It measures how undergraduates spend their time and what they gain from attending college. See http://nsse.iub.edu/index.cfm.

[7] The Opening Doors Demonstration Project is working with community colleges in several states to design and implement new types of financial aid, enhanced student services, and curricular and instructional innovations, with the goal of helping low-income students earn college credentials. See www.mdrc.org/project_31_2.html.

not differ between the two groups (Bloom & Sommo, 2005). A more recent evaluation of the same program found positive impacts on course completion and credits earned, but only for the semester in which the students were enrolled in the learning community (Scrivener et al., 2008). There was no impact on persistence in the next two semesters, although students in the learning community were more likely to be enrolled three semesters later. The learning community students were found to be more engaged and to have a stronger sense of belonging to the campus community.

Remediation

Many students enroll in college academically unprepared for college-level work, making the need for remediation a major barrier for students to overcome on the pathway to a degree (Goldrick-Rab, 2007), and suggesting that the successful completion of remediation is a possible indicator of momentum. The current research literature leaves uncertainty about the efficacy of remedial education, with many arguing that the current pedagogical approaches in use in most community colleges are not effective with a population that failed to master basic skills when exposed to similar approaches in high school (Bailey, 2009; The Carnegie Foundation for the Advancement of Teaching, 2008; Grubb, 1999). Research evaluating the effectiveness of remediation is complicated by self-selection into remedial courses (Levin & Calcagno, 2008) and by the diverse set of policies and practices across states and institutions related to assessment of students' skills and placement into appropriate courses (Bailey & Alfonso, 2005).[8] Some students who need remediation do not enroll in the courses, or enroll but fail to complete the entire sequence of courses the assessment of their skills would suggest is needed, complicating efforts to evaluate the effectiveness of remediation and the relationship between developmental education and degree completion.

Some research has found that remediation can be effective in improving the skills of under-prepared students, with several studies indicating that students who successfully complete remediation and transition into college-level courses have persistence and success rates similar to those who start directly in college-level courses (Attewell, Lavin, Domina, & Levey, 2006); Kolajo, 2004; Office of Program Policy Analysis & Government Accountability [OPPAGA], 2007; Waycaster, 2001). One large study of Ohio community college students found that students placed in remediation were more likely to transfer to a university than were students with similar levels of readiness who attended colleges where placement in remedial classes was not required (Bettinger & Long, 2005).

While these studies offer evidence of the effectiveness of remediation, a recent study of students in both two-year and four-year colleges in Texas found little evidence that remediation improves rates of success for underprepared students (Martorell & McFarlin, 2007). Texas requires students who score below a specific cut-off on the test administered under the Texas Academic Skills Program to enroll in remediation, so the researchers compared the outcomes of students who scored just below the cut-off to those with comparable preparation levels who scored just above the cut-off and were not required to take remedial courses. While the students assigned to remediation had somewhat better grades in the first college-level math course taken, there was a small negative effect on the likelihood of completing at least one year of college and no difference in the probability of earning a college degree. A similar study of Florida community college students found little impact of remediation on success in college-level courses or the likelihood of completion (Calcagno & Long, 2008).

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[8] For a discussion of the literature on a wide variety of topics related to remediation, see the recent review conducted by the Center for Student Success, part of the Research and Planning Group for California Community Colleges (2007)

The large-scale studies from Texas, Florida and Ohio had mixed results regarding the effectiveness of remediation, with little evidence in the Texas and Florida studies that remedial courses are helpful, but some positive effects of enrolling in developmental education in Ohio. Given that these studies focused only on students who scored just above and just below the cut-off score used to assign students to remediation, the findings suggesting little benefit of remediation do not necessarily apply to very low-scoring students for whom remediation may offer greater benefits. Also, the studies summarize the average effect of remediation at the state level, obscuring any evidence of more effective remediation at some institutions or for certain groups of students.

The benefits of remediation may vary by the type of coursework, although the research findings in this area are also inconsistent. A number of studies have shown better outcomes for students requiring only math remediation (Bettinger & Long, 2005; Kolajo, 2004; OPPAGA, 2007), while at least one study has found larger positive effects for remedial coursework in reading and writing (Attewell et al., 2006). The benefits may also vary by students' age, with one recent study finding that students over age 25 gain greater benefits from remedial coursework in math than do younger students (Calcagno et al., 2006). Students who enroll in remedial coursework immediately upon entering college have better outcomes than those who delay remediation (Castator and Tollefson, 1996; Weissman, Bulakowski, & Jumisko, 1997; Weissman, Silk, & Bulakowski, 1997).

A major action-research project to identify ways to improve pre-collegiate instruction and outcomes was recently completed (The Carnegie Foundation for the Advancement of Teaching, 2008). The project involved eleven California community colleges. While the research identified some promising approaches, its recommendations underscore the need for concerted and coordinated efforts by faculty and institutional leaders to improve pre-collegiate instruction through experimentation and data collection and analysis of interventions and their impacts on student learning.

Based on his recent review of the research on remedial education, Bailey (2009) recommends that institutions (1) ensure that assessment practices focus on what individual students need to be successful in college-level courses rather than just placement in a developmental sequence, (2) incorporate more academic support services into college-level courses in recognition of the ambiguity in precisely determining the skills and likely outcomes of students through an assessment test, and (3) develop accelerated remedial strategies to minimize the time necessary for students to enroll in college-level courses.

Other Issues

A few other issues show up in the research literature on student success that may apply to developing measures of intermediate student outcomes. In a study of factors related to academic success among college sophomores in a public university, Graunke and Woosley (2005) found that commitment to a major by the second year of college was a positive predictor of GPA.

In community colleges, research on the impact of registering late for classes has generally concluded that late registrants have higher course withdrawal rates, lower GPAs, and lower retention rates (Freer-Weiss, 2004; Smith, Street & Olivarez, 2002; Summers, 2000). In a study of a large cohort of students in California's community colleges, Moore and Shulock (2007)

found that as the share of courses a student enrolled in late increased, the likelihood of transfer or certificate/degree completion declined, after controlling for other factors.

Finally, several studies have suggested that the factors predicting student success may differ for various groups of students. For example, Stratton and his colleagues (2007) found that, while lower grades during freshman year were associated with dropping out for full-time students, part-time students with low grades were no more likely to drop out than part-time students with average grades (although their likelihood of drop-out was higher than for students with high grades). Credit accumulation may be a more important indicator for younger students than for older students, according to an analysis of Florida's community college data (Calcagno et al., 2006). Reaching the point of earning 20 credits increased the odds of graduating for all students, but the effect was larger among younger students (ages 17-20 on initial enrollment) than among older students (ages 25-65). And Roksa and Calcagno (2008) reported that the effect of credit accumulation on the likelihood of transfer was stronger for students who entered community college academically unprepared for college-level work than for college-ready students. These varying effects suggest that different measures of progress and success may be needed for different groups of students.

Developing Intermediate Measures of Progress and Success

The body of research reviewed here can be used as a foundation for developing intermediate measures of student progress and success and identifying signals of students being on or off track for completing a degree. While some efforts to develop such measures are already underway, it is not clear that these efforts are taking full advantage of a comprehensive review of factors that contribute to student success. It is our hope that this report will provide some context for those efforts and spur other efforts to develop useful measures.

Much of the effort already underway has developed in relation to community colleges because of the multiple missions of that sector and the inadequacy of traditional graduation rates as a measure of student success. Some have noted that, when applied to community colleges, traditional outcome measures ignore any value-added of students meeting non-completion outcomes that result in increases in basic literacy and workforce skills (Morris, Phillips, Brock, Nagler, & Dowd, 2005). The research is clear, however, that there are negligible economic benefits to accumulating only a small number of college credits, with one year of college credits being the point at which economic benefits begin to accrue (Bailey, Kienzl, & Marcotte, 2004; Marcotte, 2006). This makes it essential to monitor completion rates for those community colleges students who do seek to earn a college credential.

An example of efforts to develop intermediate measures of student success in community colleges can be seen in the work of the Community College Research Center (CCRC) using administrative data from Washington's community college system (Leinbach & Jenkins, 2008). CCRC developed "milestones" and "momentum points" for several groups of students, with student groups defined based on their program objective or their initial course enrollments. "Milestones" were defined as measurable educational achievements that include both traditional measures of completing a certificate/degree and transfer, as well as intermediate outcomes like completing remediation. "Momentum points" were defined as shorter-term attainments that were empirically correlated with the completion of a milestone, such as completing a college-level math course. The goal is to use the information gained from such analyses "to identify college practices and student behaviors that are associated with successful outcomes and inform the development of policies and practices that address barriers to achievement." (p. 1).

In another example, the eleven states that have participated in either the Ford Foundation's Bridges to Opportunity or the Lumina Foundation's Achieving the Dream initiatives have developed a set of measures of success for community college students to help states improve system and institutional performance (Ewell, 2006). The indicators measure the success of students in reaching "milestone events" based on their initial starting place in the curriculum (adult basic education, developmental education, or college-level coursework). The recommended measures include traditional measures of persistence and completion as well as the rate at which skills-deficient students complete remediation and transition to college-level coursework.

While large-scale efforts to research and develop measures of intermediate student progress appear to be occurring largely in the two-year sector, some university systems are using intermediate measures of progress in addition to the standard retention rate. The California State University requires that students needing remediation upon entry complete such remediation within one year, and annually reports the share of students meeting that requirement.[9] The City University of New York includes several measures of intermediate progress in its performance management process including:

◊   the percent of students passing gateway courses with a C or better
◊   the percent of grades issued for withdrawals or no-credit repeats
◊   the average number of credits earned in the first year
◊   pass rates on skills tests following remediation
◊   the percent of students with 70 credits but no major.[10]

CUNY's use of each of these measures would seem to be supported by the research literature reviewed above.

Table 2 lists the milestones, or measurable intermediate outcomes, that should be tracked, depending on institutional type. For example, for students beginning their studies in a community college, transferring to a university represents a milestone on the pathway to earning a bachelor's degree. The purpose of tracking intermediate milestones is to provide more points along the road to degree completion to which data can be applied to identify appropriate behaviors, strategies, and interventions.

The research literature points to predictors of success related to three categories of student enrollment behaviors:
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 momentum through academic behaviors that lead to the timely earning of college credits.

Tracking the predictors of success can help identify students at risk and point to appropriate interventions at the appropriate times in terms of practice and policy, with a goal of increasing the rate of certificate and degree completion.

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[9] See Proficiency Reports of Students Entering the CSU System at www.asd.calstate.edu/performance/proficiency.shtml.

[10] For a description of CUNY's performance measures and goals, see www1.cuny.edu/resources/performancetargets/2007_08/performances_07_08.pdf

Table 2
Milestones and Predictors of Success

Milestones	Predictors of Success

▪ Retention
▪ Complete needed remediation
▪ Transition to college-level coursework
▪ Earn one year of college-level credits
▪ Complete general education (GE) coursework
▪ Complete community college transfer curriculum
▪ Transfer from community college to a university
    o without completing transfer curriculum
    o after completing transfer curriculum
▪ Complete certificate or degree
	Remediation:
	▪ Begin remedial coursework in first term, if needed
	
	Gateway Courses:
	▪ Complete college-level math/English in the first year or two
	▪ Complete a college success course or first-year experience program
	
	Credit Accumulation and Related Academic Behaviors:
	▪ High ratio of course completion (low rate of course dropping and failure)
	▪ Complete 20-30 credits in the first year
	▪ Earn summer credits
	▪ Enroll full time
	▪ Enroll continuously, without stop-outs
	▪ On-time registration for courses
	▪ Maintain adequate academic performance

While each of these measures derives from the research on factors associated with retention and degree completion, more analysis is needed to determine the specific measures that are most appropriate depending on:

(1) the intended purpose of the measurement

Institutions could use specific indicators to identify whether particular students are on track for successful completion or whether they are at risk for dropping out. Institutions could use aggregate data to identify patterns and develop college policies and practices to better support student success. Systems and state governments could use aggregate forms of the indicators to monitor rates of student success to encourage system and institutional improvement.

(2) the type of institution

The research suggests that some of the same measures may be appropriate for both community colleges and four-year institutions, such as those measuring course dropping or academic performance. Even measures that are appropriate to both sectors, however, may need to be in somewhat different forms or measure different levels of achievement.

(3) the types of students

Some of the research suggests that different measures may be appropriate for different groups of students based on their age, their full- or part-time attendance status, or their readiness for college-level work at the time of initial enrollment. Given the various missions of community colleges, different measures may be required in that sector based on students' goals for enrolling.

Much of the research reviewed in this report has been conducted using the survey data collected and maintained by the National Center for Education Statistics. The large student-level databases maintained by states and by college and university systems have been underutilized in efforts to understand and improve student success. More research should be done using these data to confirm relationships and develop measures that are useful for tracking student progress toward degree completion.

Using Better Measures to Help More Students Complete Degrees: Some Examples

While more research and analysis is needed, some institutions, systems and states are beginning to use the results of such measurement to identify best practices, support planning for improvement, and change policies to better support student success. For example, Zane State College, a two-year institution in Ohio, used data revealing poor first-year retention rates to develop a new policy requiring new students to take a one-credit course during their first year focused on the transition to college (Jaschik, 2008). Community colleges in Texas are also using results obtained through analyzing institutional data to change policies and practices. South Texas College has imposed mandatory orientation and limits on late registration in an effort to improve retention, while El Paso Community College started conducting assessment testing in local high schools to help students better prepare for college.

Some four-year colleges and universities are also making use of their institutional data. Analyses of student data at Pennsylvania State University revealed that low-income students who graduated did not differ much from their peers of similar income levels who did not graduate in terms of academic skills, but those who graduated passed most of their first-semester coursework (Lederman, 2008). Penn State used this information to emphasize summer orientation programs, good early advising, first-year seminars and other efforts to help low-income students transition successfully into college. Purdue University mined years of its data to figure out what factors correlate with student success or failure (Rampell, 2008). It used the results of these analyses to develop an algorithm to identify at-risk students, and to implement an automated early warning system that sends messages to such students when they log into course websites, directing them to meet with their instructor or to use other campus resources.

Some states are also beginning to use data to identify and change policies to better support institutions in improving rates of student progress and success. Washington used the results of CCRC's analyses of student progress in reaching particular milestones to implement a new funding initiative (Washington State Board for Community and Technical Colleges, 2007). Community colleges in the state receive funding for every student who reaches defined "momentum points" including increasing basic skills, becoming college ready, completing a college-level math course, and earning 15 or 30 college units. Funding is also provided for certificates or degrees. The funding is intended to serve as incentive for colleges to measure student progress, share best practices, and develop strategies to increase student success.

Conclusions and Recommendations

While these and other examples are encouraging, much remains to be done to determine what kinds of data and measurement help institutions, systems and states to implement better practices and to set better policies to increase degree completion. The research literature

offers a rich source of building blocks for such efforts by suggesting additional measures – not just intermediate measures of accomplishments, but patterns of student behaviors and experiences that can signal good progress or risk. Further research and analysis to develop measures of intermediate student outcomes should:

- test the indicators for relevance for students according to their age, their attendance status, their initial readiness for college-level work, and their intended enrollment goals, as best can be determined by course taking behaviors or other available data
- refine the individual indicators to best fit the two-year or four-year college environment
- focus on developing measures to help institutions identify the points at which students most often stall in their pursuit of a degree, and implement more effective practices to improve student outcomes
- focus on developing measures to help systems and states monitor student success and set better policies to help institutions increase degree completion
- make much better use of the large student-level databases maintained by states and college and university systems to perform these kinds of analyses.

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