Strategies for Promoting Gatekeeper Course Success Among Students Needing Remediation: Research Report for the Virginia Community College System

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Table of Contents

Executive Summary

Overview

The Virginia Community College System (VCCS) is engaged in a strategic planning process to improve performance beyond the goals in *Dateline 2009*, the system's current vision and plan. A key objective is to encourage colleges to improve retention and academic success for students, particularly the substantial numbers who arrive unprepared for college-level work. Specifically, the VCCS seeks to improve the rates at which underprepared students complete developmental coursework and advance to take and pass college courses, particularly the initial college-level, or "gatekeeper," math and English offerings.

The VCCS asked the Community College Research Center (CCRC) at Teachers College, Columbia University, to conduct analyses to inform its efforts to improve student outcomes. In response, CCRC designed a study to address the following question: What student characteristics, course-taking patterns, and other factors are associated with higher probabilities that students who require remediation will take and pass college-level math and English?

The dataset used by CCRC, provided by the VCCS, contained information on 24,140 first-time college students who enrolled in a VCCS college in summer or fall 2004. It included information on student demographics, institutions attended, placement test scores and placement recommendations, transcript data on courses and grades, and information on educational attainment (including transfer to four-year institutions and certificates and associate degrees earned). Students were followed for four years, through the 2008 summer term. CCRC examined a range of educational outcomes, including: whether students took and passed development courses and gatekeeper English and math, the number of terms they were enrolled, the number of credits they accumulated, and whether they earned educational awards (certificates and associate degrees) or transferred to four-year institutions.

This report presents the main findings from CCRC's study and outlines suggestions for steps that the VCCS and its member colleges might take to improve completion of gatekeeper courses by the many students who enter the state's community colleges poorly prepared to succeed in college-level work.

Research Findings

Developmental education

Overall, one half of the VCCS entering cohort enrolled in at least one developmental education course in reading, writing, or math. The rate of developmental enrollment was particularly high for math, with 43 percent of students taking at least one developmental course in that subject. The overall passing rate for developmental English courses was 65

percent and for developmental math 48 percent, although there was much variation across specific courses.

The outcomes of students who took developmental courses depended on the level at which they started. We examined two developmental course levels for reading and writing and three for math. Students who started at lower levels of developmental coursework fared particularly poorly. They had less favorable educational outcomes than either students who started at higher levels of developmental instruction or those who did not take developmental courses.

Gatekeeper courses

Less than 50 percent of students in the study completed gatekeeper English and just over one quarter completed gatekeeper math. These low completion rates reflect the fact that many students did not even attempt to enroll in gatekeeper courses. Among students who took gatekeeper courses, the passing rate was approximately 75 percent.

Whether students enrolled in gatekeeper courses depended on whether they took developmental courses and at what level. Students who started at lower levels of developmental coursework were much less likely to take gatekeeper courses than either those who started at the highest level of developmental coursework or those who did not take any developmental courses in the subject. The outcomes were particularly low for students who started in the lowest level of developmental math (pre-algebra): less than 20 percent of them enrolled in gatekeeper math. Students who started at the highest level of developmental coursework had relatively similar rates of taking gatekeeper math as those who took no developmental courses.

Among students who enrolled in gatekeeper courses, passing rates did not differ markedly between those who previously took developmental courses and those who did not. About three quarters of students who took no developmental reading or writing passed gatekeeper English. Similar percentages of students who enrolled in different levels of developmental coursework in reading or writing completed gatekeeper English. Even in math, where gaps in gatekeeper enrollment were more pronounced, differences in gatekeeper passing rates between students who did and did not take developmental math were relatively small.

Placement recommendations and student outcomes

More than one third of students in the 2004 summer/fall cohort were missing placement recommendations. There were substantial differences among colleges in their reporting of placement recommendations, as well as in the proportion of their students recommended to take developmental courses. Among the first-time community college students, 52 percent were recommended to take developmental math, 25 percent developmental writing, and 17 percent developmental reading. However, these percentages underestimate the proportion of students requiring remediation due to missing data on placement recommendations.

Most students did not complete recommended developmental courses — not because they did not pass the developmental courses that they took, but because they never enrolled in them to begin with. Only approximately 50 to 60 percent of students referred to developmental education enrolled in the recommended developmental course. While some students took developmental courses they were not recommended to take, over one third did not take any developmental courses in the recommended subject. Students who were recommended to take lower level developmental courses were less likely to enroll in courses or complete the developmental sequence than those recommended to take higher level courses. The patterns were particularly stark for math: only 10 percent of transfer-placed students referred to the lowest level of developmental math (pre-algebra) completed the developmental math sequence. A large proportion of students referred to developmental education did not even complete the first recommended developmental course.

Notably, students who were recommended to take a developmental course but did not do so had similar rates of taking and passing gatekeeper English and math as students who were recommended for and did take a developmental course in the subject. Students who were recommended for but did not take developmental courses also fared equally well with respect to many other educational outcomes (e.g., attempting and accumulating credits, earning certificates and associate degrees, and transferring to four-year institutions) as students who were recommended for and took developmental courses. It is important to note that these findings do not imply that developmental instruction is not effective or not needed. Students who skip developmental courses may differ from those who enroll in them with respect to a number of unobserved characteristics, which may account for their higher success rates. The results do indicate that it would be useful to explore why students are deciding to forego developmental instruction and what explains why some are nevertheless successful in completing gatekeeper courses and other educational outcomes.

Placement test scores and student outcomes

Approximately two thirds of students in the dataset had placement test scores in at least one of the three subject areas: reading, writing, or math. Students with higher placement test scores were less likely to take developmental courses and more likely to take gatekeeper courses than students with lower placement test scores. However, not all students with low test scores enrolled in developmental courses, and not all students with high test scores enrolled in gatekeeper courses.

After controlling for individual characteristics and institutions attended, reading and writing test scores did not predict whether students passed gatekeeper English, while math test scores had a stronger relationship to passing developmental and gatekeeper math.

A substantially higher proportion of students in the highest quartile of the test score distribution attained at least one educational outcome (certificate, associate degree, or transfer to a four-year institution) compared with students in the lowest quartile of the test

score distribution. Higher scoring students also accumulated more credits, because they attempted more credits and completed a higher proportion of credits that they attempted.

Recommendations

In general, to increase the successful attainment of educational awards, colleges may benefit from focusing on the beginning of the educational pathway. Therefore, CCRC recommends that the VCCS concentrate on strategies focused on two objectives: (1) encourage students to take and pass gatekeeper courses, which they need to progress toward a credential or transfer to a four-year institution; and (2) promote the enrollment of students most in need of remediation in developmental courses, in order to increase their college readiness.

To advance these objectives, we recommend that the VCCS and its member colleges:

- *Consider surveying students to learn why the majority are not enrolling in gatekeeper courses and develop policies to facilitate enrollment.*

- *Develop policies to facilitate enrollment in gatekeeper math and consider alternative enrollment pathways for students starting at the lowest level of developmental math (pre-algebra).*

- *Review policies and promising practices both within and outside the system aimed at increasing gatekeeper course completion among students deemed prepared for college-level work.*

- *Investigate why students recommended to take developmental reading, writing, or math were so unlikely to enroll in any of those courses and learn what alternative strategies for success they used.*

- *When evaluating the effectiveness of instruction or developing strategies to facilitate student success, consider the level of developmental courses taken by students instead of grouping all students in need of remediation together.*

- *Investigate whether "mainstreaming" students who are enrolling in the highest level of developmental courses into college-level courses, while providing additional supports as needed, is an effective strategy for facilitating their educational attainment.*

- *Explore and consider implementing accelerated programs that require students to attend full time and other strategies to facilitate credit accumulation and, by extension, degree completion.*

- *Consider conducting an in-depth study of colleges that are more successful at fostering enrollment in and completion of gatekeeper English and math, and disseminate promising practices across the system.*

- *Ensure that all colleges report placement test scores and recommendations for all students who need to take the tests.*

- *Continue to track students over time and improve the quality of collected information to identify areas for improvement and evaluate efforts to facilitate student success.*

The VCCS has made notable strides in a relatively short amount of time in collecting and analyzing data on student success. Continuing to track the progress of students over time can help to identify areas in need of improvement and highlight successful policies and practices. Regular meetings where faculty, staff, and administrators can discuss strategies for improving student success in light of the evidence and design additional in-depth studies of specific areas identified as needing improvement will be crucial parts of the VCCS' continued efforts to enhance student success, particularly for students requiring remediation.

Introduction

The Virginia Community College System (VCCS) is engaged in a strategic planning process to improve performance beyond the goals in *Dateline 2009*, the system's current vision and plan. A key objective of the new planning process is to encourage colleges to improve retention and academic success for students, particularly the large numbers who arrive unprepared for college-level work and are referred to developmental instruction.

In 2000, to address the challenges associated with widespread inadequate preparation of entering students, the VCCS adopted recommendations by the Developmental Education Implementation Task Force (2000a; 2000b) to create a set of system-wide policies for placement of students in developmental or college-level courses. Further review and recommendations for improving assessment and placement procedures were provided by the Placement Test Review Task Force in 2008. Determining the needs of students and placing them in appropriate courses are important first steps in the process of improving retention and academic access. The next step is to ensure that students requiring remediation move beyond developmental courses to take and pass college courses, particularly the initial college-level math and English offerings, which are sometimes referred to as "gatekeeper" courses because they are generally required for a college degree.

The VCCS asked the Community College Research Center (CCRC) at Teachers College, Columbia University, to conduct a series of quantitative analyses to inform efforts by the system and its member colleges to improve the academic success of the many students who enter the system unprepared for college-level work. In the study reported here, CCRC addressed the following question: What student characteristics, course-taking patterns, and other factors are associated with higher probabilities that students who require remediation will take and pass gatekeeper math and English?

This report presents the findings from CCRC's study. The next section describes the data used for conducting the study. The third section describes patterns of student gatekeeper course completion according to: (1) developmental course enrollment, (2) placement recommendations, and (3) placement test scores. Other relevant educational outcomes, such as credits accumulated, number of terms enrolled, and credentials attained are also discussed. The final section provides conclusions from the study, as well as recommendations that the VCCS and its member colleges should consider in their efforts to improve student success in gatekeeper courses and beyond. Throughout the report, discussions of findings are supported by tables and figures that appear in the appendices.

Dataset and Variables

The Virginia Community College System (VCCS) provided the Community College Research Center (CCRC) with data on first-time community college students who enrolled in one of the 23 colleges in the system in summer or fall 2004. The dataset comprised 24,140 students.[1] Students were followed over time, through the 2008 summer term, or approximately for four years. The dataset contained information on student demographics, institutions attended, placement test scores, placement recommendations, transcript data on courses taken and grades received, and information on educational attainment (including transfer to four-year institutions and certificates and associate degrees earned).

This report focuses on the educational trajectories of students who were in need of developmental education. Several markers of the need for developmental education were considered: students' placement test scores; college placement recommendations; and developmental course-taking in reading, writing, or math. While the three markers were correlated, their correspondence was far from perfect, and thus each provides insights into educational pathways and outcomes of students who by various measures need remediation. CCRC examined a range of educational outcomes, including whether students took and passed development courses, whether they took and passed gatekeeper (or college-level) English and math, the number of terms that they were enrolled, the number of credits that they accumulated, and whether they earned educational awards (certificates and associate degrees) or transferred to four-year institutions.

Analyses of placement test scores and recommendations were constrained by missing data. Only about two thirds of students in the dataset had placement test scores for at least one subject (reading, writing, or math) and only slightly more than 50 percent had test scores for all three subjects. Thus, CCRC based analyses considering placement test scores and recommendations on a substantially reduced sample size. Moreover, since the proportion of reported test scores and recommendations varied across institutions, only descriptive analyses of institutional variation for these measures were conducted.

[1] The designation of "first-time community college students" indicates that students had no prior college credits other than those earned through high school dual enrollment programs. The 164 students who reported taking classes before summer 2004 without being enrolled in a high school dual enrollment program were excluded from these analyses, thus reducing the beginning analytic sample size to 23,976. Some students in the summer/fall 2004 cohort did not have a course record until the spring 2005 term or later, but these students were included in presented analyses.

Research Findings

This section discusses findings on educational outcomes of VCCS students from three perspectives: (1) whether students took developmental courses and at what level; (2) whether students were recommended to take developmental courses; and (3) how well students scored on placement tests.

Developmental Course-Taking Patterns and Student Outcomes

Taking and passing developmental courses

Community colleges, as open door institutions, admit all students interested in pursuing higher education. Their student bodies therefore include many who are not prepared for college-level work. In 2000 the Virginia Community College System (VCCS) Developmental Education Implementation Task Force recommended that students entering the state's community colleges take placement tests in reading, writing, and math. The Task Force also provided guidelines (subsequently revised and updated in 2008) for placing students in developmental or college-level courses based on their test scores in each subject.

Finding: *One half of the VCCS entering students enrolled in at least one developmental course in reading, writing, or math. Participation in developmental education was highest in math.*

One half of the summer/fall 2004 entering cohort enrolled in at least one developmental education course.[2] The rate of developmental enrollment was particularly high in math, with 43 percent of students taking at least one developmental course in that subject. Smaller proportions of students took developmental courses in writing (21 percent) or reading (14 percent). Table 1 in Appendix A reports the percentages of students enrolled in developmental education for all students, as well as for students disaggregated according to whether they earned dual enrollment credits during high school and whether

[2] For the purposes of the analyses presented in this report, ENG04 and ENG05 were considered developmental reading; ENG01 and ENG03 were considered developmental writing. These designations allowed for consistency throughout the report, including the subsequent sections that analyze different developmental course levels. ENG02, ENG07, and ENG08 combine reading and writing, and thus do not neatly fit into either of the examined sequences. ENG06 and ENG09 are offered primarily at one institution each and do not fit into the sequential analyses presented in this report; consequently, those courses were not included in the analyses. Enrollments in those courses were overall quite low, except for ENG09; including this course in developmental writing would increase the percentage of students taking developmental writing by approximately 5 percent. For math, all course numbers under 10 (i.e., MTH01 through MTH09) were coded as developmental math.

they were placed in transfer (which are designed to satisfy the general education requirements for a bachelor's degree) or career tech programs.[3]

The same pattern of enrollment in developmental education (highest for math, followed by writing and then reading) was evident for students who were placed in transfer and career tech programs, and for students who did and did not earn dual enrollment credits during high school. A similar proportion of students placed in transfer and career tech programs took developmental courses in reading and writing.[4] However, a higher proportion of transfer program students enrolled in developmental math, perhaps reflecting program requirements. The nine percent of students who entered the VCCS with dual enrollment credits from high school seemed, on average, to be more academically prepared: only 37 percent enrolled in developmental courses, compared with 52 percent of students without dual enrollment credits.

Finding: *The proportion of students enrolling in developmental courses varied substantially across colleges. However, there was a strong correlation across course subjects, such that community colleges with high proportions of students enrolling in developmental courses in one subject were also the colleges with high proportions of students taking developmental education in other subjects.*

Table 2 reports the proportions of students who took developmental courses in each subject area across the 23 Virginia community colleges.[5] While 14 percent of students took a developmental reading course system-wide, the proportion ranged from 5 to 25 percent across institutions. The same variation across institutions can be observed for writing and math. Developmental course-taking was most prevalent for math, and the variation was slightly larger: the proportion of students taking developmental math across institutions ranged from 25 to 62 percent.

Considering the notable variation in the proportion of students taking developmental courses across colleges, we examined correlations across subjects. Based on the reported proportions of students enrolling in developmental courses across the 23 institutions, the correlation between developmental reading and writing was 0.73; between developmental reading and math, 0.62; and between developmental writing and math, 0.77. These correlations indicate a strong relationship between the proportions of students taking developmental courses in reading, writing, and math across institutions. Colleges with a high proportion of students taking developmental courses in reading were often the same

[3] Throughout the report (except for Table 5), analyses were conducted with students as a unit of analysis. Thus, students who took multiple courses in the same area or took the same course multiple times would be counted as only one record (i.e., one instance of taking a particular type of a course).

[4] The dataset also included 34 students who were not classified as either transfer or career tech. These students were included in analyses pertaining to all students, but excluded from comparisons between transfer and career tech.

[5] These percentages may under-report developmental course-taking in reading and writing for some institutions that offer developmental courses other than those examined in this study (i.e., other than ENG04 and ENG05 for reading and ENG01 and ENG03 for writing).

colleges that had a high proportion of students taking developmental courses in other subjects. Similarly, colleges with a low proportion of students taking developmental reading also often reported a low proportion of students taking developmental courses in other subjects. These findings suggest that some colleges in the VCCS bear a disproportionate responsibility for educating students who are not academically prepared for college-level work.

Finding: *Many students participating in developmental education took more than one developmental course, either in the same subject or across subjects.*

Among students who enrolled in developmental education, a sizable proportion took multiple courses either in the same subject or across subjects (Table 3). To examine multiple course-taking in the same subject, courses were separated into different levels. Writing had two levels: Level-1 (ENG01) and Level-2 (ENG03). Similarly, reading had two levels: Level-1 (ENG04) and Level-2 (ENG05). Math courses were divided into three levels: Level-1 (Pre-Algebra: MTH01, MTH02, and MTH09), Level-2 (Algebra I: MTH03), and Level-3 (Algebra II or higher: MTH04, MTH05, MTH06, MTH07).[6]

Among students who took developmental reading or writing courses, the most common pattern was to enroll in a level-2 course (i.e., the highest level of developmental instruction in those subjects). Relatively small proportions of students took *both* level-1 and level-2 reading or writing (11 percent for reading and 14 percent for writing). Math, however, presents a different pattern: a small proportion of students enrolled in the highest level of developmental math (Algebra II or higher). One half of developmental math students enrolled in a pre-algebra course or Algebra I. Moreover, over one third of students taking developmental math enrolled in more than one course. There is also some evidence that students who were not academically prepared in one subject area tended to be underprepared in other areas as well: over one third of students participating in developmental education took a developmental course in reading/writing *and* math. These percentages understate the need for enrollment in multiple developmental courses because, as discussed below, over one third of students who should have taken developmental courses based on their test scores or recommendations did not do so.

There was a remarkable degree of similarity in the patterns of developmental course-taking between students who were placed in transfer programs and those in career tech programs. The only notable difference was in math: students in career tech programs were more likely to take a pre-algebra course and overall were less likely to take multiple math courses. This finding likely reflects different requirements for transfer and career tech programs. Regarding dual enrollment status, students who entered the VCCS with dual enrollment credits from high school were less likely to take multiple developmental courses in or across subjects. One exception to this pattern is math: similar proportions of

[6] While all institutions offer all three levels of developmental math, not all institutions offer both levels of developmental coursework in reading and writing. In addition, the number of students taking courses at particular levels was quite low in some colleges. Consequently, we do not report more detailed analyses of developmental coursework across institutions.

students with and without dual enrollment credits took multiple developmental math courses.

Finding: *Most students who took developmental courses did so at the beginning of their college career.*

Table 4 shows the semester in which students who enrolled in a developmental course first did so. The vast majority of the first-time students in the summer/fall 2004 cohort (entering a VCCS college in summer 2004 or fall 2004) who took developmental courses enrolled in their first course during the 2004-2005 academic year. Of the students who took developmental math, 88 percent took their first course before or during spring 2005. Similarly, 93 percent of students taking developmental reading or writing enrolled in their first course during the 2004-2005 academic year. A few students who took dual enrollment courses in high school enrolled in their developmental courses before summer 2004. Thus, the majority of students in the cohort examined started taking developmental courses at the beginning of their enrollment in a community college.

Finding: *The overall passing rate for developmental English courses was 65 percent and for developmental math courses 48 percent, although there was much variation across specific courses.*

Table 5 reports success rates (i.e., students earned "pass" or "satisfactory" grades) for developmental English and math courses. These calculations are based on total enrollments from summer 2004 through summer 2008. Courses rather than students are the unit of analysis (i.e., for students who took a course multiple times, each attempt was counted as taking a course). The overall success rate was higher for English (65 percent) than for math (48 percent). However, there was a notable amount of variation in passing rates across courses. For English, ENG04 and ENG05 (Reading Improvement I and II) had the highest pass rate of 68 percent, while the lowest pass rate of 50 percent was reported for ENG02 (Spelling and Vocabulary Study). Math courses showed even more variation, with pass rates ranging from 38 percent (MTH01: Developmental Mathematics) to 76 percent (MTH06: Developmental Geometry).

Taking and passing gatekeeper English and math

Finding: *Less than 50 percent of students in the cohort completed gatekeeper English and just over one quarter completed gatekeeper math. These poor outcomes, however, reflect the fact that many did not even attempt to enroll in gatekeeper courses. Among students who took gatekeeper courses, the passing rate was approximately 75 percent.*

If we simply calculated the proportion of students in the cohort who completed gatekeeper English and math, the numbers might appear discouraging.[7] Only 47 percent of students completed gatekeeper English and 26 percent of students completed gatekeeper math. However, these low overall completion rates were largely a product of students' failure to enroll in gatekeeper courses. Table 6 shows that over one third of students did not attempt to take gatekeeper English and two thirds did not enroll in gatekeeper math. Those who did enroll had a reasonably high degree of success: 77 percent of students passed gatekeeper English, and 73 percent passed gatekeeper math. For the purposes of this study, a student needed to earn a grade of C or higher to pass a gatekeeper course.[8]

The same pattern distinguishing taking from passing rates holds for students who were placed in transfer or career tech programs. A smaller proportion of students in career tech programs attempted to take gatekeeper English or math, which may be expected given that some career tech programs may not require those courses. The gatekeeper course passing rates for transfer and career tech program students were similar to one another (78 compared with 74 percent for English and 76 compared with 70 percent for math). Consideration of only the overall completion rate (i.e., the percentage of students enrolled in career tech programs who completed gatekeeper courses) would suggest that students in career tech programs had particularly low rates of success. Again, however, this poor outcome largely results from the fact that most of them did not enroll in gatekeeper courses: only 50 percent of students in career tech programs took gatekeeper English and only 31 percent enrolled in gatekeeper math.

<u>Finding</u>: *There was a substantial amount of variation in the proportion of students taking and passing gatekeeper English and math courses across colleges.*

The overall pattern reported in Table 6 regarding taking vs. passing gatekeeper courses held across institutions on average, but there was much variation among the colleges. The proportion of students taking gatekeeper English ranged from 50 to 71 percent across institutions. The variation in the proportion of students taking gatekeeper math was even more notable, ranging from 17 to 50 percent. A similar pattern, indicating more variation in math, was apparent in the passing rates: the passing rates for students who took gatekeeper English ranged from 66 to 85 percent, while the passing rates for those who took gatekeeper math ranged from 58 to 89 percent across institutions.

Although there was much variation across institutions, the relationship between the proportion of students taking and passing gatekeeper courses at the institutional level was

[7] For English, ENG111 was coded as a gatekeeper. The following math courses were counted as gatekeepers: MTH151, MTH158, MTH163, MTH166, MTH173, and MTH271. In addition, students in career tech programs could take MTH105, MTH120, MTH121, MTH126, or MTH141. Students who passed any of these designated math courses were considered to have passed gatekeeper math.

[8] Students could take a course multiple times to pass. Those who passed a course at any try were considered to have passed. Moreover, students with missing grades on gatekeeper courses were deleted from the analyses in this section. If these students were assumed to have failed the course, reported passing rates would be slightly lower.

quite weak. The correlation between institutional-level enrollment and pass rates for gatekeeper English was 0.18 and for math 0. These weak correlations indicate that institutions with high rates of students taking gatekeeper courses were not the same institutions that had high rates of students passing gatekeeper courses. It is important to note that this pattern does not emerge because institutions with a low proportion of students taking gatekeeper courses had a high proportion of students passing those courses; such a pattern would indicate a negative correlation between the two outcomes. Instead, the relationship appears to be largely random, i.e., the proportion of students taking and passing gatekeeper courses at the institutional level are not related. Thus, it appears that some institutions are better at helping students enroll while others are more successful at helping them pass once they enroll.

The correlations across subjects were stronger, but still relatively weak. The institutional-level correlation for taking gatekeeper English and math was 0.40, while the correlation for passing gatekeeper English and math was 0.30. These correlations suggest that institutions with high rates of students taking gatekeeper English were not necessarily the same institutions with high rates of students taking gatekeeper math. The same holds for passing gatekeeper English and math. Some institutions thus had higher rates of taking or passing gatekeeper English, while others had higher rates of taking or passing gatekeeper math. These results indicate that each of Virginia's community colleges performs well in some areas and can benefit from improvement in others; thus, every college can enhance student success by sharing effective practices with its peers.

<u>Finding</u>: *Whether students took gatekeeper courses depended on whether they took developmental education and at what level. Gatekeeper passing rates were remarkably similar across all groups of students, however, regardless of the developmental level at which they began.*

Overall gatekeeper course taking and passing rates provide useful benchmarks. In addition, Table 6 shows the proportions of students who took and passed gatekeeper English and math, depending on whether they had enrolled in developmental courses. Students who took developmental courses were divided into groups based on the level of their first developmental course. Reading and writing had two levels and math had three levels, as described above in the discussion of Table 3.[9]

The first point that stands out in Table 6 regarding developmental education is the importance of distinguishing among different levels. If students were simply divided into two groups — those who took developmental courses and those who did not — we would miss notable differences across levels. For reading and writing, students starting at level-1 (i.e., two levels below college level) were much less likely to take gatekeeper English than those starting at level-2 or not taking any developmental courses in those

[9] An alternative would have been to consider students taking level-1, level-2, and level-1 plus level-2 courses. However, the last category had very few cases. For example, only 11 percent of students took level-1 and level-2 reading, and they were among only 14 percent of students who took any developmental reading courses at all.

subjects. Students who started at level-2 were remarkably similar in their rates of taking gatekeeper English to students who took no developmental reading or writing courses.

The pattern for math presents an even stronger contrast across levels. Less than 20 percent of students who started in the lowest level of developmental coursework (i.e., in a pre-algebra course) took gatekeeper math. Students who started in Algebra I did slightly better, followed by students who took no developmental math. Students who started in Algebra II or higher stood out: 61 percent of them took gatekeeper math, which was a notably higher percentage than any other group. This pattern may emerge as a result of challenges associated with completing multiple developmental courses. Students who start in a pre-algebra course may perceive the road to the gatekeeper course as too long and too difficult, as they must complete multiple developmental math courses before they may even enroll in gatekeeper math. Moreover, the need to take multiple courses presents multiple opportunities for students to either not pass the courses or simply not attempt to go further. Thus, those with the longest road ahead are least likely to cross the finish line, in terms of enrolling in gatekeeper math.

The low rate of taking gatekeeper math among students who did not enroll in developmental math was surprising. We investigated this issue further and learned that the pattern emerged because that category includes two distinct groups of students: students who were recommended to take a developmental math course but did not, and those who were not recommended to take developmental math. The first group had a very low rate of enrollment in gatekeeper math (35 percent) while the second had a much higher rate (75 percent). The relationship between recommendations and course-taking is discussed in depth later in this report. For now, it is only important to note that students included in the category of "no developmental course" in Table 6 could be so categorized because they did not require remediation (i.e., they were not recommended to take developmental courses) or because they did not take developmental courses even though they were recommended to do so.

While the enrollment rates in gatekeeper courses varied, the passing rates for students who enrolled were remarkably similar. For example, 78 percent of students without developmental reading coursework passed gatekeeper English, as did 74 percent of students who started at level-1 and 73 percent of those who started at level-2. Even in math, where gaps in enrollment rates were more pronounced, differences in passing rates were relatively small (particularly compared with differences in enrollment). Similar patterns held for students placed in transfer and career tech programs. Thus, once students entered the classroom, they were approximately equally successful in learning the material and passing the course regardless of where they started. A key challenge, then, is getting students to enroll in the first place. This pattern is consistent with findings from the Achieving the Dream initiative, a national community college reform effort (Bailey, Jeong, & Cho, 2009).

As would be expected based on the previously reported variation in overall gatekeeper taking and passing rates, there was much variation across institutions in whether students who enrolled in developmental courses took and passed gatekeeper English and math.

Since all institutions do not offer all levels of reading and writing developmental coursework, and since the number of cases was low for some categories, students taking any developmental coursework (regardless of level) were combined into one category for the purposes of discussing institutional variation. Among students who took developmental reading, the rates of taking gatekeeper English ranged from 35 to 75 percent while the gatekeeper English pass rates ranged from 50 to 86 percent across colleges. The pattern was similar for students who took developmental writing. The gatekeeper math course-taking rates were lower, but they still exhibited much variation: among students who took developmental math, between 18 and 38 percent enrolled in gatekeeper math across institutions.

Although the relationships were far from perfect, there was a tendency for institutions that were successful with students who did not take developmental courses to be successful with those who did take them. We calculated the institutional rates of taking and passing gatekeeper courses for students who took developmental courses in each subject and for those who did not, and then correlated them. Most correlations were relatively high and positive, particularly for the proportion of students taking gatekeeper courses (0.64 for students who did and did not take developmental reading, 0.54 for students who did and did not take developmental writing, and 0.47 for students who did and did not take developmental math). Thus, institutions with high rates of gatekeeper enrollment tended to facilitate enrollment for all students, including those who did and did not take developmental courses.[10]

To explore the relationship between developmental and gatekeeper courses more carefully, we conducted a set of logit regression models. Because students in transfer and career tech programs have different patterns of course-taking (with respect to both developmental and gatekeeper courses), these analyses were conducted only for transfer program students. The advantage of logit models is that they control for a range of student characteristics (including test scores, gender, race, age, and dual enrollment) and for the institution attended.[11] The disadvantage of the presented logit models is that they are based on a substantially reduced sample because of missing data on test scores and recommendations.[12] Nevertheless, they present a useful alternative approach for examining students' likelihood of taking and passing gatekeeper courses. Figures 1-3 in Appendix B present predicted probabilities of taking and passing gatekeeper courses for transfer-placed students in different categories of developmental instruction. The probability of passing a course is calculated only for students who took the course (i.e., passing a course is conditional on taking that course). All control variables were held at their means for estimation of predicted probabilities. Regarding test scores, predicted

[10] Some of the institutional estimates are based on a relatively small number of cases (frequently under 100 and occasionally under 50; this is especially the case for estimates of gatekeeper passing rates, since those estimates are restricted to students who enrolled in gatekeeper courses). Consequently, presented correlations are not definitive, but they illustrate variation across colleges and invite further investigation into whether and how colleges can facilitate success of all of their students, including those who participate in developmental instruction.

[11] Institutions refer to the first institution attended.

[12] Reduction in the sample size is particularly problematic because missing cases are not missing at random. Discussions later in this report explore the patterns of missing data in more detail.

probabilities were calculated for the average student in a given course-taking category, i.e., predicted probabilities for students who took level-1 reading were calculated based on the mean reading test score for those students.

Before discussing the relationship between developmental course-taking and the probability of successful course completion, it is worthwhile to note that student characteristics are important predictors of whether students pass a particular course. Among the students in the sample examined here, women were consistently more likely to pass courses, including developmental and gatekeeper math and English, net of other factors. Similarly, Asian students were more likely to pass courses than white students, while African American students were less likely to do so. Students who took dual enrollment courses in high school were more likely to successfully pass courses than those who did not take dual enrollment courses. Similarly, older students (those who were 25 years or older in fall 2004) were more likely to pass courses than were younger students. This last finding may seem counterintuitive, but it emerges because analyses of whether students passed a course are restricted to students who took the course. Older students were notably less likely to enroll in developmental and gatekeeper courses, net of other factors, but when they did enroll, they were quite successful at passing them. This finding highlights the importance of separating enrollment in a course from passing a course: while both steps are necessary for progression toward credentials, they are separate processes with a distinct pattern of outcomes.

<u>*Finding*</u>: *Controlling for individual characteristics, including test scores and institution attended, replicates previously reported descriptive results. Students had similar probabilities of passing gatekeeper courses regardless of whether they enrolled in developmental courses. However, there were notable differences across groups in the probability of enrolling in gatekeeper courses, particularly for math.*

A comparison of transfer-placed students who did and did not participate in developmental instruction demonstrates that the gaps in the rates of taking and passing gatekeeper courses were not appreciably altered after controlling for individual characteristics (including test scores) and institutions attended. Figures 1 and 2 reveal that the probability of passing gatekeeper English (represented by black bars) was virtually identical across groups. Regardless of whether or not students took developmental reading or writing, they had the same probability of passing gatekeeper English. The patterns for enrolling in gatekeeper courses (represented by gray bars), however, differed across groups. Students who started in a level-1 reading course had a lower probability of taking gatekeeper English than students who did not take any developmental reading courses or students who started in a level-2 reading course. The same pattern held for writing.

Corroborating descriptive results, logit models for math reveal even more differences across groups. The models presented are restricted to transfer-placed students who

reported a valid algebra test score, which was included as a control variable.[13] The probability of passing gatekeeper math was relatively similar across groups. Students who started at level-1 had a lower probability of passing gatekeeper math than other groups of students. However, those differences were relatively small, compared with the differences in taking gatekeeper math.[14] Students starting at level-1 (a pre-algebra course) had a particularly low probability of taking gatekeeper math. After adjusting for individual characteristics, including test scores and institutions attended, an average student starting in a pre-algebra course had only a 12 percent chance of taking gatekeeper math. An average student in this case is one who is at the mean of all control variables and has a mean algebra test score for students enrolled in pre-algebra courses. In contrast, an average student starting in Algebra II or higher had a 62 percent chance of taking gatekeeper math. An average student in this case is one who is at the mean of all control variables and has a mean algebra test score for students enrolled in Algebra II or higher.

Other educational outcomes

Taking and passing gatekeeper English and math often constitutes only the first step in the educational attainment process. Students passing those milestones need to earn a sufficient number of additional credits to obtain educational credentials. This section considers these longer term educational outcomes. Table 7 displays the proportion of students who earned educational credentials (certificates and associate degrees) or transferred to a four-year institution. Table 8 examines several intermediate outcomes on the path toward earning a credential: number of terms enrolled and number of credits attempted and completed.

<u>*Finding*</u>: *Students who took developmental courses, particularly at level-1, were less likely to successfully attain educational outcomes than students who did not enroll in developmental courses.*

Overall, 30 percent of students attained any educational outcome (including earning a certificate or an associate degree or transferring to a four-year institution) within the observation period of approximately four years.[15] Transferring to a four-year institution was the most common educational outcome: a total of 20 percent of students transferred, with13 percent transferring without earning an associate degree and 7 percent transferring

[13] The majority of students took one of three math tests: pre-algebra, algebra, or college algebra. Algebra represents the middle range of math ability (between pre-algebra and college algebra). Moreover, algebra had the highest number of valid cases in the dataset. We thus controlled for algebra test scores in presented analyses. We discuss below the differences in student outcomes across the three distinct math tests.
[14] While there were some students with valid algebra test scores who enrolled in Pre-Algebra, a more common pattern was for students who enrolled in Pre-Algebra to take the pre-algebra test. If we calculated the predicted probability for students enrolling in Pre-Algebra based on the pre-algebra test score, the probability of taking gatekeeper math would not change, but the probability of passing gatekeeper math would increase, making the gatekeeper passing rates of these students even more similar to other groups.
[15] Educational outcomes were coded exclusively based on the highest credential completed (i.e., students who earned both a certificate and an associate degree were coded as having earned an associate degree; students who earned a certificate and then transferred to a four-year institution were coded as having transferred).

after earning an associate degree. An additional 7 percent of students earned an associate degree as their highest credential. Only 3 percent completed a certificate. Students who did not take any developmental reading or writing courses earned the highest proportion of credentials, both certificates and associate degrees. Moreover, they were more likely to transfer to a four-year institution than were students who took developmental courses in reading or writing. Among students who took developmental reading or writing, those starting at level-2 had higher rates for earning an associate degree or transferring to a four-year institution than did students who started at level-1.

Math presents a similar pattern, with the exception of students who started at the highest level of developmental math: students who started in Algebra II or higher had slightly higher rates of successfully attaining educational outcomes than students who did not take any developmental math. Students starting at the lowest level of developmental math (a pre-algebra course) had much lower success rates than either those who did not take developmental math or those who started in Algebra II or higher. Only 18 percent of students starting in a pre-algebra course attained any educational outcomes.

<u>Finding</u>: *Students who took developmental courses, and especially those starting at level-1, attempted a fewer number of credits and completed a smaller proportion of the credits attempted. All groups of students, however, were enrolled for a similar number of terms, with the exception of those starting in Algebra II or higher.*

Table 8, which reports the number of terms enrolled and credits accumulated, provides some insights into why a relatively small proportion of students earned educational credentials. Credits reported in this table refer to college-level credits.[16] Students in the summer/fall 2004 cohort could be enrolled for a maximum of 13 terms (counting summer, fall, and spring). Without counting summers, students could be enrolled for a maximum of eight terms. On average, students were enrolled for only approximately half of that time: four-and-a-half terms. All groups of students, regardless of whether they participated in developmental instruction, were enrolled for a similar number of terms. Students who started in Algebra II or higher comprised the only exception; they were enrolled for an average of five-and-a-half terms.

While four terms could be an adequate amount of time to earn an associate degree (typically around 60 credits) if students were enrolled full time, students in the sample accumulated on average only 27 college-level credits. This low level of credit accumulation emerged because students attempted a relatively small number of credits (on average 36) *and* they did not complete (by earning a grade of D or higher) all of the credits attempted. On average, students completed 66 percent of the credits they attempted.

[16] College-level credits were defined as all credits earned in courses numbered 10 or higher, except for those with ELS or BKS prefix and MTH50. For students placed in transfer programs, courses numbered 100 or above were considered college level.

Moreover, while all groups of students tended to be enrolled for a similar number of terms, they did not earn the same number of credits. Students who started at level-1 earned fewer credits than did students who either did not take a developmental course or started at level-2 or level-3 (for math). Lower credit accumulation resulted from two factors: students at level-1 attempted a fewer number of credits and they accumulated (by earning a grade of D or higher) a smaller proportion of the credits they attempted. For example, students who started at level-1 reading attempted 28 credits, compared with 36 credits attempted by students who did not take any developmental reading. Moreover, students starting in a level-1 reading course completed only 56 percent of attempted credits, compared with the 68 percent completion rate for students who did not take any developmental reading courses. The same pattern holds for writing and math, except that students who started in Algebra II or higher completed more credits than those who did not take any developmental math courses.

The reported numbers may appear low because they include all students: those placed in transfer as well as career tech programs. The second portion of Table 8 thus focuses only on transfer program students. The results are remarkably similar. Transfer program students were enrolled for approximately four-and-a-half semesters; they attempted 38 credits and successfully completed 66 percent of them. The differences between students who did and did not enroll in developmental instruction among students in transfer programs are similar to the differences among all students. Thus, a relatively low rate of credit accumulation (resulting from both a small number of credits attempted and a failure to complete all credits attempted) holds for students in transfer programs as well as those in career tech programs.

Placement Recommendations and Student Outcomes

The previous section focused on students who took developmental courses in reading, writing, and math. However, those are not necessarily the same students who were recommended to take developmental courses. The discrepancy between recommendations and course-taking emerges from two sources: (1) missing placement recommendation data, and (2) students who did not follow their placement recommendations.

Course-taking recommendations

Finding: *A large number of students were missing placement recommendations. Among students with valid placement recommendations, the highest proportion received a recommendation to take developmental math.*

As Table 9 indicates, more than one third of students in our sample were missing placement recommendations for reading, writing, or math. Considering students with valid recommendations, sizable proportions were recommended to take developmental

courses in each subject.[17] Of the total sample, 17 percent of students were recommended for a developmental reading course and 25 percent for developmental writing. Recommendations for developmental education were particularly high for math: over 50 percent of students were recommended for a developmental course in this subject. However, these percentages underestimate the proportion of students requiring remediation due to missing data on placement recommendations. Considering only students with valid recommendations, 80 percent were recommended to take developmental math, 27 percent developmental reading, and 39 percent developmental writing. The actual need for developmental education is likely higher than what Table 9 reports because a certain proportion of students with missing data would likely have been recommended to take developmental courses. Indeed, almost 20 percent of students in the dataset without a reported reading or writing recommendation actually took a developmental English course; 24 percent of students missing a math recommendation took a developmental math course. The need for developmental education is thus understated in analyses relying only on placement recommendations.

<u>Finding</u>: *There were substantial differences among colleges in their reporting of placement recommendations as well as in the proportion of their students recommended to take developmental courses.*

Although on average the dataset was missing 37 percent of writing recommendations, the proportion of missing cases varied dramatically across colleges: from 10 to 99 percent. Table 10 reports the proportion of students placed in developmental courses as well as the proportion of missing recommendations by college.[18] Two institutions provided virtually no recommendations for their students since they did not adopt COMPASS (the test on which placement recommendations were based at the other colleges) until 2005. Further, eight institutions were missing over 50 percent of writing recommendations. The patterns of missing data in reading, writing, and math were similar across institutions: institutions that provided a large proportion of recommendations for writing were the same institutions that provided a large proportion of recommendations for reading and math.

[17] The data provided by the VCCS included placement recommendations for students in reading, writing, and math. The recommendations are based on test scores, although there are a few cases with reported test scores but no placement recommendations. As was the case for analyses of course-taking, recommendations for ENG01 and ENG03 were considered developmental writing, and those for ENG04 and ENG05 were considered developmental reading. Recommendations for any math course below 10 were coded as developmental math. Students in the decision zones between developmental and gatekeeper courses were coded as recommended to take developmental education. This category includes 1 percent of students with reading recommendations and 4 percent of students with writing recommendations. No students had a recommendation code that was on the boundary between developmental and gatekeeper courses for math.

[18] Students were associated with the first institution attended. We chose to focus on the first institution because that was where placement test scores and recommendations would be most relevant. Moreover, since the majority of students took developmental education early in their educational careers, focusing on the first institution attended is important when examining educational outcomes. The majority of students stayed at one institution, although some attended multiple institutions.

Colleges also varied in the extent to which they recommended that students take developmental courses.[19] However, it is difficult to judge the true extent of this variation due to the large and variable amount of missing information. We cannot assume that all students missing recommendations were exempt from developmental education (and a sizable proportion of them did indeed enroll in developmental courses); thus, the actual distribution of recommendations for developmental instruction across institutions remains unclear. Since we cannot capture an accurate representation of the distribution of placement recommendations across colleges, we cannot examine the relationship of recommendations to other outcomes for specific institutions. Analyses of recommendations presented in this report thus include all students with valid recommendations and do not consider variation across institutions.

<u>Finding</u>: *Approximately 50 to 60 percent of students referred to developmental education took the recommended developmental course. While some such students took a developmental course they were not recommended to take, over one third did not take any developmental courses in the recommended subject.*

For students who had placement recommendations, we conducted a comparison of courses recommended versus courses taken, using two different matching procedures: an exact (or one-to-one) match and a flexible match (Table 11). The exact match starts with students who were recommended to take a specific developmental course and examines whether they took that exact course.[20] The second, more flexible matching procedure includes students in decision zones. Students whose recommendations fell in the decision zone (i.e., who were not recommended to take a specific course but were placed in the decision zone between different course levels) were considered to be matching if they took a course either above or below the decision zone. The two matching procedures produced similar results.

Course recommendations and course enrollments matched for only approximately 50 to 60 percent of students. The match was highest for writing and lowest for math (60 percent and 51 percent, respectively, as measured by our exact matching procedure). Some students did not take a recommended developmental course, but took another developmental course in the same subject area. This was particularly the case for math. However, a notable proportion of students who were recommended to take developmental courses did not take any developmental courses in the subject. Based on the exact matching strategy, 39 percent of students who were recommended to take a developmental math course did not do so. Similarly, 35 percent of students who were recommended to take a developmental writing course and 41 percent who were

[19] The proportion of students taking developmental reading and writing across colleges is understated for some institutions that offer courses other than those examined in this report (e.g., other than ENG01 and ENG03 for writing and ENG04 and ENG05 for reading).

[20] The only exception to the one-to-one recommendation-course match is MTH09, which is offered at some institutions as a pre-algebra course. Consequently, both MTH02 and MTH09 are matched to a pre-algebra recommendation.

recommended to take a developmental reading course did not take any developmental courses in those subject areas. The percentages of students not taking any developmental courses are not substantially lower under the flexible matching procedure.

Outcomes of transfer-placed students recommended to take developmental courses

To illustrate students' progression through developmental courses, we present detailed analyses of educational trajectories of students recommended to participate in developmental education. Due to different requirements and pathways for students placed in transfer and career tech programs, these analyses focus only on students in transfer programs. As was the case in the previous section, developmental recommendations and courses were separated into different levels. Writing had two levels: Level-1 (ENG01) and Level-2 (ENG03). Reading also had two levels: Level-1 (ENG04) and Level-2 (ENG05). Math courses were divided into three levels: Level-1 (Pre-Algebra: MTH01, MTH02, and MTH09), Level-2 (Algebra I: MTH03), and Level-3 (Algebra II or higher: MTH04, MTH05, MTH06, MTH07). Table 12 reports numbers and percentages of transfer program students who were recommended to take developmental courses at each level. The highest proportion of students in each subject area was recommended to take a level-2 course. Level-2 represents the highest level course for reading/writing, but it is only the middle level of developmental sequence for math.

The following analyses begin with students recommended to a particular developmental course level, and follow their progression through developmental education. Figure 4 shows the results for math. Panel A begins with 1,817 students recommended to level-3, Panel B with 4,075 students recommended to level-2, and Panel C with 1,503 students recommended to level-1. For each group of students, we consider whether they completed (took and passed) the recommended level, and then whether they completed the next level of developmental education (if there was one). The percentage in the top right hand corner denoted as "completed" represents the proportion of students who completed developmental coursework in the subject (i.e., who completed the sequence, ending with taking/passing level-3 developmental math).[21]

<u>Finding</u>: *Students who were recommended to take lower level developmental courses were less likely to complete the developmental sequence than those recommended to take higher level developmental courses. Moreover, a large proportion of students did not even complete the first recommended developmental course.*

Similar proportions of students who were recommended to take a level-2 or a level-3 course completed developmental math coursework (24 and 22 percent, respectively) (Figure 4). However, only 10 percent of students who were recommended to take a level-

[21] Some students did not follow this sequence. For example, some students who were recommended to level-2 took a level-3 course instead. If they had enrolled in and passed a level-3 course, they would have still been considered to have completed the developmental sequence (and would be included in the "completed" percentage).

1 course completed the sequence. It is also worthwhile to note that a large proportion of students exited before even completing the lowest recommended math level: 59 percent of students recommended to level-2 did not complete a level-2 course and 51 percent of students recommended to take a level-1 course did not complete level-1. Thus, the issue is not so much that students were not progressing through the sequence of developmental coursework as it is that they were not completing even the first recommended course.

Completion rates were higher for reading and writing than for math although the same patterns apply (Figure 5). Students who started at a lower reading/writing level were less likely to complete developmental coursework than those who started at a higher reading/writing level. Among students recommended to take a level-2 course, 41 percent completed a reading course and 43 percent completed a writing course. The completion rates for students recommended to take a level-1 course were only half as high (20 percent for reading and 24 percent for writing). Moreover, almost 50 percent of students recommended to take a level-1 course did not complete that first step in the sequence. Thus, most exits in developmental education occurred because students did not complete the first recommended course. A similar pattern was observed in a study of the progression of students in developmental courses that used data from community colleges participating in Achieving the Dream, a national community college reform effort (Bailey, Jeong, & Cho, 2009).

<u>Finding</u>: *Most students did not complete recommended developmental courses not because they did not pass the courses they took, but because they never enrolled in them.*

The completion rates shown in Figures 4 and 5 are based on students who took and passed a particular course. This means that the category of "did not complete" includes both some students who never enrolled in a course and some who enrolled but did not pass. Figure 6 distinguishes between these two groups. Focusing first on students who were referred to level-1 reading and writing reveals that the majority of students did not complete this level because they never enrolled in a level-1 course. Percentages for level-1 math are slightly more evenly distributed between taking and passing a course, but even then, more students did not enroll in a course than took but did not pass it. The same pattern applies to all levels of developmental coursework: at each level, students did not complete courses largely because they did not enroll in them.

<u>Finding</u>: *Students recommended to take lower level developmental courses were less likely to complete gatekeeper courses than students recommended to take higher level developmental courses. Moreover, students did not complete gatekeeper courses primarily because they never enrolled in them.*

Figure 7 reports the proportion of students who completed gatekeeper English and math based on the recommended level of developmental coursework. As might be expected, students who were recommended to take a level-1 developmental course were less likely

to complete a gatekeeper course than those recommended to take level-2 or level-3. The completion rates of gatekeeper courses were particularly low for students recommended to take any level of developmental math courses. For example, only 8 percent of the students recommended to level-1 math completed a gatekeeper course.

The contrast between taking and passing a course was even more pronounced for gatekeeper courses than it was for developmental courses. Relatively small proportions of students took a gatekeeper course but did not pass it.[22] However, almost half of students recommended to level-1 reading or writing did not even enroll in gatekeeper English. The patterns are particularly stark for math: almost 90 percent of students who were recommended to take a level-1 developmental math course never enrolled in a gatekeeper math course. Thus, the low gatekeeper completion rates are not so much a product of students not passing classes they took, but rather are a result of their never even attempting to complete the developmental sequence and enroll in gatekeeper courses.

Outcomes for students who did not follow placement recommendations

Previous sections have described the educational trajectories of students who were recommended to take developmental courses. One finding surfacing across the analyses is that a notable proportion of students recommended to take developmental courses did not do so.[23] This section examines outcomes of those students. More specifically, we compare students who were recommended to take developmental courses but did not with two other groups of students: (a) those who were recommended and did enroll in developmental courses, and (b) those who were not recommended to take developmental courses.[24] Since many students were missing placement recommendations, we also report outcomes of those students.

<u>Finding</u>: *Students who were recommended to take a developmental course but did not do so had similar rates of taking and passing gatekeeper English and math as students who were recommended and did take a developmental course in the subject.*

Table 13 shows that, as would be expected, students who were not recommended to take a developmental course in reading or writing were the most likely to take gatekeeper English (77 percent for reading and 82 percent for writing). Smaller percentages of the

[22] Students could take a course multiple times to pass. Students who took a gatekeeper course several times and passed at any try were considered to have passed.

[23] Students who were recommended but did not take developmental courses included students from all levels of recommendations. For example, 40 percent of students recommended for level-1 reading did not do so, and 47 percent of students recommended for level-2 reading did not enroll in that course. If we include in the calculations whether students took any developmental course in the subject (as opposed to only the course recommended), the percentages of students skipping developmental coursework are slightly lower, but still include students at all recommendation levels. The same pattern holds for writing and math.

[24] As Table 11 indicates, a small proportion of students did not take the recommended developmental course but took another developmental course in the subject. Those students were included in the category of "recommended *and* took a developmental course."

other groups of students examined here enrolled in gatekeeper English. Among students who were recommended to take developmental reading, 55 percent of those who did, and 50 percent of those who did not, enrolled in gatekeeper English. This 5 percentage point gap is negligible compared with the 22 to 27 percentage point gap between these students and students who were not recommended to take developmental reading. A similar pattern is observed for writing. Moreover, passing rates were remarkably similar across groups: regardless of whether students were recommended for and/or took a developmental reading or writing course, they were approximately equally likely to pass gatekeeper English. Students with a missing recommendation had the highest rate of passing gatekeeper English; however, since we do not have recommendations or test scores for these students, it is not clear why that is the case. Thus, overall, with respect to reading and writing, there were no notable differences between students who were recommended and did take a developmental course and those who were recommended but did not take such a course. This finding could imply that developmental courses are not necessary for all students recommended to take them, suggesting the need to re-evaluate the placement mechanisms. Alternatively, the finding could imply that students who skip developmental courses are a self-selected group who can succeed because of other characteristics, such as motivation, effort, and other factors not captured by placement test scores. Since our results cannot indicate which of these alternative interpretations is correct, it may be particularly fruitful to conduct further research to understand what factors facilitate the success of students who were recommended but did not take developmental courses.

A similar pattern is evident for math, although the gap between students who were not recommended to take a developmental course and those who were is more pronounced. Seventy-five percent of students who were not recommended for a developmental math course enrolled in gatekeeper math. Much smaller percentages of other groups did so: 31 percent of students who were recommended and did take developmental math, 35 percent of students who were recommended but did not take developmental math, and 28 percent of students missing math recommendations. The rates of passing gatekeeper math were more similar across groups, although the gaps were more pronounced than for reading and writing. Notably, students who were recommended to take developmental math had very similar outcomes (in terms of both taking and passing gatekeeper math) regardless of whether or not they actually took a developmental math course.

Across all the categories considered in Table 13, students placed in career tech programs were less likely to take gatekeeper courses than those placed in transfer programs. This variation may reflect in part different requirements in career tech programs; they all may not require that students pass gatekeeper courses. The difference for math was smaller in part because students in career tech programs could take a broader range of courses to satisfy the gatekeeper math requirement. The overall pattern of results reported for the entire cohort holds for students placed in both transfer and career tech programs. There is one notable exception: students in career tech programs who were recommended for but did not take a developmental reading or writing course were less likely to enroll in gatekeeper English than those who were recommended for and took developmental reading or writing. Thus, in career tech programs, there was a difference between

students who did and did not follow the recommendation to take developmental reading/writing. However, both groups had similar rates of passing gatekeeper courses.

Finding: *Students who were recommended for but did not take developmental courses fared equally well in terms of successfully attaining educational outcomes as students who were recommended for and took developmental courses.*

Among students with valid placement recommendations, those recommended to take college-level courses (i.e., not recommended to take developmental courses) were more likely to earn an associate degree or to transfer to a four-year institution (Table 14).[25] Students who were recommended for but did not take developmental courses had similar or higher rates of attaining at least one educational outcome as students who were recommended and did take developmental courses. This pattern reflects in part the types of credentials earned. Approximately twice as many students who were recommended for a developmental course but did not take it earned certificates compared with students who were recommended and did take a developmental course. However, students who did not follow their placement recommendation also earned equal or higher proportions of associate degrees and had equal or higher rates of transfer to four-year institutions than students who followed their recommendations and took developmental courses. Thus, while students who were recommended for but did not take a developmental course earned more certificates, they also attained other outcomes at comparable rates to students who were recommended and did take a developmental course.

Students who had missing recommendations for reading or writing had the highest rate of attaining at least one of the educational outcomes, in part because they earned the highest proportion of certificates. However, they also earned the highest proportion of associate degrees of any group of students. Students who were missing math placement recommendations did not fare as well, although they attained educational credentials at a higher rate than students who were recommended to take developmental math. These analyses suggest that recommendation data are not missing at random. Students with missing recommendations have a distinctive set of outcomes. If their recommendations and test scores were available, we could better understand their educational outcomes.

[25] Educational outcomes were coded exclusively on the basis of the highest credential completed (i.e., students who earned both a certificate and an associate degree were coded as having earned an associate degree; students who earned a certificate and then transferred to a four-year institution were coded as having transferred).

Finding: *Students who were recommended to take college-level courses accumulated the most credits. Students who were recommended for but did not take developmental courses accumulated a similar number of credits as students who were recommended for and did take developmental courses. However, students who were recommended for but did not take developmental courses enrolled for the shortest amount of time of any group of students with valid recommendations.*

Students who were recommended to take developmental courses but did not were enrolled for the shortest amount of time of any group of students with valid placement recommendations (Table 15). For example, students who were recommended for developmental math but did not take it were enrolled for 1.3 terms less than those who were recommended for college-level math and one term less than those who were recommended for and did take developmental math. The same pattern, although with smaller gaps, was apparent for reading and writing. The next three columns in Table 15 show the number of credits attempted and completed, as well as the percentage of credits completed. Credits in this table refer to college-level credits.[26] With respect to earning credits, students who were recommended to take college-level courses fared the best: they attempted more credits and completed more of the credits that they attempted than students who were recommended for developmental courses. At the same time, students who were recommended for developmental courses accumulated approximately the same number of credits regardless of whether or not they actually took developmental courses. Thus, again, as was the case with taking and passing gatekeeper courses, accumulation of credits does not appear to be related to whether students followed their placement recommendation.

Placement Test Scores and Student Outcomes

Placement test taking

Finding: *Approximately two thirds of students in the dataset had placement test scores in one of the three subject areas: reading, writing, or math.*

Among students in the summer/fall 2004 cohort, only approximately two thirds had placement test scores for reading, writing, or math.[27] Moreover, only slightly over half (56 percent) of students had a full set of scores for reading, writing, and math (Table 16).

[26] College-level credits were defined as all credits earned in courses numbered 10 or higher, except for those with ELS or BKS prefix and MTH50. For students placed in transfer programs, courses numbered 100 or above were considered college level.

[27] Given that the report focuses on a cohort of students entering higher education in summer/fall 2004, test scores reported before 2000 or after 2008 were deleted, as were a few scores outside of the range. Only 50-58 students were deleted in each subject, however, thereby contributing minimally to missing data.

There are several reasons why students may be missing placement test scores. First, it is possible that some students had demonstrated English and math proficiency through other means (such as the SAT or other tests), and thus were exempt from taking placement exams. This situation implies that students with missing test scores were not in need of developmental instruction. Since students who took dual enrollment courses during high school were missing a higher proportion of test scores than those who did not, there is some support for this hypothesis. However, students' course-taking patterns indicate that many students without placement test scores likely required developmental instruction. Approximately 20 percent of students who were missing reading or writing test scores took a developmental English course. Similarly, 24 percent of students missing math placement test scores took a developmental math course. Since many students who were recommended to take developmental courses did not do so, the need for developmental instruction among students missing placement test scores is likely much higher than 20 to 24 percent. Exemptions may be able to explain some, but certainly not all, of the missing data.

Another possible reason for missing placement test scores may be that some students enrolled in programs that did not require placement tests. In particular, students in some career tech programs may not have had to take placement tests. Even if this were the case, it is not the leading cause of missing data. Table 16 shows that only a slightly higher proportion of students in career tech programs than students placed in transfer programs were missing placement test scores. Even among transfer program students, one third was missing test scores for reading, writing, or math, and only 58 percent had test scores for all three subjects.

Missing data on test scores appears to largely reflect reporting differences across institutions. An examination of the pattern of missing data across institutions reveals that institutions reported from 1 to 90 percent of the data. Two institutions provided virtually no recommendations for their students since they did not adopt COMPASS until 2005. Many other institutions were missing over 50 percent of the cases. The missing data for test scores mirrors the missing data for recommendations reported in Table 10.[28] Due to the large and variable number of missing data across institutions, we are not able to determine the true distribution of test scores in each college. Consequently, the findings presented in this section are based on analyses of data on students for whom placement test scores were reported, without considering variation across institutions.

Taking and passing developmental and gatekeeper courses

<u>Finding</u>: *Students with higher placement test scores were less likely to take developmental courses and more likely to take gatekeeper courses than students with lower placement test scores. However, not all students with low test scores enrolled in developmental courses, and not all students with high test scores enrolled in gatekeeper courses.*

[28] There are only a few cases where students had valid test scores but were missing placement recommendations.

As expected, students with higher placement test scores were less likely to take developmental courses and more likely to take gatekeeper courses. However, those relationships are far from perfect. Table 17 shows the proportion of students taking developmental and gatekeeper courses in each test score quartile, where the 1st quartile refers to the one fourth of test takers with the lowest scores in the given subject area. While students took common tests for reading and writing, they could take several different math tests. The relationships between math scores and student outcomes are thus examined by subject, focusing on the three most common: pre-algebra, algebra, and college algebra.[29]

Over 40 percent of students in the lowest quartile of the reading test score distribution did not take a developmental course in reading. Neither did 34 percent of students in the lowest quartile of the writing test score distribution, even though virtually all students in the lowest test score quartiles were recommended to take developmental courses. There is some discrepancy between recommendations and course-taking at all test score levels, but the discrepancy is largest in the lowest quartile, where almost all students were recommended to take developmental courses but many did not do so.

The results for math vary by the test taken, but the overall pattern reported for reading and writing holds. Among students who were in the lowest quartile of the pre-algebra test score distribution, 28 percent did not enroll in developmental math. The same is the case for students in the lowest quartile of the algebra test score distribution, where 40 percent of students did not take developmental math. Virtually all students in the lowest quartile of pre-algebra and algebra test score distributions had a recommendation indicating that they needed to enroll in developmental coursework. College algebra shows a different pattern: a small proportion of students who took college algebra were recommended to take developmental math but a higher proportion of them did so.

The final column in Table 17 shows that students with higher test scores were more likely to take gatekeeper courses.[30] However, even in the highest reading and writing test score categories (i.e., 4th quartile), between 15 and 20 percent of students did not take gatekeeper English. This is notable because these students were not referred to developmental instruction and thus could proceed immediately to gatekeeper English. This pattern is even more pronounced for math, although the percentages varied across tests. Among students in the highest quartile of the pre-algebra test, only 31 percent took a gatekeeper math course. Higher percentages of students in the highest quartiles of algebra (65 percent) and college algebra (75 percent) took gatekeeper math. Thus, even among students who were arguably well prepared for college-level work (based on their test scores and recommendations) many were not proceeding to gatekeeper courses.

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[29] Some students also took geometry or trigonometry tests. Moreover, some took math tests relying on different scoring schemas and thus had to be excluded. The number of cases used for math analyses is as follows: 5,384 for pre-algebra, 6,176 for algebra, and 770 for college algebra.

[30] For English, gatekeeper course is ENG111. The following math courses were counted as gatekeepers: MTH151, MTH158, MTH163, MTH166, MTH173, or MTH271. In addition, students in career tech programs could take MTH105, MTH120, MTH121, MTH126, or MTH141. If students passed any of these designated math courses, they were considered to have passed gatekeeper math.

These results do not arise simply because reported percentages include students enrolled in career tech programs. When analyses were restricted only to students placed in transfer programs, the proportion of students in the highest quartile of the test score distribution who did not take gatekeeper courses was similar (15 percent for reading, 12 percent for writing, 71 percent for pre-algebra, 33 percent for algebra, and 24 percent for college algebra). This similarity implies that students are being lost early in the educational pipeline. Students with low test scores were particularly unlikely to proceed to gatekeeper courses, but a substantial number of students with test scores indicating that they were "college ready" were also leaving the system without taking this crucial step toward earning a degree. Understanding why students, particularly those with high test scores, are not proceeding to gatekeeper courses warrants further investigation.

<u>Finding</u>: *While placement test scores were related to whether students took a particular course, they were not strongly related to whether students passed the course. Correlations between test scores and passing rates for either developmental or gatekeeper courses were weak.*

Table 18 reports correlations between placement test scores and students' successful completion of developmental and gatekeeper courses. To successfully complete a developmental course, a student needed to earn a grade of "satisfactory" or "pass." To successfully complete a gatekeeper course, a student needed to earn a grade of C or higher.[31] All correlations displayed in Table 18 are very small, indicating that test scores are not good predictors of whether students will pass developmental or gatekeeper courses. The correlations were slightly higher for math than for reading or writing. The highest correlation (r=0.22) was between algebra test scores and passing developmental math. Other correlations were much weaker. This holds for students placed in both transfer and career tech programs. Thus, it appears that once students enrolled in a course they were approximately equally likely to pass it, regardless of their test score. As the previous section indicated, the primary issue is that students, especially those with low test scores, are not enrolling in required courses.

To further investigate the relationship between test scores and success rates in developmental and gatekeeper courses, we conducted a set of logit analyses that controlled for student characteristics other than their test scores. Each logit model predicted the likelihood that a student would successfully pass a developmental or gatekeeper course if taken. Due to different course-taking patterns in transfer and career tech programs, these analyses were conducted only for students in transfer programs. All models controlled for gender, race/ethnicity, age, dual enrollment in high school, and institution attended.[32] Based on these models, we calculated predicted probabilities that

[31] Students who repeated a course but passed at any try were considered to have passed the course. For developmental courses, students needed to pass all courses they took (i.e., students who took multiple developmental courses needed to pass all of them to be coded as "passed"). The correlations were weaker when considering whether students passed any of the developmental courses they took.

[32] Institutions refer to the first institution attended.

students in different test score quartiles would pass developmental and gatekeeper courses. All control variables were set at their means. This analysis examined test score quartiles, instead of a continuous measure of test scores, due to apparent non-linearity in the relationship. If course passing rates are plotted against test score quartiles, the relationship is not always linear (which may in part explain low correlations reported in Table 18).

<u>*Finding*</u>: *After controlling for individual characteristics and institutions attended, reading and writing test scores did not predict whether students passed gatekeeper English. While there was some indication of a curvilinear relationship with respect to passing developmental courses, students in the lowest and highest test score quartiles had similar probabilities of success. Math test scores had a stronger relationship to passing gatekeeper and developmental math.*

Figure 8a reports the predicted probability for transfer program students of passing developmental reading (gray bars) and gatekeeper English (black bars) by reading test score quartiles. Figure 8b reports the same for writing. The first point that stands out in Figures 8a and 8b is that all black bars are virtually identical; thus, there is no relationship between reading or writing test scores and whether students passed gatekeeper English. This finding corresponds to the almost 0 correlations reported in Table 18.

There were some differences across quartiles with respect to the probability of passing developmental courses. Students in the third test score quartile had a lower probability of passing developmental reading than other students. With respect to developmental writing, students in the second quartile had the highest probability of passing developmental writing courses. These differences in part illuminate why correlations, which estimated a linear relationship between test scores and gatekeeper passing rates, were low. At the same time, the usefulness of a particular test is not entirely clear when higher scores do not imply better performance. Indeed, students in the lowest (1^{st}) and highest (4^{th}) quartiles in Figures 8a and 8b had similar probabilities of passing developmental reading and writing.

Figures 9a and 9b report predicted probabilities for transfer program students of passing developmental math (gray bars) and gatekeeper math (black bars) for different quartiles of pre-algebra and algebra test scores.[33] Math test scores seem to predict outcomes better than reading and writing scores and they have a logical linear relationship, implying that students with higher test scores perform better. The probability of passing gatekeeper

[33] Results for college algebra are not presented due to the small number of cases. There were only 582 transfer-placed students with valid college algebra test scores. When attempting to run a regression using college algebra test quartiles, many variables (including age, race/ethnicity, and some of the institutions) dropped from the model due to collinearity or due to perfectly predicting the probability of passing developmental or gatekeeper math.

math was 9 percentage points higher for students in the highest (4th) quartile of the pre-algebra test score distribution than for those in the lowest (1st) quartile. There is a similar gap (8 percentage points) between students in the highest and lowest algebra test score quartiles. The relationship between math test scores and passing developmental math is stronger, particularly for algebra test scores. Students in the bottom of the algebra test score distribution had a substantially lower probability of passing developmental math than did other students.

Other educational outcomes

While successfully completing developmental and gatekeeper courses are important outcomes, they are only the first steps on the road to educational attainment. Table 19 displays the proportion of students who earned educational credentials (certificates or associate degrees) or transferred to a four-year institution. Table 20 examines several intermediate outcomes: number of terms enrolled and number of credits attempted and completed.

<u>*Finding*</u>: *Students with higher test scores were more likely to attain educational outcomes examined than were those with lower test scores.*

A substantially higher proportion of students in the highest quartile of the test score distribution attained at least one educational outcome, compared with students in the lowest quartile of the test score distribution.[34] This pattern held for all test scores (reading, writing, pre-algebra, algebra, and college algebra), although the gaps between the highest and lowest quartiles varied somewhat across subjects. While students with higher test scores had higher rates of attaining educational outcomes, it is notable that only one third of students in the highest reading and writing quartiles attained any educational outcomes. The percentages for math differed by the test taken, but even in the most positive case scenario, when students were in the highest quartile of the college algebra test score distribution, only approximately one half of them attained any educational outcomes. This finding may not be surprising considering previously discussed results, which showed that many students, including those with high test scores, were not enrolling in gatekeeper courses, which often constitute a requisite step on the road toward earning educational credentials.

The overall pattern for attaining any educational outcomes reflects the pattern for students earning an associate degree and/or transferring to a four-year institution. A higher proportion of students in the top test score quartile earned an associate degree and/or transferred to a four-year institution. Among the small proportion of students earning certificates (3 percent), test scores were either inconsequential (such that a similar proportion of students in each test score quartile earned certificates) or negatively

[34] Educational outcomes were coded exclusively based on the highest credential completed (i.e., students who earned both a certificate and an associate degree were coded as having earned an associate degree; students who earned a certificate and then transferred to a four-year institution were coded as having transferred).

correlated with attainment (students with lower test scores were more likely to earn certificates than those with higher test scores).

Finding: *Students with higher test scores accumulated more credits because they both attempted more credits and completed a higher proportion of the credits that they attempted. However, test scores did not appear to have a strong relationship to the number of terms enrolled.*

Test scores also had a positive relationship to accumulation of credits (Table 20). Credits in this discussion refer to college-level credits.[35] Students in the highest quartile of the test score distribution accumulated more credits than students in other quartiles. The gaps between students in the highest and lowest quartiles were quite pronounced. For example, students in the highest (4^{th}) quartile of the writing test score distribution completed 32 credits while those in the lowest quartile completed only 20. Considering different math test scores, the gaps in credit accumulation were highest for algebra test scores, where students in the highest quartile completed 38 credits while those in the lowest quartile completed 20 credits.

Students with higher test scores were completing more credits because they were both attempting a larger number of credits and earning a higher proportion of them. For example, the noted differences in writing emerged because students in the highest quartile attempted more credits (42, compared with 28 for students in the lowest quartile) and earned more of the credits they attempted (69 percent, compared with 56 percent for students in the lowest quartile).

While test scores seem quite relevant for credit accumulation, they are less consequential for the number of terms enrolled. Students in the sample were enrolled for approximately four-and-a-half terms and most students were close to that average, regardless of their test score. However, students who took the college algebra test were enrolled for a slightly longer period of time.

[35] College-level credits were defined as all credits earned in courses numbered 10 or higher, except for those with ELS or BKS prefix and MTH50. For students placed in transfer programs, courses numbered 100 or above were considered college level.

Recommendations

Based on the findings discussed in this report, CCRC has the following recommendations for the VCCS and its member colleges.

Gatekeeper Courses

Recommendation 1: *The VCCS should consider surveying students to learn why the majority of them are not enrolling in gatekeeper courses and develop policies to facilitate enrollment.*

Many students in the summer/fall 2004 first-time-in-college cohort did not complete gatekeeper courses — not because they did not pass them, but because they did not enroll in them. In fact, approximately one third of students never enrolled in gatekeeper English and two thirds never even attempted to take gatekeeper math. Failure to enroll in gatekeeper courses held for all groups of students: those with different test scores and those taking different levels of developmental courses, but it was particularly prevalent among those starting in lower level developmental courses. Students who did enroll in gatekeeper courses had a relatively high degree of success: 77 percent passed gatekeeper English and 73 percent passed gatekeeper math. Moreover, students who enrolled in gatekeeper courses were approximately equally likely to succeed regardless of their starting point.

It is not clear whether students' lack of enrollment in gatekeeper courses was due to a limited capacity to enroll students who needed them, problems with scheduling, lack of counseling and/or students' understanding of the courses they needed to take, or other factors. Surveying students to understand why they are not enrolling in these courses would help to illuminate factors deterring students from gatekeeper courses and inform the development of policies to facilitate enrollment.

Recommendation 2: *The VCCS should develop policies to facilitate enrollment in gatekeeper math, given the overall low rate of participation in this area. Moreover, gatekeeper completion rates for students starting in pre-algebra are extremely low, suggesting that the VCCS might consider recommending alternative enrollment pathways for these students.*

While not enrolling in gatekeeper courses was an issue for many students, it was particularly pronounced among students in need of remediation (whether that is defined by test scores, placement recommendations, or actual enrollment in developmental courses). The patterns were especially stark in math. Enrollment rates in gatekeeper math were low for all students, but they were especially discouraging for students in need of developmental instruction. Only 12 percent of students recommended to level-1 math (pre-algebra) enrolled in gatekeeper math during the four-year observation period.

Similarly, only 20 percent of students in the bottom quartile of the algebra test score distribution and only 13 percent in the bottom quartile of the pre-algebra test score distribution took gatekeeper math. Moreover, among students who actually enrolled in pre-algebra, less than 20 percent proceeded to take gatekeeper math.

Given the low gatekeeper math enrollment rates, the VCCS should establish policies that would facilitate math enrollment, whether doing so means working with high schools to improve math preparation, providing summer bridge programs, or altering the structure of developmental instruction in math. An alternative set of strategies may be needed for students recommended to the lowest level of developmental math (pre-algebra). Students in this category have extremely low gatekeeper completion rates, implying that colleges may want to consider alternative approaches to facilitating their educational success, by for example, encouraging them to enroll in occupational certificate programs that do not require college-level math and English as an intermediate step toward eventually earning a degree.

Recommendation 3: *VCCS colleges should review policies and practices aimed at increasing gatekeeper course completion among students deemed prepared for college-level work. They should look for promising practices both within and outside the system.*

Community colleges face a challenging task of providing postsecondary educational opportunities for many students who are not necessarily ready for college-level work. As a result, they invest much energy and effort in helping students to get ready for college-level instruction. While this report and these recommendations are focused on students who need remediation, it is worthwhile to note that even among students who were reasonably well prepared academically, many did not make good progress toward a degree. Among students in the top quartiles of reading and writing test score distributions, 15-20 percent did not enroll in gatekeeper English. Moreover, 25 percent of students in the top quartile of the college algebra test score distribution did not enroll in gatekeeper math (and percentages are much higher for students who took the algebra or pre-algebra tests). Similarly, even among students who did not take any developmental courses, large proportions did not enroll in gatekeeper English and particularly gatekeeper math. This finding indicates that academic preparation (or lack thereof) is not the only factor that needs to be addressed. Understanding why even students who are considered prepared for college-level work are not achieving key milestones is an important step in enhancing overall success rates. It is likely that policies designed to assist academically prepared students to complete gatekeeper courses will also be beneficial for students in need of remediation.

Developmental Education

Recommendation 4: *The VCCS should investigate why students recommended to take developmental reading, writing, or math were so unlikely to enroll in any of those courses. Moreover, since students who did not follow their placement recommendations fared equally well as students who were recommended for and did take developmental courses, the VCCS should investigate this phenomenon further and learn from students about alternative strategies for success.*

Analyses of developmental course-taking underestimate the extent of the need for remediation since many students who were recommended to take developmental courses did not do so. The true extent of discrepancies between test scores/recommendations and course-taking behaviors is not known due to missing data, but even the available data indicate that many students did not do what would be expected, given the system-wide placement policies. Only approximately 50-60 percent of students took a recommended developmental course. While a few took other courses in the same subject, over one third of students recommended for a developmental course in reading, writing, or math did not take a single course in that subject.

Notably, students who were recommended for but did not take developmental courses fared equally well with respect to the educational outcomes examined as students who were recommended for and did take developmental courses. This finding suggests that failing to follow the placement recommendation is not detrimental to the success of at least some students. It is important to note that the finding does not imply that developmental instruction is not effective or not needed. Students who skip developmental courses may differ from those who enroll in them with respect to a number of unobserved characteristics, which may account for their higher success rates. However, these results suggest that it would be useful to explore why students are deciding to forego developmental instruction and what explains why some are nevertheless successful in completing gatekeeper courses and other educational outcomes.

Recommendation 5: *When considering the effectiveness of developmental instruction or developing policies and practices to facilitate student success, the VCCS should consider the level of developmental courses taken by students instead of grouping all students in need of remediation together.*

Not all students who required remediation fared the same. Analyses separating students by level (two levels for reading and writing and three levels for math) demonstrate that students who started community colleges with a level-1 developmental course did less well with respect to all outcomes, including completing developmental courses, completing gatekeeper courses, accumulating credits, or earning credentials. These patterns persisted even after controlling for individual characteristics, including test

scores and institutions attended. Even in regression models, the gaps between students starting in level-1 courses and other students were notable, particularly for math.

Recommendation 6: *The VCCS might investigate whether "mainstreaming" students who are enrolling in the highest level of developmental courses into college-level courses, while providing additional supports as needed, is an effective strategy for facilitating their educational attainment.*

The importance of distinguishing between different levels of developmental instruction is also apparent when considering students who started at the highest level of developmental courses (level-2 for reading and writing and Algebra II or higher for math). Students who enrolled in the highest level of developmental courses had substantially higher rates of taking gatekeeper courses than students who enrolled in lower level developmental courses. Moreover, these students also had similar or higher rates of taking and passing gatekeeper English and math than students who did not enroll in developmental courses. Part of this pattern is explained by the fact that the category of "did not enroll in developmental courses" included students who were recommended to take developmental courses but did not, as well as those not in need of remediation. Since information on placement recommendations is limited by missing data, and since students who did and did not follow their placement recommendations may have differed on a range of unobservable characteristics, CCRC's results cannot establish a causal relationship between developmental coursework and gatekeeper outcomes. However, positive gatekeeper outcomes for students starting at the highest level of developmental instruction indicate the usefulness of further studying the effectiveness of developmental course-taking and exploring whether "mainstreaming" students heretofore thought to be in need of higher level developmental courses may be an effective strategy for facilitating their educational attainment.

Previous efforts to accelerate the progress of remedial students into college-level courses by offering developmental instruction concurrently with related college-level courses or integrating academic support into college courses have shown some promise (see, e.g., Bragg & Barnett, 2009; Scott, 2003; Wlodkowski 2003; Wlodkowski & Kasworm, 2003), although these approaches have not yet been rigorously evaluated (Bailey, 2009).

Educational Attainment

Recommendation 7: *Colleges may benefit from focusing on the early part of the pathway — enrollment in and completion of developmental and gatekeeper courses — to increase the successful attainment of educational awards.*

At the end of the educational pipeline, less than one third of first-time VCCS students earned an associate degree or certificate or transferred to a four-year institution within the four-year observation period. Educational attainment rates were low for all groups of students, but particularly so for students with low test scores or students who took

developmental courses, especially at level-1. This finding is not necessarily surprising given the results on developmental and gatekeeper courses. The majority of the students were lost early in the educational process, at or before the point of taking developmental and/or gatekeeper courses. Increasing credential attainment will thus require a focus on those early milestones. Completing developmental and gatekeeper courses is not a guarantee that students will attain long-term educational outcomes (as many students who attained these milestones still did not earn credentials or transfer to four-year institutions), but it is a key part of the process: if the majority of students are not even reaching these early educational milestones, they will certainly not make it to the point where they earn credentials.

Recommendation 8: *The VCCS should investigate and consider implementing new approaches to facilitate credit accumulation and, by extension, degree completion.*

Another way to increase degree completion is to help students accumulate more credits. On average, students accumulated only 27 credits during the observation period of approximately four years, which is less than half the credits generally required for an associate degree. In part, this is because they were enrolled for only approximately 4.5 terms on average and did not attempt many credits. Moreover, students earned only approximately two thirds of the credits for the courses in which they enrolled. Some students may still earn credentials in the coming years, if they continue to enroll in courses and earn credits, but at this rate of credit accumulation, it would take students approximately eight years to earn an associate degree. Many will not to persist on this long road toward a credential. The VCCS may wish to explore creating accelerated programs that students attend full-time and other strategies to facilitate credit accumulation, and by extension degree completion.

Variation across Colleges

Recommendation 9: *The VCCS should consider conducting an in-depth study of institutions that are more successful in fostering student achievement of key milestones (particularly taking and passing gatekeeper English and math), and disseminate promising practices across the system. No college is successful in all areas; institutions can thus learn from each other about more effective ways to facilitate different dimensions of student success.*

There was much variation in developmental course-taking across institutions, with anywhere between 25 and 62 percent of students enrolling in developmental math. Variation in the proportion of students enrolling in developmental reading and writing was smaller but still pronounced. However, despite the variation, there is no clear link between the proportion of students enrolling in developmental courses and other outcomes at the institutional level. Moreover, there is a very weak relationship at the institutional level between the probability of students' taking and of passing gatekeeper

courses, indicating that some institutions are more successful at getting students to take these courses while others are more successful at getting them to pass the courses. Similarly, some institutions are better at helping students take and pass gatekeeper English while others are more effective at getting students to take and pass gatekeeper math. These differences indicate that all institutions have something to offer as well as something to learn from the others.

To provide research-based guidance on this issue, CCRC was recently awarded a grant by the Bill and Melinda Gates Foundation to partner with the VCCS on a study of colleges identified through quantitative analysis as comparatively effective (controlling for student characteristics and other factors) in enabling students to take and pass gatekeeper English and math.

Data Collection and Analysis

<u>Recommendation 10</u>: *The VCCS should ensure that all colleges report placement test scores and recommendations for all students and indicate if certain students are exempt from taking a placement test.*

The VCCS is in the vanguard among state systems seeking to collect data on student progression and use this information to improve educational outcomes. However, as of the 2004 cohort, reporting of placement test scores and other data was not consistent across the colleges in the system. Over one third of the students in the dataset were missing placement test scores and recommendations for reading, writing, or math. Many such students still enrolled in developmental courses, implying that they were in need of developmental instruction. Even if there is a group of students who are exempt from taking placement tests, it would be helpful to have a code indicating their exempt status. The proportion of students for whom we have at least some placement test data varied from 1 to 90 percent across institutions. If implementing a state-wide course placement policy is a goal, and if a consistent placement policy is intended to guide the provision and evaluation of developmental courses, understanding why some institutions did not report placement test scores and recommendations, particularly colleges missing the majority of cases, is worthy of investigation.

<u>Recommendation 11</u>: *The VCCS and its member colleges should continue to track students over time and improve the quality of the data collected in order to identify areas in need of improvement and evaluate efforts to facilitate student success. Moreover, regular meetings where faculty, staff, and administrators can discuss strategies for improving student success in light of the evidence and design additional in-depth studies of specific areas identified as needing improvement will be crucial parts of the VCCS' continued efforts to enhance students' educational outcomes.*

The VCCS has made notable strides in a relatively short amount of time in collecting and analyzing data on student success. Tracking the progress of students over time, as presented in this study, can help to identify "leakage points" where students struggle on the path to program completion and ascertain what institutions are more successful at helping students complete key milestones.

The VCCS and its colleges can use the dataset constructed by CCRC, which combines students' background information, test scores, recommendations, and course-taking patterns, to further examine patterns of student progression through the system. Once critical junctures in students' educational pathways are identified, additional research can be conducted to identify the underlying reasons why some students advance while others do not, and to guide the development of policies and practices that facilitate and accelerate student progression and success. In this process, it is especially important to learn students' perspectives on barriers to success, and to involve faculty, student service staff, and administrators in reviewing the evidence and designing and testing strategies for overcoming such barriers. By comparing the rates at which students in successive entering cohorts achieve key milestones, VCCS colleges and the overall system can gauge the effectiveness of their efforts to improve student success in gatekeeper courses and other key milestones leading to a college credential.

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Appendix A: Tables

Table 1. Percentage of Students Enrolling in Developmental Education Courses, by Program Placement and Dual Enrollment Status in High School

	All Students	Dual Enrollment in High School		Program Placement	
		Yes	No	Transfer	Career Tech
Developmental Reading, Writing or Math	50.7	36.7	52.1	54.3	45.5
Developmental Reading	14.1	7.0	14.9	13.8	14.5
Developmental Writing	21.3	10.0	22.4	20.9	21.7
Developmental Math	42.6	31.8	43.7	47.7	35.3
All Students in the Summer/Fall 2004 Cohort	100.0	9.2	90.8	58.5	41.4

Note: Developmental courses were defined as follows: reading: ENG04 and ENG05, writing: ENG01 and ENG03, math: MTH01, MTH02, MTH03, MTH04, MTH05, MTH06, MTH07, and MTH09.

Table 2. Percentage of Students Taking Developmental Courses in Reading, Writing, and Math, by College

College	Reading (%)	Writing (%)	Math (%)
A	6.34	17.1	25.9
B	25.4	33.7	61.8
C	10.21	23.1	54.3
D	23.46	34.0	48.8
E	24.88	30.7	57.0
F	14.87	32.5	56.0
G	10.95	20.1	25.0
H	10.5	21.3	46.2
I	5.05	16.5	35.9
J	9	26.5	56.9
K	21.5	33.2	58.3
L	9.27	18.1	43.2
M	17.57	22.0	43.2
N	11.2	20.4	36.2
O	9.68	17.8	35.5
P	17.6	37.2	58.2
Q	12.03	11.8	28.7
R	12.97	14.7	29.6
S	15.8	26.2	45.3
T	18.4	24.9	43.7
U	6.95	13.5	30.6
V	12.1	9.1	48.0
W	11.29	13.6	36.5
Total	**14.1**	**21.3**	**42.6**

Note: Developmental courses were defined as follows: reading: ENG04 and ENG05, writing: ENG01 and ENG03, math: MTH01, MTH02, MTH03, MTH04, MTH05, MTH06, MTH07, and MTH09.

Table 3. Percentage of Students Taking Different Levels of Developmental Courses, by Program Placement and Dual Enrollment Status in High School, for Students Who Took a Developmental Course

	All Students	Dual Enrollment in High School		Program Placement	
		Yes	No	Transfer	Career Tech
Took Developmental Reading					
Level-1	27.0	40.9	26.3	25.7	28.8
Level-2	62.6	54.5	62.9	63.2	61.5
Level-1 and Level-2	10.5	4.5	10.8	11.1	9.7
Took Developmental Writing					
Level-1	32.6	45.2	32.0	31.0	34.8
Level-2	53.4	48.9	53.6	55.0	50.9
Level-1 and Level-2	14.1	5.9	14.4	13.9	14.3
Took Developmental Math					
Pre-algebra	20.4	11.1	21.0	14.6	31.3
Algebra I	29.0	29.1	29.0	28.7	29.7
Algebra II or Higher	15.6	27.4	14.8	17.7	11.8
Multiple Math Courses	35.0	32.3	35.1	39.0	27.2
Multiple Courses, Across Subjects					
Reading and Writing	18.8	12.0	19.3	17.4	21.2
Reading/Writing and Math	35.0	21.0	36.0	34.3	35.9

Note: Developmental course levels were defined as follows: reading level-1: ENG04, reading level-2: ENG05, writing level-1: ENG01, writing level-2: ENG03, pre algebra: MTH01, MTH02, MTH09, algebra I: MTH03, algebra II or higher: MTH04, MTH05, MTH06, and MTH07.

Table 4. Term of First Developmental Enrollment, for Students Who Took a Developmental Course

		First Took Developmental Writing		First Took Developmental Reading		First Took Developmental Math	
Year	**Term**	N	%	N	%	N	%
Dual enrollment							
Before Summer 2004		1	0.0	2	0.0	8	0.1
2004	Summer	166	4.9	322	6.3	543	5.3
	Fall	2,725	80.4	3,993	78.2	7,295	71.5
2005	Spring	266	7.8	436	8.5	1,131	11.1
	Summer	28	0.8	35	0.7	138	1.4
	Fall	95	2.8	140	2.7	384	3.8
2006	Spring	30	0.9	53	1.0	199	2.0
	Summer	7	0.2	15	0.3	53	0.5
	Fall	19	0.6	30	0.6	163	1.6
2007	Spring	15	0.4	25	0.5	90	0.9
	Summer	4	0.1	2	0.0	21	0.2
	Fall	18	0.5	34	0.7	95	0.9
2008	Spring	13	0.4	14	0.3	65	0.6
	Summer	3	0.1	7	0.1	18	0.2
Total		**3,390**	**100.0**	**5,108**	**100.0**	**10,203**	**100.0**

Table 5. Success Rates of Developmental Courses Based on Enrollments Over Four Years

		Success Rate (%) ("Satisfactory" and "Pass")
Developmental English		
Course Number	*Course Title*	
1	Preparing for College Writing I	62.2
2	Spelling and Vocabulary Study	50.0
3	Preparing for College Writing II	63.1
4	Reading Improvement I	68.3
5	Reading Improvement II	68.3
7	Writing and Reading Improvement I	67.8
8	Writing and Reading Improvement II	56.3
Total		**64.8**

		Success Rate (%) ("Satisfactory" and "Pass")
Developmental Math		
Course Number	*Course Title*	
1	Developmental Mathematics	38.0
2	Arithmetic	55.8
3	Algebra I	44.9
4	Algebra II	48.4
5	Algebra Revisited	50.6
6	Developmental Geometry	76.3
7	Developmental Trigonometry	55.6
9	Pre-Algebra	56.3
Total		**48.1**

Note: Success rates were calculated based on total enrollments from summer 2004 through summer 2008. Since courses were the unit of analysis, each enrollment in the course was counted as one record (i.e., calculations included multiple records per student).

Table 6. Percentage of Students Taking and Passing Gatekeeper Courses, by the Level of the First Developmental Course

	All Students		Program Placement: Transfer		Program Placement: CareerTech	
	Took Gatekeeper	Passed Gatekeeper	Took Gatekeeper	Passed Gatekeeper	Took Gatekeeper	Passed Gatekeeper
All students						
Took/Passed Gatekeeper English	61.9	77.0	70.0	78.3	50.3	74.4
Took/Passed Gatekeeper Math	36.0	73.4	40.0	75.5	30.5	69.5
Specific groups of students						
Reading						
No Developmental Course	63.0	77.5	71.7	78.7	50.8	75.0
First Course: Level-1	45.9	74.2	50.8	75.3	39.5	72.4
First Course: Level-2	59.5	73.0	64.8	74.6	52.0	70.4
Writing						
No Developmental Course	64.1	77.6	73.2	78.8	51.2	74.9
First Course: Level-1	46.4	72.3	49.2	73.8	43.0	70.0
First Course: Level-2	59.6	75.8	65.2	76.6	51.1	74.3
Math						
No Developmental Course	39.1	73.7	46.9	75.9	30.1	69.8
First Course: Pre-algebra	19.3	67.5	15.3	73.4	24.2	63.0
First Course: Algebra I	31.9	73.8	32.0	74.7	31.8	71.5
First Course: Algebra II or Higher	61.0	75.6	62.6	75.9	56.6	74.6

Note: Passing a gatekeeper course is conditional on taking the course. Students needed to earn a C or higher to be coded as having passed a gatekeeper course.

Note: Developmental course levels were defined as follows: reading level-1: ENG04, reading level-2: ENG05, writing level-1: ENG01, writing level-2: ENG03, pre algebra: MTH01, MTH02, MTH09, algebra I: MTH03, algebra II or higher: MTH04, MTH05, MTH06, and MTH07.

Table 7. Percentage of Students Successfully Attaining Different Educational Outcomes, by the Level of the First Developmental Course

	Any Successful Outcome	Certificate	Associate Degree	Associate Degree and Transfer to 4yr	Transfer to 4yr
Reading					
No Developmental Course	31.4	3.1	7.4	7.5	13.4
First Course: Level-1	15.8	2.5	3.9	2.5	6.8
First Course: Level-2	19.5	2.1	5.0	4.5	7.8
Writing					
No Developmental Course	32.3	3.1	7.6	7.8	13.7
First Course: Level-1	16.5	2.2	3.7	3.1	7.4
First Course: Level-2	21.7	2.5	5.8	4.3	9.2
Math					
No Developmental Course	32.9	3.7	7.6	7.6	13.9
First Course: Pre-algebra	18.3	3.2	5.5	2.5	7.2
First Course: Algebra I	25.2	1.4	5.7	6.3	11.9
First Course: Algebra II or Higher	38.5	1.0	8.6	13.5	15.6
All Students	29.5	3.0	7.0	7.0	12.6

Note: Educational outcomes were coded exclusively based on the highest credential completed (e.g., students who earned both a certificate and an associate degree were coded as having earned an associate degree; also, students who earned a certificate and then transferred to a four-year institution were coded as "transfer to 4yr").

Table 8. Number of Terms Enrolled and Number of College-Level Credits Attempted and Completed, by the Level of the First Developmental Course

	All Students			
	Number of Terms Enrolled	Number of College-Level Credits Attempted	Number of College-Level Credits Completed	Percentage of College-Level Credits Completed
Reading				
No developmental course	4.4	36.3	28.2	67.6
First course: Level-1	4.5	28.2	20.4	55.7
First course: Level-2	4.8	32.4	23.8	59.3
Writing				
No developmental course	4.3	36.8	28.7	68.3
First course: Level-1	4.5	27.7	20.0	55.7
First course: Level-2	4.7	33.7	24.9	61.4
Math				
No developmental course	4.0	34.8	27.3	68.7
First course: Pre-algebra	4.7	30.5	22.4	58.9
First course: Algebra I	4.9	37.2	27.8	63.7
First course: Algebra II or higher	5.5	48.6	37.9	70.0
All Students	4.4	35.5	27.4	66.3

	Program Placement: Transfer			
	Number of Terms Enrolled	Number of College-Level Credits Attempted	Number of College-Level Credits Completed	Percentage of College-Level Credits Completed
Reading				
No developmental course	4.5	38.9	30.0	67.5
First course: Level-1	4.6	28.2	19.9	54.2
First course: Level-2	4.9	33.0	23.9	58.1
Writing				
No developmental course	4.5	39.6	30.7	68.2
First course: Level-1	4.5	27.3	19.4	54.5
First course: Level-2	4.8	33.9	24.6	60.7
Math				
No developmental course	4.2	38.3	29.9	68.5
First course: Pre-algebra	4.7	30.1	21.6	57.9
First course: Algebra I	4.9	37.5	28.0	63.9
First course: Algebra II or higher	5.5	48.4	38.0	70.8
All Transfer-Placed Students	4.6	37.8	28.9	66.0

Note: Credits earned in courses numbered 10 or higher were considered college level, except for those with ELS or BKS prefix and MTH50. For students placed in transfer programs, courses numbered 100 or above were considered college level. Students needed to earn a grade of D or higher to complete attempted credits.

Table 9. Number and Percentage of Students Recommended to Take Developmental and College-Level Courses, by Subject

	Recommendation					
	Developmental		College-Level		Missing	
	N	% total	N	% total	N	% total
Reading	4,163	17.4	11,046	46.1	8,767	36.6
Writing	5,896	24.6	9,239	38.5	8,841	36.9
Math	12,455	52.0	2,961	12.4	8,560	35.7

Note: Developmental recommendations were defined as follows: reading: ENG04 and ENG05, writing: ENG01 and ENG03, math: MTH01, MTH02, MTH03, MTH04, MTH05, MTH06, MTH07, and MTH09.
Students in the decision zones were coded as being recommended to take developmental courses.

Table 10. Recommended Placements for Reading, Writing, and Math, by College

	Reading			Writing			Math		
	College-Level	Developmental	Missing	College-Level	Developmental	Missing	College-Level	Developmental	Missing
College		%	%		%	%		%	%
A	31.2	10.2	58.5	21.0	18.5	60.5	5.4	37.1	57.6
B	0.3	1.2	98.5	0.2	1.3	98.5	0.2	2.2	97.7
C	42.9	22.3	34.9	32.0	32.0	36.0	18.4	43.3	38.3
D	57.4	32.7	9.9	55.6	34.6	9.9	18.5	72.2	9.3
E	0.2	0.7	99.2	0.2	1.0	98.8	0.0	1.5	98.5
F	57.8	24.3	17.9	40.3	40.3	19.4	7.1	76.1	16.8
G	25.3	14.8	59.9	25.6	15.1	59.3	8.7	33.1	58.2
H	55.3	22.8	22.0	45.8	32.1	22.1	15.1	67.5	17.4
I	33.3	17.0	49.6	25.2	20.3	54.5	6.3	43.1	50.5
J	72.3	10.2	17.5	43.8	38.7	17.5	14.8	77.2	8.0
K	55.6	19.3	25.1	41.2	33.0	25.8	13.7	52.3	34.1
L	52.8	14.8	32.4	41.7	26.1	32.3	23.1	53.1	23.8
M	50.9	24.3	24.8	41.6	33.6	24.8	15.8	63.1	21.2
N	37.1	21.5	41.4	31.1	28.0	40.9	10.1	44.6	45.3
O	53.2	22.9	23.9	49.0	27.1	23.9	18.1	54.4	27.5
P	58.5	21.6	19.9	25.4	54.5	20.1	10.1	75.2	14.7
Q	48.8	12.5	38.7	27.7	33.8	38.5	16.9	46.5	36.6
R	43.9	18.2	37.9	45.4	16.7	37.9	15.6	51.4	33.1
S	50.9	21.8	27.2	33.7	33.7	32.6	5.2	67.4	27.4
T	22.3	17.3	60.4	19.0	20.8	60.2	2.4	38.8	58.8
U	30.8	11.4	57.8	29.1	15.8	55.0	7.3	36.5	56.2
V	60.4	21.2	18.4	64.5	16.4	19.2	6.7	72.3	21.0
W	23.9	14.7	61.4	18.6	18.1	63.3	5.3	32.8	61.9
Total	**46.1**	**17.4**	**36.6**	**38.5**	**24.6**	**36.9**	**12.4**	**52.0**	**35.7**

Note: Developmental recommendations were defined as follows: reading: ENG04 and ENG05, writing: ENG01 and ENG03, math: MTH01, MTH02, MTH03, MTH04, MTH05, MTH06, MTH07, and MTH09. Students in the decision zones were coded as being recommended to take developmental courses.

Table 11. Comparison Between Developmental Courses Recommended and Taken, by Subject, for Students Who Were Recommended to Take a Developmental Course

	Exact Match			
	Recommended N	Took Recommended Developmental Course %	Took Another Developmental Course %	Did Not Take a Developmental Course %
Reading	3,970	55.4	3.6	41.0
Writing	5,074	60.1	5.4	34.5
Math	11,933	50.8	10.4	38.7
	Flexible Match			
	Recommended N	Took Recommended Developmental Course %	Took Another Developmental Course %	Did Not Take a Developmental Course %
Reading	4,163	56.0	3.7	40.3
Writing	5,896	62.9	4.7	32.4
Math	12,455	51.7	10.0	38.3

Note: Exact matching procedure included only placement recommendations for specific courses; flexible matching procedure also included recommendations in decision zones; students in decision zones were considered to match if they took a course above or below the decision zone.

Table 12. Number and Percentage of Students Recommended to Take Specific Levels of Developmental Courses, by Subject, for Students Placed in Transfer Programs

	Recommendation						
	Any Level	**Level-1**		**Level-2**		**Level-3**	
	N	N	% total	N	% total	N	% total
Reading	2,306	876	38.0	1,430	62.0		
Writing	3,427	1,719	50.2	1,708	49.8		
Math	7,395	1,503	20.3	4,075	55.1	1,817	24.6

Note: Developmental course levels were defined as follows: reading level-1: ENG04, reading level-2: ENG05, writing level-1: ENG01, writing level-2: ENG03, pre algebra: MTH01, MTH02, MTH09, algebra I: MTH03, algebra II or higher: MTH04, MTH05, MTH06, and MTH07.

Table 13. Percentage of Students Taking and Passing Gatekeeper Courses, by Developmental Recommendation and Course-Taking

	All Students		Program Placement: Transfer		Program Placement: Career Tech	
	Took Gatekeeper	Passed Gatekeeper	Took Gatekeeper	Passed Gatekeeper	Took Gatekeeper	Passed Gatekeeper
Developmental Reading						
Not recommended	76.6	75.5	80.6	76.5	69.7	73.3
Recommended and took	55.1	73.8	58.7	75.3	50.1	71.1
Recommended but did not take	49.7	74.1	59.4	77.4	39.7	68.9
Missing recommendation	47.6	81.8	59.9	82.8	32.9	79.5
Developmental Writing						
Not recommended	81.5	75.0	85.6	76.2	74.5	72.7
Recommended and took	53.9	75.3	56.7	76.7	49.8	72.7
Recommended but did not take	50.4	74.4	60.1	76.2	39.0	71.3
Missing recommendation	47.5	82.0	59.9	83.1	32.7	79.6
Developmental Math						
Not recommended	74.8	77.5	76.7	77.2	69.9	78.5
Recommended and took	30.7	71.9	30.3	74.4	31.7	67.0
Recommended but did not take	34.5	67.9	33.7	72.3	35.2	63.7
Missing recommendation	28.3	75.1	36.9	76.5	18.7	72.1

Note: Passing a gatekeeper course is conditional on taking the course. Students needed to earn a C or higher to be coded as having passed a gatekeeper course.

Table 14. Percentage of Students Successfully Attaining Different Educational Outcomes, by Developmental Recommendation and Course-Taking

	Any Successful Outcome	Certificate	Associate Degree	Associate Degree and Transfer to 4yr	Transfer to 4yr
Developmental Reading					
Not recommended	29.4	1.9	6.9	7.3	13.3
Recommended and took	17.7	1.6	3.8	4.2	8.2
Recommended but did not take	22.3	3.0	5.0	4.0	10.3
Missing recommendation	34.3	4.7	8.3	7.9	13.4
Developmental Writing					
Not recommended	30.3	1.7	7.2	7.7	13.7
Recommended and took	18.6	1.5	4.2	3.9	8.9
Recommended but did not take	25.0	3.8	5.3	5.2	10.7
Missing recommendation	34.3	4.7	8.3	7.9	13.4
Developmental Math					
Not recommended	46.6	1.4	11.3	15.0	19.0
Recommended and took	23.6	1.5	5.5	5.9	10.7
Recommended but did not take	25.4	3.0	6.4	4.3	11.7
Missing recommendation	31.1	4.9	7.1	6.6	12.5
All Students	29.5	3.0	7.0	7.0	12.6

Note: Educational outcomes were coded exclusively based on the highest credential completed (e.g., students who earned both a certificate and an associate degree were coded as having earned an associate degree; also, students who earned a certificate and then transferred to a four-year institution were coded as "transfer to 4yr").

Table 15. Number of Terms Enrolled and Number of College-Level Credits Attempted and Completed, by Developmental Recommendation and Course-Taking

	All Students			
	Number of Terms Enrolled	Number of College-Level Credits Attempted	Number of College-Level Credits Completed	Percentage of College-Level Credits Completed
Developmental Reading				
Not recommended	4.6	38.3	28.9	65.5
Recommended and took	4.7	30.6	22.1	55.8
Recommended but did not take	3.9	29.2	21.3	58.3
Missing recommendation	4.2	34.6	28.1	71.7
Developmental Writing				
Not recommended	4.7	39.9	30.1	66.1
Recommended and took	4.6	30.2	22.0	57.4
Recommended but did not take	3.8	29.7	22.4	59.6
Missing recommendation	4.2	34.6	28.1	71.8
Developmental Math				
Not recommended	5.2	49.7	40.0	74.8
Recommended and took	4.9	35.9	26.6	61.4
Recommended but did not take	3.9	32.5	24.4	63.1
Missing recommendation	3.9	32.0	25.4	69.5
All Students	4.4	35.5	27.4	66.3
	Program Placement: Transfer			
	Number of Terms Enrolled	Number of College-Level Credits Attempted	Number of College-Level Credits Completed	Percentage of College-Level Credits Completed
Developmental Reading				
Not recommended	4.6	39.4	29.6	65.4
Recommended and took	4.8	31.4	22.5	55.4
Recommended but did not take	4.1	31.3	22.9	58.6
Missing recommendation	4.5	38.6	31.0	71.5
Developmental Writing				
Not recommended	4.7	41.1	30.8	66.2
Recommended and took	4.7	30.5	22.0	57.4
Recommended but did not take	4.0	31.9	23.9	59.4
Missing recommendation	4.5	38.7	31.1	71.6
Developmental Math				
Not recommended	5.2	50.4	40.6	74.8
Recommended and took	5.0	36.5	27.0	61.9
Recommended but did not take	4.0	34.0	25.0	62.1
Missing recommendation	4.1	35.3	27.6	68.5
All Transfer-Placed Students	4.6	37.8	28.9	66.0

Note: Credits earned in courses numbered 10 or higher were considered college level, except for those with ELS or BKS prefix and MTH50. For students placed in transfer programs, courses numbered 100 or above were considered college level. Students needed to earn a grade of D or higher to complete attempted credits.

Table 16. Percentage of Students with Reported Placement Test Scores, by Subject

	Reading	Writing	Math	Reading and Writing	Reading Writing, and Math
All Students	63.4	63.2	64.3	62.9	56.3
Program Placement					
Transfer	66.1	65.9	67.9	65.5	58.4
Career Tech	59.8	59.6	59.3	59.2	53.5
High School Dual Enrollment					
Yes	42.5	42.1	46.8	41.4	35.5
No	65.5	65.4	66.1	65.0	58.4

Table 17. Percentage of Students Taking Developmental and Gatekeeper Courses, by Test Score Quartiles

	Recommended Developmental	Took Developmental	Took Gatekeeper
Reading Test Score			
4th Quartile	0	0.5	81.5
3rd Quartile	0	1.7	77.2
2nd Quartile	18.6	14.5	70.7
1st Quartile	95.2	58.9	50.8
Writing Test Score			
4th Quartile	0	2.5	85.3
3rd Quartile	8.3	11.0	81.5
2nd Quartile	79.9	49.0	66.7
1st Quartile	90.4	65.8	46.7
Pre-Algebra Test Score			
4th Quartile	100.0	61.8	30.9
3rd Quartile	100.0	64.6	27.1
2nd Quartile	100.0	70.6	16.8
1st Quartile	96.8	71.7	13.1
Algebra Test Score			
4th Quartile	26.2	31.3	64.7
3rd Quartile	97.7	62.7	43.0
2nd Quartile	100.0	66.4	25.6
1st Quartile	100.0	60.2	20.3
College Algebra Test Score			
4th Quartile	0.0	3.1	74.6
3rd Quartile	0.0	1.1	74.4
2nd Quartile	5.4	18.2	78.3
1st Quartile	34.9	41.1	61.1

Note: The first quartile refers to the one fourth of test takers with the lowest scores in the given subject area.

Table 18. Correlations Between Placement Test Scores and Successful Completion of Developmental and Gatekeeper Courses

Correlations Between:	All	Transfer	Career Tech
Reading Test Score and			
Passing Developmental Reading	0.05	0.03	0.09
Passing Gatekeeper English	0.03	0.02	0.05
Writing Test Score and			
Passing Developmental Writing	0.08	0.09	0.06
Passing Gatekeeper English	0.04	0.03	0.04
Pre-Algebra Test Score and			
Passing Developmental Math	0.09	0.12	0.03
Passing Gatekeeper Math	0.14	0.13	0.13
Algebra Test Score and			
Passing Developmental Math	0.22	0.23	0.19
Passing Gatekeeper Math	0.09	0.03	0.15
College Algebra Test Score and			
Passing Developmental Math	0.08	0.10	-0.02
Passing Gatekeeper Math	0.06	0.08	-0.01

Table 19. Percentage of Students Successfully Attaining Different Educational Outcomes, by Test Score Quartiles

	Any Successful Outcome	Certificate	Associate Degree	Associate Degree and Transfer to 4yr	Transfer to 4yr
Reading Test Score					
4th Quartile	33.6	1.9	8.0	8.9	14.8
3rd Quartile	28.8	2.0	6.5	7.1	13.2
2nd Quartile	25.7	1.7	6.3	6.2	11.6
1st Quartile	19.1	2.3	4.0	3.7	9.1
Writing Test Score					
4th Quartile	33.8	1.3	8.6	9.7	14.2
3rd Quartile	29.7	2.1	6.9	7.1	13.5
2nd Quartile	24.9	2.1	5.1	5.7	12.0
1st Quartile	18.3	2.3	4.1	3.2	8.6
Pre-Algebra Test Score					
4th Quartile	26.4	2.2	7.1	5.1	11.9
3rd Quartile	19.3	2.4	5.7	4.1	7.2
2nd Quartile	16.6	2.2	4.0	2.3	8.2
1st Quartile	14.9	2.8	3.6	1.4	7.1
Algebra Test Score					
4th Quartile	42.0	1.7	11.9	13.6	14.8
3rd Quartile	31.4	2.3	9.3	7.8	12.0
2nd Quartile	23.7	1.8	5.3	4.3	12.3
1st Quartile	19.0	3.1	5.6	2.6	7.8
College Algebra Test Score					
4th Quartile	53.9	1.0	14.0	19.2	19.7
3rd Quartile	49.5	1.0	13.0	15.8	19.6
2nd Quartile	47.3	1.5	11.8	13.3	20.7
1st Quartile	32.6	2.1	8.4	10.0	12.1
No Test Score Available	32.5	5.6	7.6	6.7	12.6
All Students	29.5	3.0	7.0	7.0	12.6

Note: First quartile refers to the one fourth of test takers with the lowest scores in the given subject area.

Note: Educational outcomes were coded exclusively based on the highest credential completed (e.g., students who earned both a certificate and an associate degree were coded as having earned an associate degree; also, students who earned a certificate and then transferred to a four-year institution were coded as "transfer to 4yr").

Table 20. Number of Terms Enrolled and Number of College-Level Credits Attempted and Completed, by Test Score Quartiles

	Number of Terms Enrolled	Number of College-Level Credits Attempted	Number of College-Level Credits Completed	Percentage of College-Level Credits Completed
Reading Test Score				
4th Quartile	4.7	41.4	31.8	69.2
3rd Quartile	4.6	38.3	28.6	64.4
2nd Quartile	4.5	35.6	26.6	62.8
1st Quartile	4.3	29.0	21.0	56.2
Writing Test Score				
4th Quartile	4.8	42.1	32.4	68.8
3rd Quartile	4.6	39.9	29.8	66.0
2nd Quartile	4.5	34.4	25.4	61.4
1st Quartile	4.2	27.7	20.1	55.9
Pre-Algebra Test Score				
4th Quartile	4.5	35.5	26.5	64.5
3rd Quartile	4.6	33.1	24.7	61.8
2nd Quartile	4.1	27.1	19.1	55.7
1st Quartile	4.3	24.8	17.2	55.4
Algebra Test Score				
4th Quartile	5.0	47.2	38.2	73.2
3rd Quartile	4.9	42.3	32.5	66.1
2nd Quartile	4.6	35.2	25.4	60.8
1st Quartile	4.1	28.0	20.4	57.3
College Algebra Test Score				
4th Quartile	5.0	51.7	42.4	77.2
3rd Quartile	4.6	48.8	38.3	73.9
2nd Quartile	4.9	48.1	39.8	76.5
1st Quartile	5.1	44.7	35.0	69.7
No Test Score Available	3.8	31.4	25.5	71.1
All Students	4.4	35.5	27.4	66.3

Note: All credits numbered above 10 were considered college level, except for those with ELS or BKS prefix and MTH50.

Appendix B: Figures

Figure 1. Predicted Probability of Taking and Passing Gatekeeper English, by the Level of the First Developmental Reading Course, for Students Placed in Transfer Programs

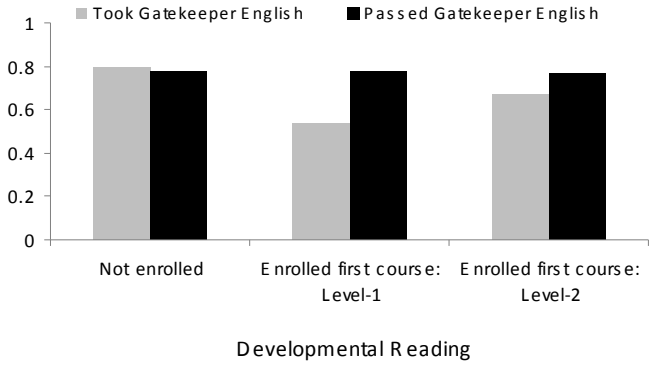


Figure 2. Predicted Probability of Taking and Passing Gatekeeper English, by the Level of the First Developmental Writing Course, for Students Placed in Transfer Programs

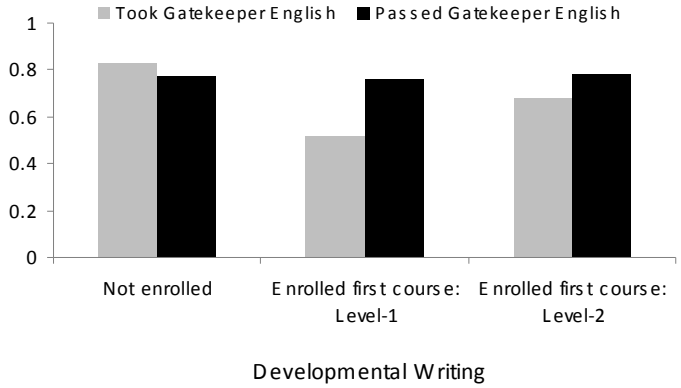


Figure 3. Predicted Probability of Taking and Passing Gatekeeper Math, by the Level of the First Developmental Math Course, for Students Placed in Transfer Programs

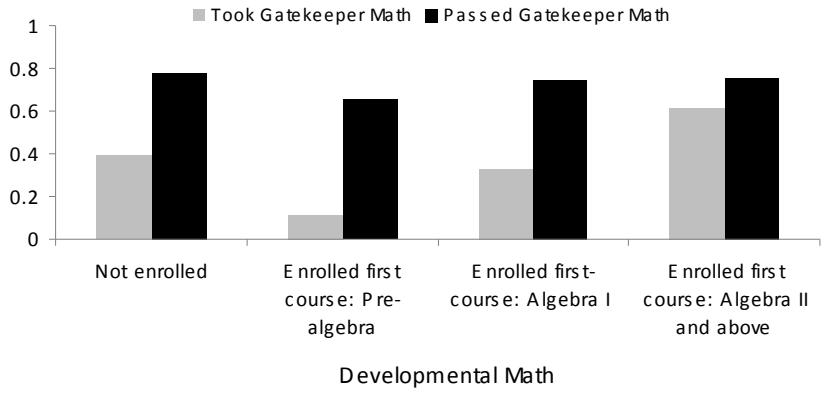
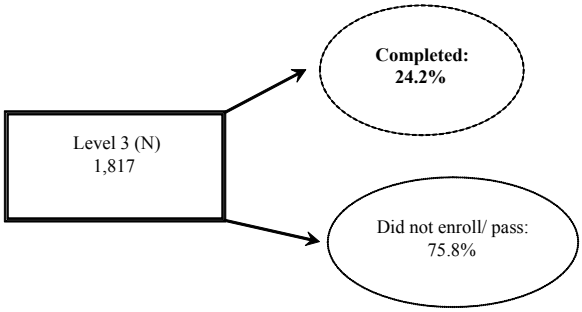
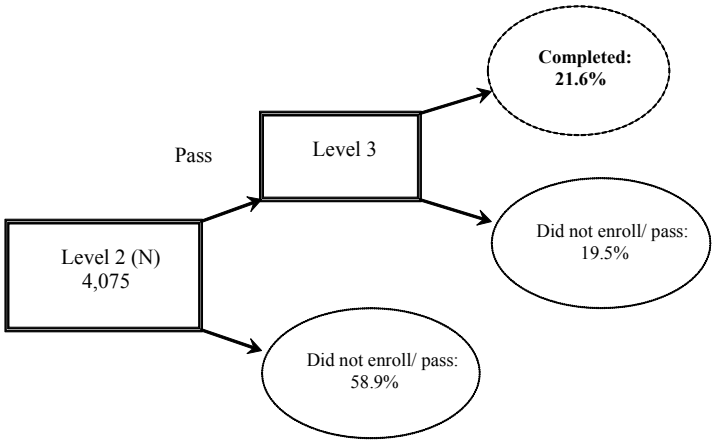


Figure 4. Completion of Developmental Courses, for Students Recommended To Take Different Levels of Math

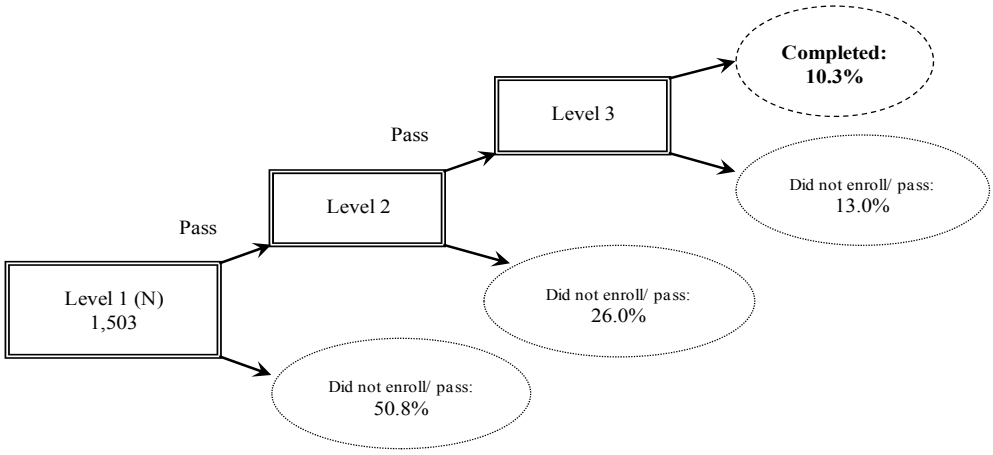
A. Students Referred to Level-3 Math (Algebra II or Higher)



B. Students Referred to Level-2 Math (Algebra I)



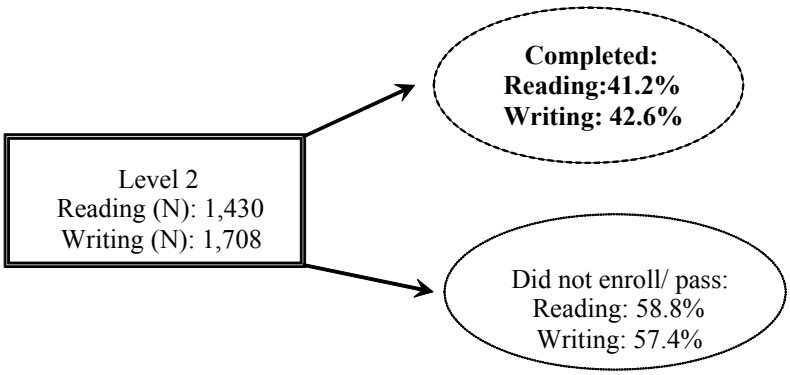
C. Students Referred to Level-1 Math (Pre-Algebra)



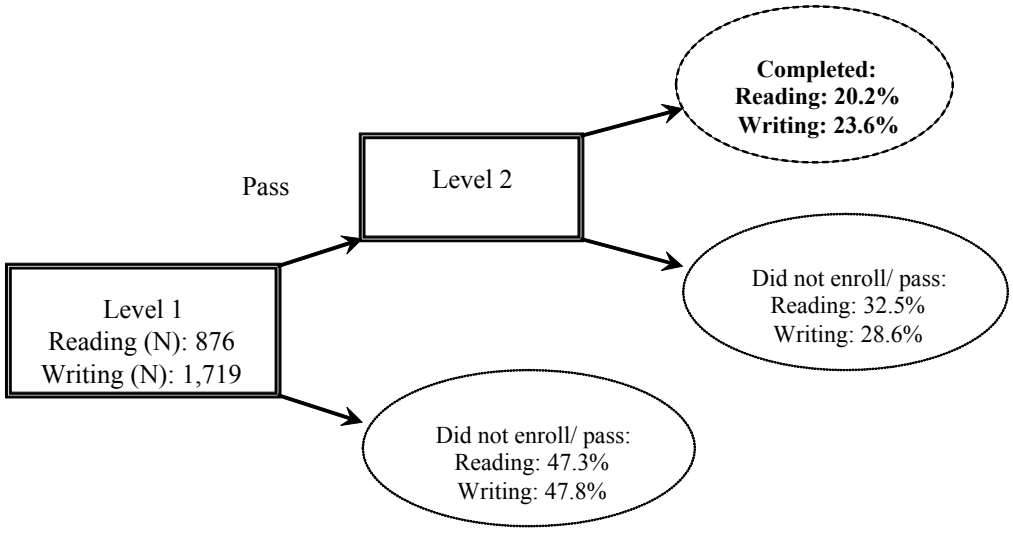
Note: The rates are for students placed in transfer programs. Developmental course levels were defined as follows: level-1 math: MTH01, MTH02, and MTH09, level-2 math: MTH03, and level-3 math: MTH04, MTH05, MTH06, and MTH07. Students in the decision zones were coded as being recommended to take developmental courses.

Figure 5. Completion of Developmental Courses, for Students Recommended To Take Different Levels of Reading and Writing

A. Students Referred to Level-2 Reading and Writing

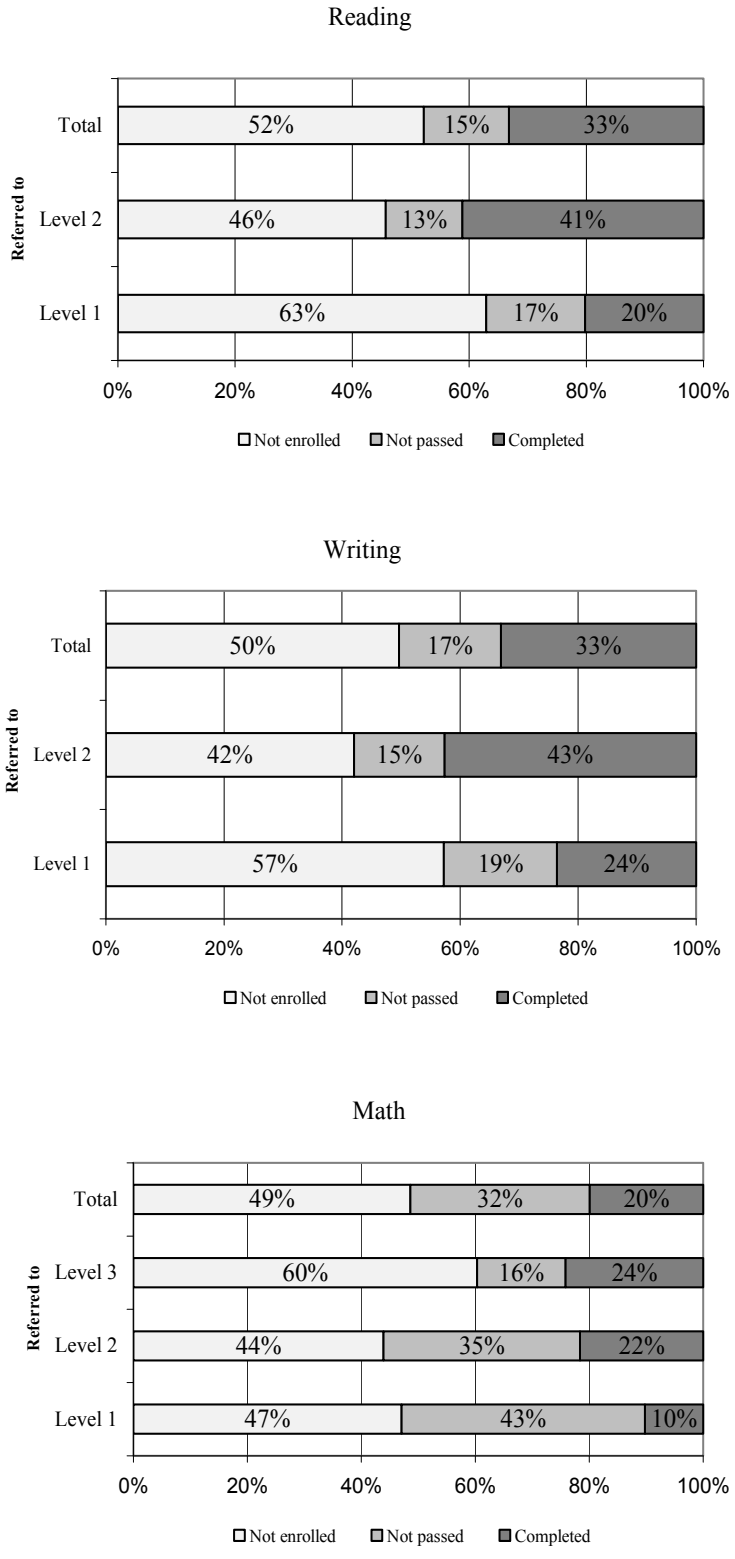


B. Students Referred to Level-1 Reading and Writing



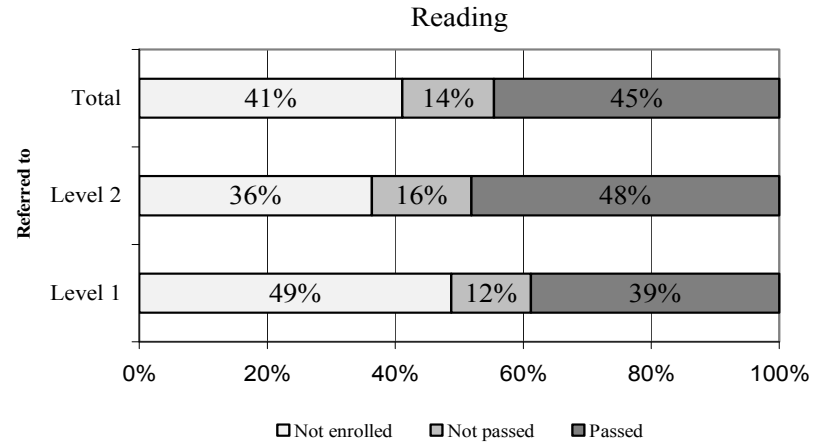
Note: The rates are for students placed in transfer programs. Developmental course levels were defined as follows: reading level-1: ENG04, reading level-2: ENG05, writing level-1: ENG01, and writing level-2: ENG03. Students in the decision zones were coded as being recommended to take developmental courses.

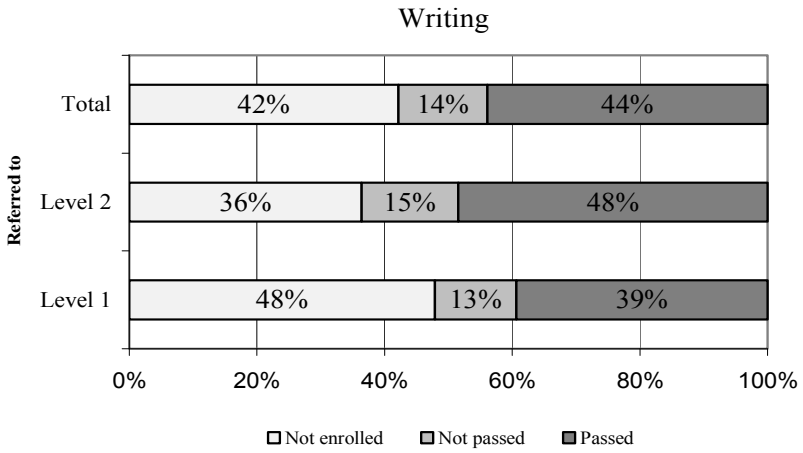
Figure 6. Percentage of Students Enrolling in and Completing Developmental Courses, by Subject and Level of the Recommended Developmental Course

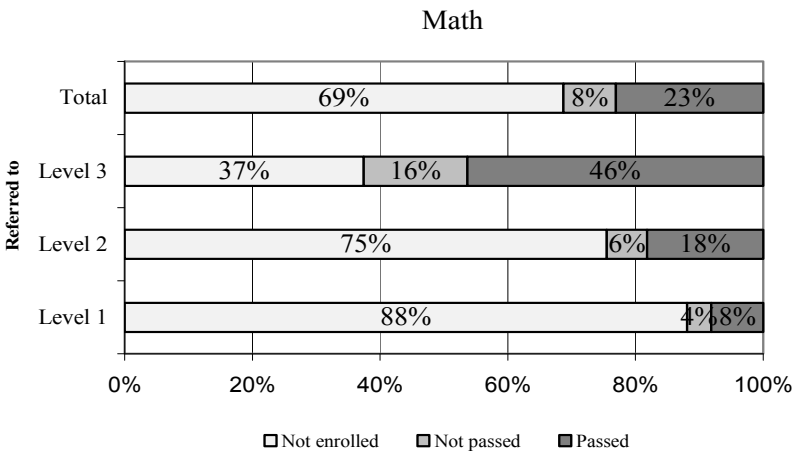


Note: The rates are for students placed in transfer programs.

Figure 7. Percentage of Students Enrolling in and Completing Gatekeeper Courses, by Subject and Level of the Recommended Developmental Course







Note: The rates are for students placed in transfer programs.

Figure 8a. Predicted Probability of Passing Developmental Reading and Gatekeeper English, by Reading Test Score Quartiles, for Students Placed in Transfer Programs

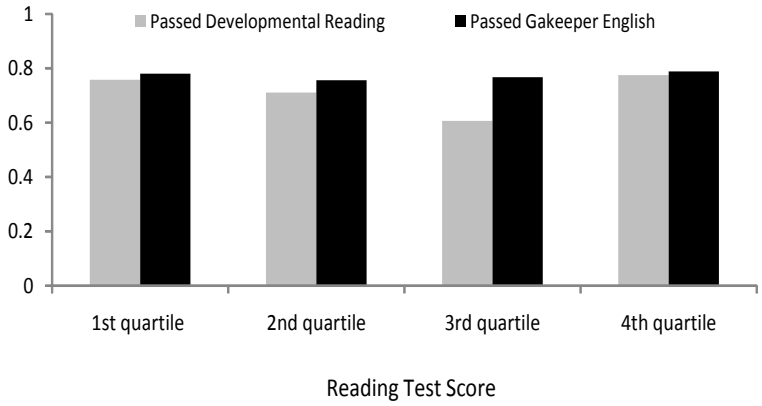


Figure 8b. Predicted Probability of Passing Developmental Writing and Gatekeeper English, by Writing Test Score Quartiles, for Students Placed in Transfer Programs

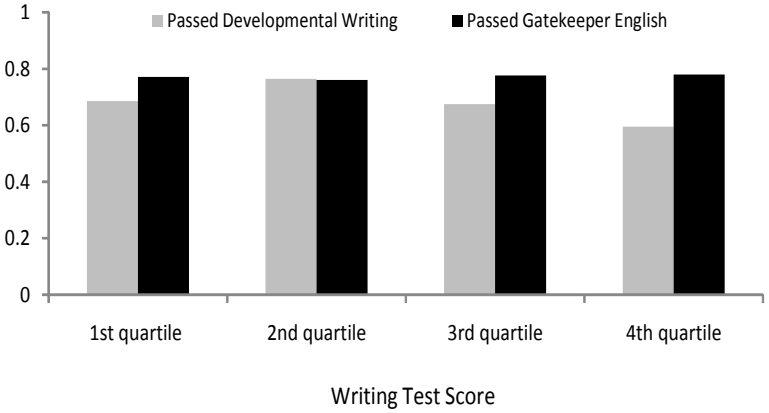


Figure 9a. Predicted Probability of Passing Developmental and Gatekeeper Math, by Pre-Algebra Test Score Quartiles, for Students Placed in Transfer Programs

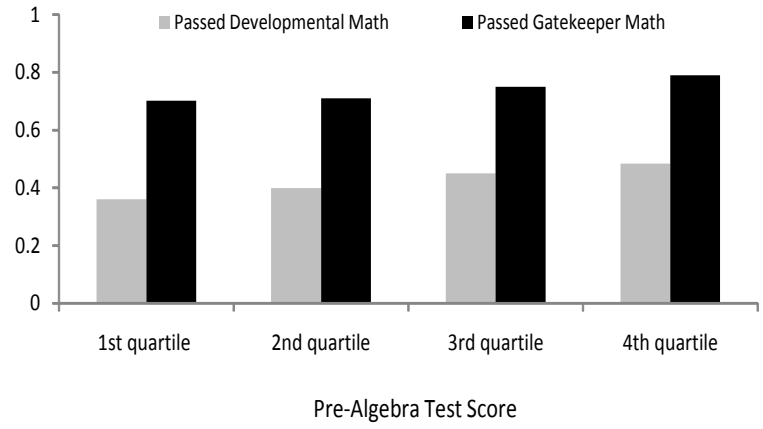


Figure 9b. Predicted Probability of Passing Developmental and Gatekeeper Math, by Algebra Test Score Quartiles, for Students Placed in Transfer Programs