Community College Research Center
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

Online Learning in the Virginia Community College System

Shanna Smith Jaggars and Di Xu

September 2010

Acknowledgments: Funding for this study was provided by Lumina Foundation for Education through a grant to CCRC as part of Achieving the Dream: Community Colleges Count (see the initiative's website at http://www.achievingthedream.org).The authors thank David Blazar for his assistance with the research and Thomas Bailey, Davis Jenkins, and Donna Jovanovich for their useful comments in reviewing an earlier draft.

Address correspondence to:

Shanna Smith Jaggars
Senior Research Associate
Community College Research Center
Teachers College, Columbia University
525 West 120th Street, Box 174
New York, New York 10027
Tel.: 212-678-3091
Email: jaggars@tc.edu

Visit CCRC's website at: http://ccrc.tc.columbia.edu

Table of Contents

Abstract

In January 2001, the Virginia Community College System (VCCS) released a distance learning strategic plan that endorsed taking a student-centered approach to online learning as well as providing support services to promote faculty development and student success. The current study was commissioned by VCCS to investigate student outcomes for the 2004 student cohort by examining: (1) patterns of online course taking among Virginia community college students; (2) college-ready and underprepared students' retention and performance in online versus face-to-face courses; and (3) subsequent educational outcomes for underprepared and college-ready students who participate in online learning.

Results indicate that nearly half of Virginia community college students enrolled in an online course across the period of study, with online enrollments increasing dramatically over four years. However, few students enrolled in an entirely online curriculum in a given term, even by the time the study concluded in 2008. In general, students with stronger academic preparation were more likely to enroll in online courses. Regardless of their initial level of preparation, however, students were more likely to fail or withdraw from online courses than from face-to-face courses. In addition, students who took online coursework in early semesters were slightly less likely to return to school in subsequent semesters, and students who took a higher proportion of credits online were slightly less likely to attain an educational award or transfer to a four-year institution. Additional analyses with a new cohort of students entering in 2008 were consistent with the results of the 2004 cohort.

1. Introduction

In the past decade, distance education through online coursework has become a common option for students: Over 25% of U.S. college students took an online course in the fall of 2008, and the annual growth rate in online enrollment far exceeds the growth rate in overall higher education enrollment (Allen & Seaman, 2010). Distance courses offer the flexibility of offsite asynchronous education, and online courses promise a variety of other learner benefits, such as computer-mediated student-to-student interaction and collaboration, and immediate automated feedback on student learning. Despite the potential benefits of online course taking, however, questions remain regarding its effectiveness in the community college setting. In general, research suggests that community college students who *complete* online courses earn equivalent grades to those who complete face-to-face courses (Blackner, 2000; Carpenter, Brown, & Hickman, 2004; Musgrove, 2002; Summerlin, 2003); however, online students are less likely to complete their courses (Blackner, 2000; Carpenter, Brown, & Hickman, 2004; Rosenfeld, 2005; Summerlin, 2003; Zavarella, 2008).

Community college administrators are often particularly concerned about the performance of academically underprepared students in online courses, and indeed there is some suggestive evidence that less-prepared students may fare better in face-to-face than in online courses (Figlio, Rush, & Lin, 2010; Peterson & Bond, 2004). For example, some online students report frustration with their own slowness of typing, problems navigating the course management system, and difficulty following material on the screen (Aman & Shirvani, 2006; Bambara, Harbour, Davies, & Athey, 2009), and these problems may be more pronounced among students with weak educational backgrounds. Underprepared students may also have poor time-management and independent-learning skills, which many colleges view as critical to success in online education (Liu, Gomez, Khan, & Yen, 2007). In addition, despite the potential for strong and consistent student-instructor and student-to-student interaction online, some courses may lack this component, leading to a sense of student isolation (Bambara, Harbour, Davies, & Athey, 2009) and alienation (Rovai & Wighting, 2005). Thus underprepared students encountering course-related difficulties in an online course may feel more comfortable dropping the class than seeking assistance from their instructor or fellow students.

Recognizing the challenges involved in online learning, in 2001 the Virginia Community College System (VCCS) released a distance learning strategic plan that endorsed taking a student-centered approach to online learning as well as providing support services to promote faculty development and student success. VCCS commissioned the current study to examine online course enrollment and performance among both college-ready and academically underprepared students across the system. In particular, we analyze: (1) patterns of online course taking among Virginia community college students; (2) college-ready and underprepared students' retention and performance in online versus face-to-face courses; and (3) subsequent educational outcomes for underprepared and college-ready students who participate in online learning.

2. Data and Methods: 2004 Cohort

Analyses were performed on a dataset containing nearly 24,000 program-placed students across all 23 community colleges in Virginia. First-time students who initially enrolled during the summer or fall of 2004 were tracked through the summer of 2008, approximately four years. The dataset contains information on student demographics, institutions attended, developmental placement scores and recommendations, transcript data on courses taken and grades received, and information on educational attainment. Information on each course is also included, such as the course subject, whether it was a developmental or college-level course, and whether it was a distance-education or face-to-face course. This dataset does not distinguish between face-to-face and hybrid-online courses; "distance" education refers to courses with 95% or more of the content offered asynchronously. Although some distance courses in the Virginia system are offered through television, correspondence, or other methods, most are entirely online courses; we will refer to these courses as "online courses" throughout the report.

"Underprepared" students are defined as those who scored below college-ready standards on VCCS placement exams. As discussed in detail in Roksa, Jenkins, Jaggars, Zeidenberg, and Cho (2009), placement exam data in the current dataset suffer from missing data issues as well as inconsistencies arising from the use of multiple exams and are therefore not feasible for inclusion in most inferential analyses. In most analyses, then, we define student preparation according to whether the student ever enrolled in at least one remedial course in English or math, termed “remedial-enrolled.” Across the sample, 51% of students took a remedial course in one or both subjects: 26% of students enrolled in developmental English, while 42% enrolled in developmental math.

Analyses were sometimes conducted with the student as the unit of analysis and other times with the course as the unit of analysis, as noted in each analysis. In order to ensure a consistent student sample size regardless of the unit of analysis, courses with no valid outcomes (e.g., audited courses) were dropped from the dataset. There was no systematic difference between online and face-to-face courses in terms of the proportion dropped. Removing these courses also dropped a small proportion (less than 1%) of students who only took such courses, resulting in 23,823 students (and 317,812 courses taken by those students) for analysis.

3. Findings

3.1 Characteristics of Students Enrolling in Online Coursework

Across their first semester of enrollment at Virginia community colleges, 14% of students in the 2004 cohort attempted at least one online course; across their first year, 23% of students attempted such a course; across their entire community college career (through summer 2008), 43% attempted such a course.

Table A.1 (all tables can be found in Appendix A) presents online course enrollment rates among key demographic groups in the first semester (summer/fall 2004), first year (summer 2004–spring 2005), and across the entire student career (through summer 2008). On a descriptive basis, it appears that online courses were consistently more popular among women, White students, those aged 25 years or older at college entry, students who applied and were eligible for federal need-based aid, English-fluent students, and students with a stronger level of academic preparation (students who were college-ready at enrollment, students who did not take remedial courses, and students who had been dual-enrolled prior to enrollment). No strong differences were apparent between students in the career-tech versus the transfer program.

The dataset does not include explicit information on students' employment or child care responsibilities, two external factors often thought to contribute to online course enrollment. Among students who applied for federal financial aid, however, two variables may serve as useful proxies of external responsibilities. First, financial aid applicants indicated whether or not they were dependents of their parents. Students who are not dependents may be more likely to be employed full time. Second, independent students also indicated whether they had dependents of their own. As Table A.1 shows, both being independent and having dependents seem associated with online course taking.

Given that some student characteristics change from semester to semester (such as full-time student status and prior enrollment history), we also conducted a semester-based analysis, exploring possible relationships between variables that can change over time and online course taking in fall 2004 and spring 2005. As Table A.2 shows, full-time students, students who had earned prior credits, students who had previously taken an online course, students who were previously or concurrently enrolled in computer literacy, and students who were previously or concurrently enrolled in a student development course seem more likely to have attempted online courses than their counterparts across the first two semesters.

To better understand which demographic characteristics had a statistically significant impact on online course taking in the first semester and first year, we conducted an analysis incorporating the student characteristics explored above,[1] using multilevel modeling techniques to take into account clustering of students within colleges. Results indicate that in terms of both the first semester and the first year, online courses were significantly[2] more popular among females, English-fluent students, those who applied and were eligible for financial aid, who never enrolled in remedial education, who were above 25 years old at college entry, who had earned credits in

---

[1] Due to a high proportion of missing placement scores, this analysis and all subsequent inferential analyses use math and English developmental education enrollment (rather than developmental placement scores) as covariates.

[2] Throughout this paper, we use the terms "significant" and "significantly" to denote statistical significance ($p < .05$).

previous semesters, who had enrolled in computer literacy or development courses, and who had attempted online courses before. In terms of ethnicity, Black students and Hispanic students were significantly less likely to take an online course both in the first semester and first year than were White students. While dual enrollment did not have a significant influence on online course taking in the first semester, students who had taken dual enrollment courses were significantly more likely to attempt an online course in the first year.

Observed demographic differences between students who ever enrolled in an online course and those who did not could be due, at least in part, to individual variations in college persistence. As shown in Table A.3 (and as discussed in more detail in section 3.3), online course enrollments increased dramatically across the four-year period of the study (a pattern concomitant with a general increase in online course offerings across Virginia community colleges). As a result of the general increase in online course offerings and enrollments, students who persisted longer would have more opportunities to take an online course. To disentangle college persistence from the likelihood of taking an online course, we also conducted analyses of demographic characteristics of online course-takers separately for each subsequent semester of enrollment; in general, the same demographic patterns persisted regardless of the timing of online course enrollment.

Among students who applied for federal financial aid, we conducted secondary analyses adding dependency status and whether the student had dependents as predictors of online course taking during the first semester of enrollment. Being an independent student and (among independent students) having dependents significantly increased the probability of taking at least one course online.

3.2 Characteristics of Online Courses

Across all courses included in our dataset, only 12% were taken online, while 88% were taken in person. Table A.4 presents the percentage of courses taken online, broken down by different types of courses.[3] On a descriptive basis, it appears that online

[3] Based on VCCS definitions, "high risk" courses are those with above-median rates of D grades, failures, and withdrawals. Only courses with annual system wide enrollments greater than 500 and individual course enrollments greater than 10 are eligible for VCCS classification as high-risk, which excluded 34% of the course enrollments in this study. Online course enrollments may be higher for "high-risk" courses because these courses have large enrollments and are perhaps more likely to be offered online.

course enrollment rates were higher for non-developmental courses, non-gatekeeper courses, and courses offered for exactly three credits. We also examined online course enrollment rates based on the subject of the course (as classified by the NCES Higher Education General Information Survey taxonomy). Online courses represent a higher-than-average proportion of enrollments within the academic subject areas of Social/Military Science and Humanities/Fine Arts, and within the occupational subject areas of Health, Business, and Information Technology. Online courses represent a below-average proportion of enrollments within the academic areas of Math, English, Physical/Computer Science, Student Development/ESL, and Physical Education, and within the occupational areas of Electrical/Mechanical Engineering and Natural Science. However, it is unclear whether online course enrollments were more popular in a given subject (such as social science) because students preferred to take such courses online or because more courses were offered online in that subject area than in others (such as physical science).

We also examined online enrollment among remedial and gatekeeper English and math courses.[4] Gatekeeper courses are an essential prerequisite for most community college degrees and certificates, representing the first college-level course in that subject area. Table A.5 indicates that while the online enrollment rate was low among all English remedial courses, it dropped to zero for English 02, 07, and 08, suggesting that these courses were not offered online at any college. Compared to remedial English, the percentage of online enrollments for remedial math was generally higher for all courses. As Table A.6 shows, Math 05, 06, 07, and 09 had a relatively high percentage of online course enrollment, with Math 06 representing the highest rate of online enrollment (19%). As for gatekeeper courses, online course enrollment varied substantially among different courses, ranging from 3% (for Mathematics for Allied Health) to 21% (for Introduction to Mathematics).

3.3 Patterns of Enrollment among "Ever-Online" Students

Among students who ever took an online course at any point across their career at Virginia community colleges ("ever-online" students), 31% attempted only one online

[4] Given that there is only one gatekeeper English course (ENG111), the online course enrollment for gatekeeper English and gatekeeper Math are jointly presented in one table (Table A.7).

course, 19% attempted two, 28% took three to five, and 22% took six or more online courses. Averaging across the semesters each student was actively enrolled within VCCS, 68% of ever-online students took fewer than one online course per semester. However, from these statistics it is unclear whether ever-online students took few courses (but most of them online), took many courses with a predominately face-to-face mix, or shifted the number and mix of online and face-to-face courses over time. To address these questions, we examined changes in the number and percent of credits taken online, as well as the proportion of students taking *all* their credits online, for three sets of students: (1) all students, (2) ever-online students, and (3) students actively enrolled in an online course for a given semester ("actively online" students).[5]

Tables A.8–A.10 present the averages for each statistic for each semester, separately for each subset of students. Figure B.1 (all figures can be found in Appendix B) visually presents the trends across academic years.[6] The average percent of credits taken online increased fairly steadily across all three subsets of students. The average number of online credits also increased consistently across the long semesters for all and ever-online students from 2004 to 2007, then leveled off in 2007-08, perhaps because active students were finishing up their requirements and were taking fewer courses overall. For actively online students, however, the number of credits taken online remained fairly consistent across the college career, at between 4 and 5 credits per semester.

These results, taken together with those in Table A.3, suggest that the increase in online course enrollments from 2004 to 2008 can be separated into two trends: (1) students were increasingly likely to try at least one online course over time, moving themselves into the "ever-online" category; and (2) over time, those who were actively online in a given semester only slightly increased the *number* of credits taken online, but sharply increased the *proportion* of credits taken online. As an illustration, in one semester, a student may take one online and two face-to-face courses; in the next, she

[5] Analyses were conducted at the semester level, calculating the number and percent of online credits for each student actively enrolled in that semester, then averaging across students within semesters.
[6] As explained later in this section, given that the pattern of online course taking was quite different in summer terms, we examined the online enrollment time trend based on only fall and spring semesters. Annual averages were calculated by averaging across the fall and spring for each student, then averaging across students.

may take only two courses, one online and one face-to-face. Although she has not increased the number of courses taken online, she has increased the proportion.

Tables A.8–A.10 also clearly indicate that online courses were much more popular during summer terms. Averaged across years, summer semesters (36%) outweigh fall semesters (21%) and spring semesters (25%) in terms of the percent of credits taken online. However, when considering the average *number* of credits taken online, summer semesters (2.11) still outweigh fall semesters (1.96) but not spring semesters (2.42).

Finally, we consider the proportion of students who took all their courses online in a given semester. Across all students, few took an entirely online curriculum during long semesters. Even in a long semester in which a student enrolled in at least one online course, he or she was unlikely to take *all* credits online. Although this proportion grew over time (from less than one-fifth in the first year to over one-third in the final year), most students who took online courses in a given long semester also participated in face-to-face coursework during that semester. During summer semesters, however, more than half of students who enrolled in an online course took all their courses online.[7] Taken together, these results suggest that although students increased their online course enrollments over time, most enrolled in online courses intermittently or as one course among several other face-to-face courses.

3.4 Course Completion and Subsequent Course Enrollment Outcomes

This section compares student course performance between online and face-to-face courses. Given the strong demographic differences between ever-online students and those who chose an entirely face-to-face curriculum, analyses in this section consider ever-online students only.

We first focus on course completion, defined as earning a D or better in the course (as opposed to withdrawing from or failing the course).[8] Treating course as the unit of

---

[7] Additional analyses indicate that the typical student taking all credits online in a given long semester enrolled in approximately two courses, an average which remained fairly consistent from fall 2004 (6.42 credits) to spring 2008 (6.20 credits). The typical student taking all courses online in a given summer took between one and two courses, an average remaining fairly consistent from summer 2004 (4.73 credits) to summer 2008 (4.80 credits).

[8] We use passing the course with a D or better as the standard for successful completion in this analysis because most developmental courses do not award letter grades; passing these courses is considered the

analysis (i.e., examining the 184,357 online and face-to-face courses taken by ever-online students), 78% of courses were successfully completed. As might be expected, overall course completion rates were slightly lower for developmental (remedial-enrolled) students. As shown in Table A.11, however, the 4 percentage point difference in completion rates between college-ready and developmental students was negligible in comparison to the 13 percentage point difference in completion between face-to-face and online courses. We anticipated that the decrement in performance for online courses would be stronger for developmental students. However, at least on a descriptive basis, no such interaction was apparent: College-ready students had completion rates 13 to 15 points lower in online education courses, and developmental students had completion rates 11 to 13 points lower in online education courses.

We also examined the performance of ever-online students enrolled in developmental courses offered face-to-face versus online. As noted above, a very small proportion of remedial courses were offered through online education; however, this still constituted a fairly large pool of online remedial enrollments to examine (English N = 373, math N = 773) in comparison with face-to-face remedial enrollments. Again considering only those remedial students who ever participated in online education, Table A.12 shows that the decrement in performance for online courses was even greater in remedial classes, with a 24 percentage point difference in remedial English courses and a 19 percentage point difference in remedial math courses.

To examine whether these observed differences are statistically significant after controlling for characteristics of students, we ran a series of inferential analyses predicting course completion, focusing particularly on math and English courses.[9] Given the descriptive findings of a wider gap between online and face-to-face courses when the course was remedial, preliminary versions of the models included an interaction between

---

equivalent of earning a D or above. In later analyses using gatekeeper courses, which do award letter grades, we use passing the course with a C or better as the standard for successful completion.

[9] For each subject area, we ran a three-level multilevel model including course-level and semester-level characteristics on level 1, student characteristics on level 2, and primary college affiliation on level 3. It was sensible to treat course and semester variables as belonging to the same level, as the vast majority of students took only one math course, or only one English course, per semester. For each model, intercepts were allowed to vary randomly at both the student and school level. There was insufficient data within students to allow the impact of course mode (online versus face-to-face) to vary randomly across students; however, the effect of course mode was allowed to vary randomly across schools.

course mode (online versus face-to-face) and an indicator of whether the given course was remedial. The interaction was consistently weak and non-significant; for parsimony and ease of interpretation of other effects, the interaction was dropped from the final models. Although course mode did not interact with the level of the specific *course*, it is still possible that course mode interacts with the initial preparedness of the *student*. Accordingly, we also investigated interactions between course mode and remedial-enrollment status in each subject, as discussed in more detail below.

Preliminary versions of the model also tested the hypothesis that over time, online course completion rates may improve relative to face-to-face completion rates (perhaps due to system-wide policy changes), by including a time trend across academic years as well as an interaction between the time trend and course mode. The interaction was consistently weak and non-significant, and was also dropped from the final models.

Two final models were conducted within each subject area. Model 1 included all courses in that subject across the college career (including 21,299 math and 25,393 English courses), controlling for both course-level and student-level characteristics. Course-level characteristics included whether the course was developmental, was taken for greater than three credits, and was taught by part-time or full-time faculty; the model also included controls that varied by semester, including whether the student had taken a computer literacy course previously or concurrently, whether the student had taken a student development course previously or concurrently, whether the course was taken during a summer semester or long term, a time trend reflecting the year in which the course was taken, and the student's credit load for the current semester.[10] Student-level characteristics included gender, minority status, aged 25 years or older in fall 2004, dual-enrolled prior to college entry, transfer-oriented versus occupational program placement, applied for and was eligible for need-based aid, and remedial-enrollment status for both math and English. For consistency between the two subject areas' models, each equation also included cross-level interactions between course mode and both remedial-enrollment variables.

[10] Preliminary descriptive analyses implied that the relationship between credit load and course performance was curvilinear, with students most likely to complete a course if they were taking very few credits (3 or fewer) or were attending college more than full time (more than 12 credits). Accordingly, credit load (centered around 12 credits) was entered as both a linear and squared predictor.

As a robustness check of Model 1, we also added student dependency status (for those who applied for financial aid) and whether the student had dependents (for independent students) as predictors of course completion. Among the subset of students who provided these data, the coefficients for online learning on math and English course completion remained consistent before and after inclusion of these additional controls. Accordingly, these predictors were dropped, and further analysis proceeded with the full sample of students.

Model 2 built upon Model 1 by adding the course-level predictors of the student's GPA and credits earned prior to enrollment in the given course. If a student had no GPA prior to enrolling in a course, that particular course could not be included in Model 2. Accordingly, all summer 2004 courses and most (82% of math and 85% of English) fall 2004 courses were dropped from Model 2, resulting in 15,756 math courses and 16,868 English courses for analysis. Prior GPA was a powerful predictor, and it dampened the coefficients of age, gender, and remedial-enrollment status. Outside of these changes, however, the pattern of coefficients remained fairly consistent between Model 1 and Model 2.

For all models, the online course coefficient was strongly and significantly negative; indeed, course mode represented the *strongest* effect in every model (with the exception of prior GPA in Model 2). For math courses, the interaction between student remedial-enrollment status and course mode was non-significant; for English, however, the interaction was significant and negative. As logistic models with interactions can be challenging to interpret, Figure B.2 provides the Model 2 predicted probabilities[11] of passing a course separately for online and face-to-face courses, moderated by remedial-enrollment status in the given subject. In Figure B.2, the passing rate in online courses is clearly lower for both subject areas. For math courses, the non-significant interaction with remedial status is apparent in that the gap between online and face-to-face courses is similar between remedial-enrollment and non-remedial-enrollment math students. For English, however, a significant interaction indicates that the online versus face-to-face

[11] Probabilities calculated at the grand mean of all controls except credit load (centered around 12 credits) and the variables involved in the interaction (uncentered).

gap is greater among those students who took a remedial English course at some point in their college career.

These results indicate that ever-online students who took a given course online were less likely to complete the course, and this effect was consistent across both non-remedial and remedial courses (given the lack of interaction for whether the *course* was at the remedial level). However, are students who take remedial courses online equally likely to persist to enroll in college-level courses, and to succeed in those courses? Using the student as the unit of analysis, we considered gatekeeper enrollment among remedial-enrollment students who ever took any online course. Among those who took remedial English, 72% eventually enrolled in a gatekeeper English course; however, the rate of gatekeeper enrollment was nearly 30 percentage points lower (45% versus 76%) for those who took a remedial English class via an online method in comparison to those who took all English remedial classes face-to-face. Among those who took remedial math, the rate of gatekeeper enrollment was 20 percentage points lower for students who took remedial math via online education (26% versus 46%).

Thus, on a descriptive basis, students who took remedial courses online were less likely to have ever moved on to college-level math and English courses. To further explore this pattern, we performed inferential analyses examining gatekeeper enrollment and success rates (defined as earning a C or better) among ever-online remedial-enrollment students, comparing those students who took at least one remedial course online with those who took the entire sequence of courses face-to-face. The student was the unit of analysis; analyses were performed separately for students who took math (N = 4,660) and English (N = 2,495) remedial courses, controlling for student-level characteristics as well as the clustering of students within schools. For enrollment, the inferential results matched the descriptive difference closely: Online remedial enrollment was significantly associated with lower gatekeeper enrollments in both subject areas. The inclusion of controls did not affect the estimated gap for English (a 29 percentage point difference in gatekeeper enrollment) but slightly narrowed the gap for math (a 15 percentage point difference). Among those who enrolled in the given gatekeeper course, having taken the corresponding remedial course online was negatively related to success rates in English (a 9 percentage point difference) but was not related to success rates in math. A final model combining gatekeeper enrollment *and* success yielded a model-based predicted probability of 32% that those who took an English remedial course online would eventually enroll and succeed in gatekeeper English, while 59% of those who took a fully face-to-face remedial sequence would do so; for math, the corresponding percentages were 20% and 31%.[12] A robustness check of these models, adding as controls dependency status and whether the student had dependents (among the subset of students who provided this information), did not alter the estimated impacts of online learning.

3.5 Subsequent Outcomes for Online Students

Given that students were less likely to complete online courses than face-to-face courses, we examined whether enrolling in online courses early in the college career is associated with subsequent educational outcomes, particularly one-semester and one-year retention and earning an educational award or transferring to a four-year college.

We first examined first-semester and first-year retention. Table A.13 presents descriptive statistics which suggest that students who took at least one online course in the first fall semester were equally likely to persist into the spring semester as those who took only face-to-face courses, a pattern that appears consistent regardless of developmental status.[13] Similarly, among those students who persisted into the spring, those who took online courses in the first year were equally likely to persist into the second fall semester as those who did not. These observed patterns are surprising, given that high online course withdrawal and failure rates might discourage online students from persisting in school; however, there are two plausible explanations for the apparent lack of difference.

[12] Given that students who begin remedial education at lower levels are much less likely to progress to gatekeeper courses (Roksa et al., 2009), it is important to note that online remedial courses were not disproportionately low-level. Rather, among the subsample included in the inferential analysis, online remedial course enrollments were disproportionately high-level; for example, 82% of remedial English courses taken online were at the highest level of remediation, while only 61% of remedial English courses taken face-to-face were at the highest level.

[13] For persistence analyses, we used versions of the remedial enrollment and online course enrollment variables that are definitionally independent of future persistence. We defined remedial enrollment as having taken a remedial course prior to or during the current semester, and online enrollment as having taken an online course in the current semester.

First, rather than dropping out of school, students who did poorly in online coursework might have made the logical decision to switch to entirely face-to-face coursework. Additional descriptive analyses indicate that many students indeed made this choice. Among students who took both methods of coursework during the first fall of enrollment, those who did equally well in both types of coursework had a 31% probability of enrolling in an entirely face-to-face curriculum in the spring; in contrast, those who did more poorly in online coursework than face-to-face coursework had a 45% probability of enrolling in entirely face-to-face courses in the spring.

Second, as shown in previous analyses (Table A.1), students who chose online coursework were also students who had other characteristics typically associated with better short- and long-term outcomes. Thus, their otherwise *higher* rates of retention might have been dampened by their participation in online coursework. To examine this possibility, we conducted further analysis controlling for student characteristics,[14] using a multilevel model to take into account clustering of students within school. The first model included all students enrolled in fall 2004, comparing spring 2005 retention between students who took at least one online course during that time to those who did not. The second model included all students still enrolled in spring 2005, comparing fall 2005 retention between those who took at least one online course during the spring to those who did not. Results suggest that students taking at least one online course were slightly but significantly less likely to persist. The model-based predicted probabilities of retention from fall 2004 to spring 2005 were 69% for online students and 74% for face-to-face students; from spring 2005 to fall 2005, they were 67% for online students and 70% for face-to-face students. These results support the notion that, after controlling for the stronger academic preparation of online students, online coursework is negatively related to next-semester persistence.

[14] Gender, ethnicity, over 25 years of age at college entry, type of program (career tech versus transfer), financial aid status, took computer literacy course prior or concurrently, credits attempted current semester, ESL status, dual enrollment status, took student success course prior or concurrently, ever-remedial status. The interaction term between remediation enrollment and online course did not reach statistical significance and was thus excluded from both models. The spring 2005 model also included prior credits and GPA, which dropped 1,863 students who had no fall GPA (i.e., earned no college-level credits in their first semester). As a result, the overall model-based predicted probabilities of retention are slightly higher than the descriptive retention rates in Table A.13. Addition of dependency status and whether the student had dependents did not substantially alter results among the subset of students who provided these data.

Next we examined the long-term outcome of attaining an educational award or transferring to a four-year college. Controlling for student characteristics[15] and considering students who were retained through spring 2005, a multilevel analysis compared students who ever took an online course with those who had not and found no significant difference in probability of award/transfer. However, as noted in a previous section, students who were still enrolled in later semesters were more likely to participate in online courses; it is possible that ever-online students in this analysis are simply students who stayed in school longer and thus may have better outcomes. To remove the potential confounding differences between ever-online and never-online students, a second analysis focused on the proportion of credits taken online among ever-online students only. Ever-online students who took a higher proportion of credits online were significantly less likely to attain an award or transfer to a four-year college: At the 25th percentile (8% of credits taken online), these students had an estimated 48% probability of award or transfer; at the 75th percentile (28% of credits taken online), the probability of award/transfer was 42%.[16]

3.6 Additional Analysis for 2008 Cohort

The lack of a significant trend in improvement of online course performance over time may be somewhat discouraging. However, rather than effecting improvements within a given cohort of students, system-wide changes may effect improvements for successive cohorts of students, a possibility that cannot be explored with a single cohort. The 2004 cohort entered the system six years ago; it is possible that recent cohorts had a very different online experience. To explore this possibility, we procured an additional dataset, which included over 28,000 program-placed students entering in the summer or fall of 2008, who were tracked through the spring of 2009. This dataset distinguished between fully online and hybrid-online courses, but only for courses in fall 2008 and later; therefore, in analyses that examined online and hybrid course enrollments, we

---

[15] Gender, ethnicity, over 25 years of age at college entry, type of program (career tech versus transfer), financial aid status, ESL status, dual enrollment status, ever-remedial status, GPA at start of spring 2005. A robustness check showed that adding student dependency status and whether the student had dependents did not substantially alter results among the subset of students who provided those data.

[16] Predicted award/transfer probabilities are higher for this subsample than the VCCS population at large, given that they were ever-online (i.e., more-prepared) students who were retained through spring 2005 and who had valid GPAs in that semester (i.e., had taken at least one course for a grade).

excluded consideration of summer 2008 courses. All other variable and value definitions were identical between the 2008 and 2004 cohort datasets, and in the 2008 analyses we continued to define remedial status according to enrollment. (In this sample, 48% of students enrolled in either remedial math or English during their first year: 27% in developmental English, and 39% in developmental math.)

As with the 2004 cohort, courses with no valid outcomes were dropped from the dataset. Removing these courses also dropped a small proportion (less than 1%) of students, resulting in 28,389 students and 200,503 courses for analysis (or 180,637 courses when considering fall and spring only). For the 2008 cohort of students across their first fall and spring, 9% of courses were taken online and 3% were taken via a hybrid mode.

Student Characteristics. Across their first fall semester at a Virginia community college, 17% of students in the 2008 cohort attempted at least one online course and 9% at least one hybrid course; in the spring, 23% attempted an online and 12% a hybrid course. Taking into account both the fall and spring, 27% attempted an online and 16% attempted a hybrid course. Consistent with the 2004 cohort results, there were strong demographic differences between students who enrolled in online courses and those who took only face-to-face courses (Table A.14). In contrast, students enrolled in hybrid courses were quite similar to those enrolled in face-to-face courses, with a few exceptions: Hybrid courses seemed slightly more popular among Asian students and English-as-a-Second-Language students.

Examining demographics that varied by semester, Table A.15 shows that full-time students were more likely to take both online and hybrid courses. Similar to the 2004 cohort, students who had earned prior credits, taken a previous online course, taken a computer literacy course, or taken a student development course seemed more likely to enroll in an online course. Students who had taken a previous hybrid course or computer literacy course were more likely to enroll in a hybrid course; however, prior credit-earning or enrollment in a student development course each appeared unrelated to hybrid enrollment.

Characteristics of Online Courses. Table A.16 presents the percentage of courses taken online, broken down by different types of courses. Overall, the proportion of courses taken online, and differences in those proportions across types of courses, were similar between the 2004 cohort (followed for four years) and the 2008 cohort (followed for just one year). A few obvious differences, however, are discussed below.

As with the 2004 cohort, online course enrollment rates appear higher for non-developmental courses and courses offered for exactly three credits. Within each academic subject area, online course enrollments also remained fairly consistent with the 2004 cohort results. Only within the occupational IT and academic Social/Military Science areas did the proportion of courses taken online change substantially; in both cases, the percentage taken online dropped by about five percentage points. It is not clear whether this change is due to decreased online offerings in those areas or decreased student demand for online courses in those areas (it is also possible, if those subject areas offered online sections only for more advanced courses, that the newly arrived 2008 cohort was not yet eligible to enroll in those online courses).

For the 2008 cohort, hybrid enrollment was not affected by course characteristics such as whether the course was remedial, and there was less variation in the proportion of hybrid enrollments across subject areas. The most popular areas for hybrid enrollment were Basic Skills and occupational IT courses; the least popular were Physical Education and Physical/Computer Science.

In terms of remedial English and math courses, developmental geometry and trigonometry seem to have had high proportions of online and hybrid enrollments; however, these proportions may not be stable given the very small number of 2008 cohort students who enrolled in them over the first year (geometry N = 22; trigonometry N = 6). Outside of these courses, the proportion of online enrollments was fairly consistent between the 2004 and 2008 cohorts, with some exceptions. The proportion of online enrollments dropped in pre-algebra (14% to 5%). In terms of gatekeeper courses, Survey of Technical Mathematics shifted a higher proportion of its enrollments to online (from 18% to 31%), although this proportion may not be stable given small course enrollments (N = 40). Increases in the proportion of online were also observed for Mathematics for Allied Health (from 3% to 13%) and Business Mathematics I (from 13% to 18%). None of the gatekeeper courses had substantial hybrid enrollments.

Patterns of Online and Hybrid Enrollment. Among the 2008 cohort students who took at least one course online, 46% took just one online course in their first year, 22% took two, 25% took three to five, and the remaining 7% took six or more. Among those who took at least one hybrid course, 74% took just one, 19% took two, 7% took three to five, and less than 1% took six or more. Tables A.17–A.21 and Figure B.3 show patterns of online and hybrid enrollment among the 2008 cohort. When comparing online course enrollments between the 2008 and 2004 cohorts (also see Tables A.8–A.10 and Figure B.1), it seems that increases in online course enrollment occurred more strongly *within* cohorts than *between* cohorts. For example, average credits taken online increased by 41% (from 0.57 to 0.81) between the two cohorts' first fall semesters, but increased by 200% between the 2004 cohort's first and last long semester (from 0.57 to 1.72). Accordingly, online growth across Virginia community colleges may be due to a small *cohort* effect (newly admitted students in 2008 slightly prefer online course taking compared with newly admitted students in 2004), but there is a much larger effect operating within each cohort. This within-cohort growth may be due to *maturity* (e.g., as students progress in their programs, they increasingly prefer online courses—or online courses are made increasingly available to them as they progress to more advanced courses), or may be due to *selection* (e.g., better-prepared and higher-performing students may tend to stay in the VCCS system longer, and these students are also more likely to choose online courses).

Course Completion. Given the strong demographic differences between ever-online students and those who chose an entirely face-to-face curriculum, course completion analyses consider only students who ever took an online or hybrid course. Examining the 77,853 courses taken by ever-online or ever-hybrid students, 75% of courses were completed with a D or better. Table A.23 shows that, consistent with the 2004 cohort, online course completion rates were 12 percentage points lower than face-to-face completion rates. Hybrid completion rates were 9 percentage points lower than face-to-face completion rates. Restricting the dataset to developmental courses only[17]

[17] As with the 2008 cohort, a very small proportion of remedial courses were offered through online education; however, this still constituted a fairly large pool of remedial enrollments via both online (English N = 288, math N = 539) and hybrid (English N = 316, math N = 360) modes to compare with face-to-face remedial enrollments.

(Table A.24), the decrement in performance for online courses is greater within remedial English classes (a 26 percentage point difference, consistent with the 2004 cohort) than in remedial math courses (a 13 percentage point difference, a somewhat smaller gap than the 2004 result). For hybrid remedial courses, the decrement in performance is small for English (a 6 percentage point gap) but much greater for math (a 27 percentage point gap). These widely varying results across subjects, together with the information in Table A.18 indicating wide variation across math and English courses in terms of the proportion enrolled online, prompted us to examine whether online versus face-to-face completion gaps differed across specific math and English courses. While there was some variation in the size of the gaps across specific classes, in all courses the online completion rates were substantially lower than face-to-face completion rates. Hybrid completion rates were also substantially lower than face-to-face completion rates, with one exception: the only course in which hybrid students neared the completion rate of face-to-face students was in English 05 (hybrid completion rate = 74%, face-to-face completion rate = 76%).

To examine whether these observed differences are statistically significant after controlling for characteristics of students, we ran a series of inferential analyses predicting course completion, focusing on math and English courses. As there were only two semesters of online/hybrid data for the 2008 students, we modified the 2004 models slightly.[18] Separate models were run for each semester, with each analysis considering only students who took at least one online or hybrid course in the given semester. Model 1 for each subject area included courses in that subject taken in the fall semester (including 3,751 math and 5,339 English courses). Course completion was predicted by dummy-coded indicators of whether the course was taken online, hybrid, or face-to-face, controlling for all the same variables used in the 2004 analysis, including interactions between course mode and remedial-enrollment status in the given subject area. Model 2

[18] For each subject area and each semester, we ran a two-level multilevel model including course-level, semester-level, and student-level characteristics on level 1, and primary college affiliation on level 2. For each model, intercepts were allowed to vary randomly at the school level. Not all schools offered hybrid courses, and the *N* of hybrids within other schools was small, resulting in problems estimating the variance of the hybrid course effect across schools. Accordingly, the slopes of online and hybrid course mode were fixed. The models included the same set of covariates as the 2004 analysis, except that the indicator for summer term was inapplicable and therefore excluded. Given that robustness checks with the 2004 data indicated that inclusion of student dependency status and number of dependents did not alter results (among the subset of students who provided those data), these variables were not included in the 2008 analyses.

included courses in the spring semester (including 3,040 math and 4,008 English courses), including the same set of controls as well as two additional variables: the student's GPA and credits earned prior to spring semester enrollment.

Similar to the 2004 cohort results, the online course coefficient was strongly and significantly negative for all four models. The only significant interaction of online coursework with remedial status was for English courses in the fall semester. The interpretation of this coefficient is similar to the English interaction observed among the 2004 cohort: The negative effect of online education was stronger among remedial-enrollment students (a 23 percentage point gap in course completion) than among those who never enrolled in remedial English (a 7 percentage point gap). The main effect of hybrid course taking was not significant in any model, but the hybrid interaction with remedial-enrollment status was significant for one model (fall semester math courses). This interaction denoted that a negative effect of hybrid math courses was much stronger for remedial-enrollment math students (a 30 percentage point gap) than for those who had never enrolled in remedial math (a 7 percentage point gap). In the spring semester, the negative coefficient for the interaction diminished only slightly, but its standard error more than tripled; as a result, the effect only trended toward significance ($p < .10$).

Overall, the visual pattern of completion for online versus face-to-face courses is quite similar to that shown in Figure B.2, indicating strong consistency in the negative coefficient for online courses across cohorts. The lack of significance for the hybrid effects may be due in part to small sample sizes for hybrid courses. Given that the only significant effect for hybrid course taking (an interaction with remedial enrollment in fall 2008) diminished when we considered spring semester courses including the powerful control of prior GPA, we cannot conclude that hybrid courses had intrinsically lower completion rates than face-to-face courses. However, given the general lack of student demographic differences among hybrid and face-to-face course enrollees, and the much lower descriptive completion rates for hybrid courses, further qualitative and quantitative exploration of hybrid course success rates is certainly warranted.

We did not examine gatekeeper enrollment or completion for the 2008 cohort. With the short (one-year) timeframe under consideration, many developmental students would not have had time to complete their developmental sequence and enroll in gatekeeper courses.

Retention. For the 2008 cohort, we next examined whether enrolling in online or hybrid courses in the first fall semester is associated with retention to the spring. Also available to us were enrollment (but not course completion) records for these students in fall 2009, which allowed us to examine retention from spring 2009 to the following fall. The descriptive statistics in Table A.25, similar to the 2004 analysis, suggest that student retention was just as high (or higher) for students who had taken online or hybrid courses in comparison to students who took neither type of course. This pattern seems independent of whether the student had enrolled in developmental courses; however, the descriptive statistics do not control for other student characteristics. To take these into account,[19] two multilevel models were run. The first included all students enrolled in fall 2008 and predicted retention to spring 2009. In addition to the controls, the model included one dummy variable indicating whether the student had enrolled in at least one online course during the fall, and another indicating enrollment in at least one hybrid course during the fall. The parallel second model included all students still enrolled in spring 2009, predicting retention to the fall, and added prior credits and GPA as controls. For the model predicting retention from fall 2008 to spring 2009, the online coefficient was significant and negative, while the hybrid coefficient was not significant. Model-adjusted predicted probabilities indicate that students who took only face-to-face courses had a 75% probability of returning in the spring, while those who took at least one online course had a 73% probability. For the model predicting retention from spring to fall 2009, the negative online coefficient was dampened and only trended toward significance ($p < .10$), while the hybrid coefficient remained non-significant.

[19] We used the same list of controls as in the 2004 cohort analysis. As in the 2004 models, the interaction terms between remediation enrollment and course mode did not reach statistical significance and were dropped from the model.

4. Conclusion

Analyses of the 2004 cohort indicate that nearly half of these students enrolled in an online course across the four-year span, with online enrollments increasing dramatically across the four years these students were tracked. However, few students enrolled in an entirely online curriculum in a given term. In general, students with demographic characteristics associated with stronger academic preparation (e.g., female, dual-enrolled prior to college entry, scored as college-ready on incoming math and English assessments) were more likely to enroll in online courses. Among students who applied for financial aid (and who thus provided additional information on their external circumstances), those who were independent from their parents and those who had dependents of their own were also more likely to take online courses.

Controlling for a variety of student and course-level information, we found that: students were more likely to fail or withdraw from online courses than from face-to-face courses; students who took remedial courses online were less likely to advance to subsequent gatekeeper courses; students who took online coursework in early semesters were slightly less likely to return to school in subsequent semesters; and ever-online students who took a higher proportion of their coursework online were slightly less likely than other ever-online students to eventually earn an educational award or transfer to a four-year school. Overall, while online course taking and student remedial status each had main effects on course performance and subsequent outcomes (for example, in terms of course completion, underprepared students performed more poorly, and online students also performed more poorly, and thus a student in both categories performed *most* poorly), the two effects did not typically interact. One exception appeared in the 2004 analysis of English course completion, in that the online versus face-to-face gap was greater among underprepared students than it was among college-ready students.

The analysis of course completion rates initially included a term examining whether online course completion rates improved in comparison to face-to-face completion rates over the 2004–2008 period. No such trend was apparent, indicating that system-wide efforts to improve distance education did not significantly improve online course completion across the careers of the 2004 student cohort.

Although we were able to control for a wide variety of potentially confounding factors, our analysis of the 2004 cohort did face some limitations. First, we did not have data on students' personal motivation or academic commitment, and information on students' external responsibilities was limited. For example, we were unable to control for the number of hours employed; however, we did control for course load and (for those who provided it) dependency status, which are likely to correlate with hours of employment. We were able to circumvent the problem of unobserved differences between ever-online and never-online students by conducting most of our analyses with only those students who chose to take at least one online course. However, the possibility remains that, among ever-online students, those who had the most complex and highly-burdened personal lives chose to enroll in *more* online courses.

Second, in the 2004 cohort analysis, we were not able to compare between entirely face-to-face, hybrid-online, and fully online courses. VCCS began to include an indicator for hybrid courses in institutional data as of the fall of 2008. Additional analyses using the fall 2008 cohort replicated the 2004 results in terms of demographic characteristics of online course-takers, significantly lower completion rates for online courses, and slightly lower semester-to-semester retention rates for online course-takers. In terms of hybrid-online results, demographic characteristics of hybrid course-takers were fairly similar to VCCS students as a whole, and descriptive analyses suggest that hybrid course completion rates were lower than face-to-face course completion rates. However, perhaps due to the small number of hybrid course enrollments available for analysis, it is not clear whether hybrid courses have significantly lower completion rates. It does not appear that hybrid course taking was related to semester-to-semester retention.

Overall, students who participated in more online courses had lower success rates on a variety of outcomes. This pattern of results may suggest that, in order to reach the same level of student engagement and success exhibited by face-to-face learning, online courses must be systematically improved, which may require a substantial investment of additional resources. To engage and empower students, online courses may need to be explicitly designed for the unique context of the web-based environment (Twigg, 2005), yet many online instructors merely import traditional pedagogy and materials to the web (Bransford, Vye, & Bateman, 2002; Cox, 2006; Zemsky & Massy, 2004). Instructors typically have neither the training nor the time to implement radical course redesigns (Cox, 2006). In addition, little research exists on effective online pedagogical techniques, leaving instructors without proven templates and techniques to which they can turn. Accordingly, additional research may be needed to: (1) identify online education teaching strategies and pedagogies that help engage and retain both college-ready and underprepared students, and (2) examine institutional structures and policies that help support consistently high-quality online courses. To provide research-based guidance, CCRC was recently awarded a grant by the Bill and Melinda Gates Foundation to partner with VCCS on a study of colleges and courses that are effective in enabling students to complete online coursework at rates comparable to similar face-to-face courses, particularly in critical developmental and gatekeeper English and math courses.

References

Allen, I. E., & Seaman, J. (2010). *Learning on demand: Online education in the United States, 2009.* Needham, MA: Sloan Consortium.

Aman, J. R., & Shirvani, S. (2006). Dick and Jane online: Considering online coursework. *Journal of Computing Sciences in Colleges, 21*(3), 131–138.

Bambara, C. S., Harbour, C. P., Davies, T. G., & Athey, S. (2009). Delicate engagement: The lived experience of community college students enrolled in high-risk courses. *Community College Review, 36(3),* 219–238.

Blackner, D. M. (2000). *Prediction of community college students' success in developmental math with traditional classroom, computer-based on-campus and computer-based at a distance instruction using locus of control, math anxiety and learning style* (Unpublished doctoral dissertation.) University of North Texas, Texas.

Bransford, J., Vye, N., & Bateman, H. (2002). Creating high-quality learning environments: Guidelines from research on how people learn. In P. A. Graham & N. G. Stacey (Eds.), *The knowledge economy and postsecondary education: Report of a workshop* (pp. 159–198). Washington, DC: National Academy Press.

Carpenter, T. G., Brown, W. L., & Hickman, R. C. (2004). Influences of online delivery on developmental writing outcomes. *Journal of Developmental Education, 28*(1), 14–18.

Chambers, T. E. (2002). *Internet course student achievement: In Ohio's two-year community and technical colleges, are online courses less effective than traditional courses?* (Unpublished doctoral dissertation.) Bowling Green State University, Ohio.

Cox, R. D. (2006). Virtual access. In T. Bailey & V. S. Morest (Eds.), *Defending the community college equity agenda* (pp. 110–131). Baltimore, MD: Johns Hopkins University Press.

Figlio, D. N., Rush, M., & Yin, L. (2010). *Is it live or is it Internet? Experimental estimates of the effects of online instruction on student learning* (Working Paper No. 16089). Cambridge, MA: National Bureau of Economic Research.

Liu, S., Gomez, J., Khan, B., & Yen, C. (2007). Toward a learner-oriented community college online course dropout framework. *International Journal on E-Learning, 6*(4), 519–542.

Musgrove, A. T. (2002). *An examination of the Kolb LSI and GEFT and their relationship to academic achievement in web-based and face-to-face nursing courses* (Unpublished doctoral dissertation.) Florida Atlantic University, Florida.

Peterson, C. L., & Bond, N. (2004). Online compared to face-to-face teacher preparation for learning standards-based planning skills. *Journal of Research on Technology in Education, 36*(4), 345–361.

Roksa, J., Jenkins, D., Jaggars, S. S., Zeidenberg, M., & Cho, S.-W. (2009). *Strategies for promoting gatekeeper course success among students needing remediation: Research report for the Virginia Community College System.* New York, NY: Columbia University, Teachers College, Community College Research Center.

Rosenfeld, G. (2005). *A comparison of the outcomes of distance learning students versus traditional classroom students in the community college* (Unpublished doctoral dissertation.) Florida Atlantic University, Florida.

Rovai, A. P., & Wighting, M. J. (2005). Feelings of alienation and community among higher education students in a virtual classroom. *The Internet and Higher Education, 8*(2), 97–100.

Summerlin, J. A. (2003). *A comparison of the effectiveness of off-line internet and traditional classroom remediation of mathematical skills* (Unpublished doctoral dissertation.) Baylor University, Texas.

Twigg, C. A. (2005). *Increasing success for underserved students: Redesigning introductory courses.* Saratoga Springs, NY: National Center for Academic Transformation.

Zavarella, C. A. (2008). *Computer-based instruction and remedial mathematics: A study of student retention at a Florida community college* (Unpublished doctoral dissertation.) University of South Florida, Florida.

Zemsky, R., & Massy, W. F. (2004). *Thwarted innovation: What happened to e-learning and why*. West Chester, PA: University of Pennsylvania, Learning Alliance for Higher Education.

Appendix A: Tables

Table A.1
Percentage of 2004 Cohort Enrolled in Online Courses: First Semester, First Year, and Ever

	First Semester	First Year	Ever
All Students (*N* = 23,823)	14%	23%	43%
Gender			
Male	11%	18%	36%
Female	16%	26%	49%
Ethnicity			
White	17%	27%	50%
African American	9%	16%	34%
American Indian	9%	20%	39%
Asian	7%	12%	32%
Hispanic	6%	11%	28%
Unknown	9%	15%	33%
Age (Under/Over 25 at College Entry)			
Under 25	12%	21%	43%
25 or Older	20%	27%	43%
Type of Program			
Career Tech	15%	23%	41%
Transfer	13%	22%	45%
Financial Aid Status			
Applied and Eligible for Need-Based Aid	18%	30%	51%
Not Applied or Not Eligible	11%	18%	38%
*Dependency Status**			
Dependent on Parents	16%	27%	51%
Independent	23%	34%	53%
*Has Dependents***			
Has No Dependents	17%	25%	42%
Has 1 or More Dependents	25%	37%	56%
*Underprepared Status - English****			
Recommended Reading/Writing Dev-Ed	9%	17%	37%
College-Ready English	14%	23%	47%
*Underprepared Status - Math****			
Recommended Math Dev-Ed	11%	19%	41%
College-Ready Math	12%	22%	49%
Remedial-Enrollment Status - English			
Ever Enrolled Reading/Writing Dev-Ed	9%	18%	40%
Did Not Enroll Reading/Writing Dev-Ed	15%	24%	45%
Remedial-Enrollment Status - Math			
Ever Enrolled Math Dev-Ed	11%	21%	41%
Did Not Enroll Math Dev-Ed	15%	24%	46%
ESL Status			
ESL Student (Ever Took ESL course)	2%	4%	20%
Non-ESL Student	14%	23%	44%
Dual Enrollment Status			
Dual Enrolled Prior to Entry	27%	42%	65%
Not Dual Enrolled	12%	21%	41%

* Only students applying for federal financial aid, *N* = 9,755.
** Only federal financial aid applicants who were independent, *N* = 3,657.
*** Only students with valid test scores; *N* = 14,465 Reading/Writing; *N* = 15,441 Math.

Table A.2
Percentage of 2004 Cohort Enrolled in Online Courses in the First Two Long Semesters

	Fall 2004 (*N* = 23,504)	**Spring 2005 (*N* = 17,274)**
All Students	13%	20%
Full-Time Status		
Full-Time Student	14%	23%
Part-Time Student	12%	17%
Previous Course Taking		
Earned Prior Credits	24%	22%
No Prior Credits Earned	11%	10%
Prior Online Course Experience		
Took Prior Online Course	55%	60%
No Prior Online Course	12%	14%
Enrollment in Computer Literacy Course		
Prior/Concurrent Computer Literacy Course	19%	27%
No Computer Literacy Course	12%	18%
Enrollment in Student Development		
Prior/Concurrent Student Development	15%	23%
No Student Development Course	12%	18%

Table A.3
Percentage of 2004 Cohort Students Taking Any Credits Online for Each Semester Enrolled

	***N* Enrolled**	**Percentage Taking Any Credits Online**
Summer 2004	2,511	17%
Fall 2004	23,504	13%
Spring 2005	17,274	20%
Summer 2005	4,679	22%
Fall 2005	12,500	23%
Spring 2006	10,868	29%
Summer 2006	4,278	32%
Fall 2006	7,663	31%
Spring 2007	6,482	34%
Summer 2007	2,885	38%
Fall 2007	4,875	32%
Spring 2008	4,083	34%
Summer 2008	1,603	35%

Table A.4
Percentage Online Course Enrollments by Type of Course (2004 Cohort)

	Percentage Online
All Courses (*N* = 317,812)	12%
Remedial vs. Non-Remedial	
Remedial Courses	4%
Non-Remedial Courses	13%
Gatekeeper vs. Non-Gatekeeper	
Gatekeeper Courses	8%
Non-Gatekeeper Courses	13%
High Risk vs. Regular *	
High-Risk Course	14%
Not High-Risk Course	12%
Number of Credits	
Course with > 3 Credits	6%
Course with 3 Credits	15%
Course with < 3 Credits	9%
Instructor Full-Time Status	
Course with Full-Time Instructor	13%
Course with Part-Time Instructor	10%
Course Subjects	
Academic: Physical & Computer Science	6%
Academic: Humanities & Fine Arts	14%
Academic: Social & Military Science	21%
Academic: Mathematics	6%
Academic: English	10%
SDV, ESL, Basis Skills	9%
Physical Education	3%
Occupational: Business	18%
Occupational: IT	18%
Occupational: Health	21%
Occupational: Electric/Mechanical	2%
Occupational: Natural Science	11%
Occupational: Public Service	17%

* Excludes small-enrollment courses. *N* = 208,882.

Table A.5
Percentage Online Course Enrollments by Remedial English Course (2004 Cohort)

Course	Percentage Online
All Remedial English (*N* = 10,852)	3%
Preparing for College Writing I (ENG01)	1%
Spelling and Vocabulary Study (ENG02)*	0%
Preparing for College Writing II (ENG03)	5%
Reading Improvement I (ENG04)	2%
Reading Improvement II (ENG05)	5%
Writing and Reading Improvement I (ENG07)	0%
Writing and Reading Improvement II (ENG08)*	0%

* Small course enrollment, *N* < 50.

Table A.6
Percentage Online Course Enrollments by Remedial Math Course (2004 Cohort)

Course	Percentage Online
All Remedial Math (*N* = 18,119)	4%
Developmental Mathematics (MTH01)	5%
Arithmetic (MTH02)	4%
Algebra I (MTH03)	4%
Algebra II (MTH04)	5%
Algebra Revisited (MTH05)	10%
Developmental Geometry (MTH06)	19%
Developmental Trigonometry (MTH07)*	11%
Pre-Algebra (MTH09)	14%

* Small course enrollment, *N* < 50.

Table A.7
Percentage of Online Course Enrollments by Gatekeeper Course (2004 Cohort)

Course	Percentage Online
All Math/English Gatekeeper (*N* = 30,973)	8%
College Composition I (ENG111)	8%
Survey of Technical Mathematics I (MTH105)	18%
Introduction to Mathematics (MTH120)	21%
Fundamentals of Mathematics I (MTH121)	8%
Mathematics for Allied Health (MTH126)	3%
Business Mathematics I (MTH141)	13%
Math for the Liberal Arts I (MTH151)	6%
Math for the Liberal Arts II (MTH 152)†	8%
College Algebra (MTH158)	6%
Precalculus I (MTH163)	6%
Precalculus and Trigonometry (MTH166)	4%
Calculus with Analytic Geometry I (MTH173)	5%
Applied Calculus I (MTH271)	4%

† Considered gatekeeper math by some colleges.

Table A.8
Average Number and Percent of Credits Taken Online by All Students in Each Semester Enrolled (2004 Cohort)

	N Enrolled	Number Credits Taken Online	Percent Credits Taken Online	Percent Taking All Credits Online
Summer 2004	2,511	0.74	12%	7%
Fall 2004	23,504	0.57	6%	2%
Spring 2005	17,274	0.95	9%	3%
Summer 2005	4,679	0.92	16%	11%
Fall 2005	12,500	1.12	11%	4%
Spring 2006	10,868	1.47	15%	5%
Summer 2006	4,278	1.53	25%	17%
Fall 2006	7,663	1.52	17%	8%
Spring 2007	6,482	1.72	19%	8%
Summer 2007	2,885	1.67	30%	23%
Fall 2007	4,875	1.57	19%	10%
Spring 2008	4,083	1.72	21%	13%
Summer 2008	1,603	1.58	29%	23%

Table A.9
Average Number and Percent of Credits Taken Online by Ever-Online Students in Each Semester Enrolled (2004 Cohort)

	N Ever-Online	Number Credits Taken Online	Percent Credits Taken Online	Percent Taking All Credits Online
Summer 2004	1,293	1.44	23%	14%
Fall 2004	10,242	1.30	14%	6%
Spring 2005	8,819	1.86	18%	6%
Summer 2005	2,684	1.61	28%	20%
Fall 2005	7,145	1.95	19%	7%
Spring 2006	6,549	2.44	24%	9%
Summer 2006	2,788	2.35	38%	27%
Fall 2006	4,855	2.40	27%	12%
Spring 2007	4,190	2.65	29%	13%
Summer 2007	1,982	2.44	44%	34%
Fall 2007	3,144	2.44	29%	15%
Spring 2008	2,653	2.64	33%	19%
Summer 2008	1,078	2.36	43%	34%

Table A.10
Average Number and Percent of Credits Taken Online Among Students Actively Online in the Current Semester (2004 Cohort)

	N Actively Online	Number Credits Taken Online	Percent Credits Taken Online	Percent Taking All Credits Online
Summer 2004	428	4.35	69%	43%
Fall 2004	3,073	4.32	47%	19%
Spring 2005	3,535	4.64	45%	15%
Summer 2005	1,023	4.21	74%	52%
Fall 2005	2,879	4.85	48%	17%
Spring 2006	3,173	5.03	50%	18%
Summer 2006	1,390	4.72	77%	54%
Fall 2006	2,348	4.96	56%	24%
Spring 2007	2,173	5.11	56%	25%
Summer 2007	1,091	4.43	79%	62%
Fall 2007	1,556	4.93	59%	31%
Spring 2008	1,400	5.01	63%	36%
Summer 2008	568	4.47	82%	65%

Table A.11
Percentage of Courses Completed (D or Above) in Face-to-Face Versus Online Courses Among Ever-Online Students (2004 Cohort)

	Face-to-Face	Online	Overall
Courses (*N* = 182,755)	81%	68%	78%
Student English Status			
No Remedial English	82%	69%	79%
Remedial-Enrolled	77%	64%	75%
Student Math Status			
No Remedial Math	84%	69%	80%
Remedial-Enrolled	78%	67%	76%

Table A.12
Percentage of Developmental Courses Completed (D or Above) Among Ever-Online Students (2004 Cohort)

	Face-to-Face	Online	Overall
Courses (*N* = 13,126)	64%	43%	62%
English	77%	53%	75%
Math	57%	38%	55%

Table A.13
Percentage of Students Meeting Retention Goals (2004 Cohort)

	Retained to Spring 05*		Retained to Fall 05**	
	Took Online Course in Fall 04		Took Online Course in Spring 05	
	No	Yes	No	Yes
All Students	72%	73%	67%	65%
Student English Status				
No Remedial English	72%	73%	67%	65%
Remedial-Enrolled	72%	72%	67%	68%
Student Math Status				
No Remedial Math	71%	72%	64%	63%
Remedial-Enrolled	75%	76%	71%	69%

* *N* = 23,504.
** Among those who were retained at least through spring, *N* = 17,274.

Table A.14
Percentage of 2008 Cohort Enrolled in Online and Hybrid Courses: First Semester, First Year

	Online		Hybrid	
	First Semester	First Year	First Semester	First Year
All Students (*N* = 28,389)	17%	27%	9%	16%
Gender				
Male	15%	21%	10%	16%
Female	20%	31%	9%	17%
Ethnicity				
White	22%	33%	9%	16%
African American	12%	19%	8%	15%
American Indian	20%	26%	9%	18%
Asian	7%	13%	14%	24%
Hispanic	7%	12%	11%	19%
Unknown	13%	20%	13%	20%
Age (Under/Over 25)				
Under 25	16%	26%	10%	17%
25 or Older	24%	32%	8%	13%
Type of Program				
Career Tech	20%	29%	9%	16%
Transfer	16%	25%	10%	17%
Financial Aid Status				
Applied and Eligible for Need-Based Aid	22%	33%	9%	17%
Not Applied or Not Eligible	14%	22%	10%	16%
*Dependency Status**				
Dependent on parents	18%	30%	10%	18%
Independent	29%	39%	9%	15%
*Has Dependents***				
Has No Dependents	20%	29%	9%	14%
Has 1 or More Dependents	32%	43%	9%	16%
*Underprepared - English****				
Recommended Reading/Writing Dev-Ed	12%	21%	10%	16%
College-Ready English	19%	29%	10%	18%
*Underprepared - Math****				
Recommended Math Dev-Ed	15%	24%	10%	17%
College-Ready Math	17%	27%	12%	19%
Remedial-Enrollment Status - English				
Ever Enrolled Reading/Writing Dev-Ed	12%	21%	9%	16%
Did Not Enroll Reading/Writing Dev-Ed	20%	29%	10%	16%
Remedial-Enrollment Status - Math				
Ever Enrolled Math Dev-Ed	14%	24%	9%	17%
Did Not Enroll Math Dev-Ed	19%	28%	10%	16%
ESL Status				
ESL Student (Ever Took ESL course)	2%	3%	14%	24%
Non-ESL Student	18%	27%	9%	16%
Dual Enrollment Status				
Dual Enrolled Prior to Entry	31%	46%	8%	15%
Not Dual Enrolled	15%	23%	10%	17%

* Only students applying for federal financial aid, *N* = 14,210.
** Only federal financial aid applicants who were independent, *N* = 3,833.
*** Only students with valid test scores, *N* = 18,491 Reading/Writing; 20,138 Math.

Table A.15
Percentage of 2008 Cohort Students Enrolled in Online and Hybrid Courses in the First Two Long Semesters

	Online		Hybrid	
	Fall 2008	**Spring 2009**	**Fall 2008**	**Spring 2009**
All Students	17%	23%	9%	12%
Full-Time Status				
Full-Time Student	19%	27%	11%	15%
Part-Time Student	15%	20%	7%	9%
Previous Course Taking				
Earned Prior Credits	30%	24%	9%	12%
No Prior Credits Earned	14%	20%	10%	12%
Prior Online/Hybrid Course Experience				
Took Prior Course of This Type	59%	62%	N/A	30%
No Prior Course of This Type	16%	14%	N/A	10%
Enrollment Computer Literacy Course				
Prior/Concurrent Computer Literacy Course	24%	30%	13%	16%
No Computer Literacy Course	16%	21%	9%	10%
Prior Enrollment in Student Development				
Prior/Concurrent Student Development	19%	25%	11%	13%
No Student Development Course	16%	21%	8%	11%

Note. Fall 2008, *N* = 28,388; Spring 2009, *N* = 21,241.

Table A.16
Percentage Online Course Enrollments by Type of Course (2008 Cohort)

	Percentage Online	Percentage Hybrid
Fall & Spring Courses (*N* = 180,637)	9%	3%
Remedial vs. Non-Remedial		
Remedial Courses	3%	3%
Non-Remedial Courses	10%	4%
Gatekeeper vs. Non-Gatekeeper		
Gatekeeper Courses	7%	2%
Non-Gatekeeper Courses	10%	4%
High Risk vs. Regular *		
High-Risk Course	11%	4%
Not High-Risk Course	7%	3%
Number of Credits		
Course with > 3 Credits	4%	3%
Course with 3 Credits	11%	3%
Course with < 3 Credits	9%	4%
Instructor Full-Time Status		
Course with Full-Time Instructor	11%	4%
Course with Part-Time Instructor	8%	3%
Course Subjects		
Academic: Physical & Computer Science	5%	1%
Academic: Humanities & Fine Arts	10%	3%
Academic: Social & Military Science	16%	4%
Academic: Mathematics	5%	2%
Academic: English	7%	3%
SDV, ESL, Basic Skills	8%	6%
Physical Education	4%	1%
Occupational: Business	16%	5%
Occupational: IT	13%	7%
Occupational: Health	24%	4%
Occupational: Electric/Mechanical	1%	2%
Occupational: Natural Science	8%	6%
Occupational: Public Service	18%	4%

* Excludes small-enrollment courses; *N* = 122,917.

Table A.17
Percentage Online Course Enrollments by Remedial English Course (2008 Cohort)

	Percentage Online	Percentage Hybrid
All Remedial English (*N* = 11,811)	2%	3%
Preparing for College Writing I (ENG01)	1%	4%
Spelling and Vocabulary Study (ENG02)*	0%	0%
Preparing for College Writing II (ENG03)	3%	2%
Reading Improvement I (ENG04)	2%	2%
Reading Improvement II (ENG05)	3%	4%
Writing and Reading Improvement I (ENG07)	0%	0%
Writing and Reading Improvement II (ENG08)	0%	0%

* Small course enrollment, *N* < 50.

Table A.18
Percentage Online Course Enrollments by Remedial Math Course (2008 Cohort)

	Percentage Online	Percentage Hybrid
All Remedial Math (*N* = 14,990)	4%	2%
Developmental Mathematics (MTH01)	3%	0%
Arithmetic (MTH02)	5%	2%
Algebra I (MTH03)	3%	3%
Algebra II (MTH04)	4%	2%
Algebra Revisited (MTH05)	1%	5%
Developmental Geometry (MTH06)*	68%	0%
Developmental Trigonometry (MTH07)*	17%	33%
Pre-Algebra (MTH09)	5%	0%

* Small course enrollment, *N* < 50.

Table A.19
Percentage Online Course Enrollments by Gatekeeper Course (2008 Cohort)

	Percentage Online	Percentage Hybrid
All Gatekeeper Courses (*N* = 23,983)	7%	2%
College Composition I (ENG111)	8%	3%
Survey of Technical Mathematics I (MTH105)*	31%	0%
Introduction to Mathematics (MTH120)	19%	1%
Fundamentals of Mathematics I (MTH121)	10%	0%
Mathematics for Allied Health (MTH126)	13%	0%
Business Mathematics I (MTH141)	18%	0%
Math for the Liberal Arts I (MTH151)	4%	2%
Math for the Liberal Arts II (MTH 152) †	5%	2%
College Algebra (MTH158)	3%	0%
Precalculus I (MTH163)	4%	<1%
Precalculus and Trigonometry (MTH166)	4%	0%
Calculus with Analytic Geometry I (MTH173)	2%	0%
Applied Calculus I (MTH271)	6%	0%

* Small course enrollment, *N* < 50.
† Considered gatekeeper math by some colleges.

Table A.20
Average Number and Percent of Credits Taken Online and Hybrid by All 2008 Cohort Students in Each Semester Enrolled

	N Enrolled	Number Credits Taken Online	Percent Credits Taken Online	Percent Taking All Credits Online
Fall 2008	28,388	0.81	8%	3%
Spring 2009	21,241	1.15	11%	4%
	***N* Enrolled**	**Number Credits Taken Hybrid**	**Percent Credits Taken Hybrid**	**Percent Taking All Credits Hybrid**
Fall 2008	28,388	0.32	3%	<1%
Spring 2009	21,241	0.47	4%	<1%
	***N* Enrolled**	**Number Credits Online or Hybrid**	**Percent Credits Online or Hybrid**	**Percent Taking All Online/Hybrid**
Fall 2008	28,388	1.13	11%	4%
Spring 2009	21,241	1.61	16%	5%

Table A.21
Average Number and Percent of Credits Taken Online and Hybrid by Ever-Online / Ever-Hybrid 2008 Cohort Students in Each Semester Enrolled

	N Ever Online	Number Credits Taken Online	Percent Credits Taken Online	Percent Taking All Credits Online
Fall 2008	7,652	3.02	29%	11%
Spring 2009	6,401	3.81	37%	14%
	***N* Ever Hybrid**	**Number Credits Taken Hybrid**	**Percent Credits Taken Hybrid**	**Percent Taking All Credits Hybrid**
Fall 2008	4,629	1.97	18%	3%
Spring 2009	4,042	2.44	23%	4%
	***N* Ever Online/Hybrid**	**Number Credits Online or Hybrid**	**Percent Credits Online or Hybrid**	**Percent Taking All Online/Hybrid**
Fall 2008	10,938	2.94	28%	10%
Spring 2009	9,184	3.73	36%	12%

Table A.22
Average Number and Percent of Credits Taken Online and Hybrid Among 2008 Cohort Students Actively Online / Hybrid in the Current Semester

	N Actively Online	Number Credits Taken Online	Percent Credits Taken Online	Percent Taking All Credits Online
Fall 2008	4,957	4.66	45%	17%
Spring 2009	4,971	4.90	48%	18%
	***N* Actively Hybrid**	**Number Credits Taken Hybrid**	**Percent Credits Taken Hybrid**	**Percent Taking All Credits Hybrid**
Fall 2008	2,686	3.40	23%	6%
Spring 2009	2,574	3.84	36%	6%
	***N* Actively Online/Hybrid**	**Number Credits Online or Hybrid**	**Percent Credits Online or Hybrid**	**Percent Taking All Online/Hybrid**
Fall 2008	7,214	4.46	42%	15%
Spring 2009	7,006	4.89	47%	16%

Table A.23
Percentage of Courses Completed (D or Above)
Among 2008 Cohort Ever-Online/Hybrid Students

	Face-to-Face	Online	Hybrid	Overall
Courses (*N* = 77,853)	79%	67%	70%	75%
Student English Status				
No Remedial English	81%	69%	73%	78%
Remedial-Enrolled	71%	58%	62%	68%
Student Math Status				
No Remedial Math	82%	69%	74%	79%
Remedial-Enrolled	73%	63%	63%	70%

Table A.24
Percentage of Courses Completed (D or Above)
Among 2008 Cohort Ever-Online/Hybrid Students' English/Math Developmental Courses

	Face-to-Face	Online	Hybrid	Overall
Courses (*N* = 9,295)	62%	43%	46%	59%
English	74%	48%	68%	72%
Math	53%	40%	26%	50%

Table A.25
Percentage of Students Meeting Retention Goals Among All 2008 Cohort Students

	Retained to Spring				Retained to Following Fall**			
	Took Online	Took Hybrid	Took Both	Took Neither	Took Online	Took Hybrid	Took Both	Took Neither
All Students*	75%	78%	82%	74%	78%	83%	79%	80%
Student English Status								
No Remedial English	74%	77%	83%	73%	78%	82%	80%	80%
Remedial-Enrolled	78%	80%	75%	79%	79%	83%	78%	80%
Student Math Status								
No Remedial Math	74%	76%	82%	72%	78%	81%	78%	79%
Remedial-Enrolled	78%	81%	80%	78%	79%	85%	82%	81%

* *N* = 28,388. ** Among those who were retained at least through spring, *N* = 21,241.

Appendix B: Figures

Figure B.1
Average Number and Percent of Credits Taken Online Among All Students, Ever-Online Students, and Actively Online Students in Each Semester Enrolled (2004 Cohort)

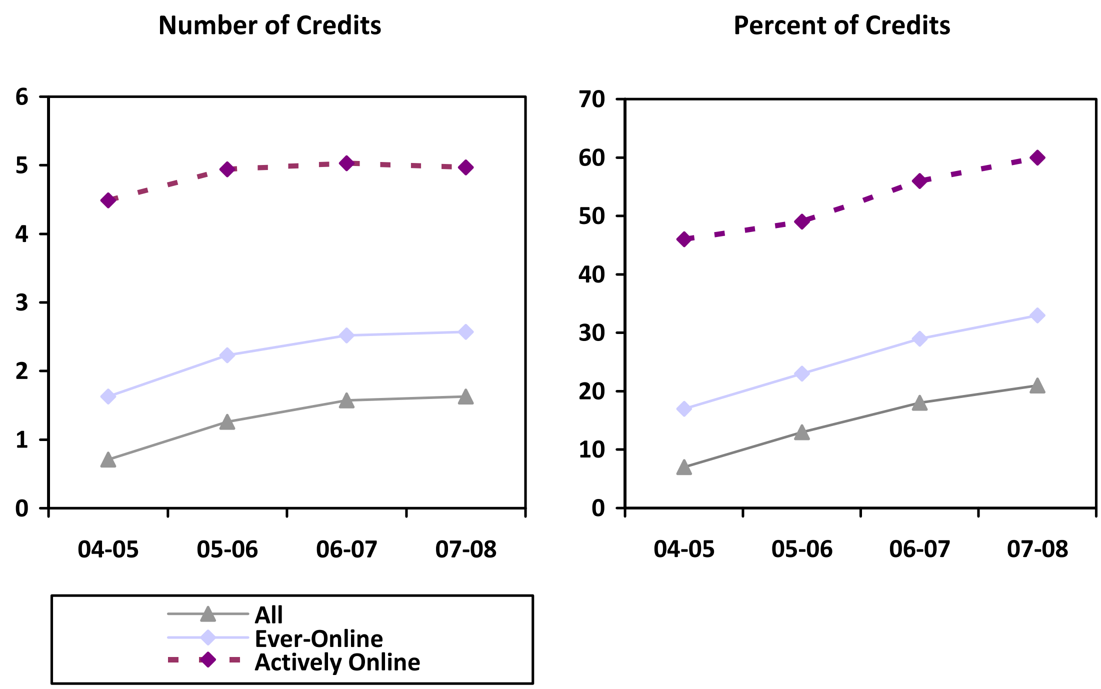

Figure B.2
Predicted Probabilities of Earning Credit in Online and Face-to-Face Courses in Math and English (2004 Cohort)

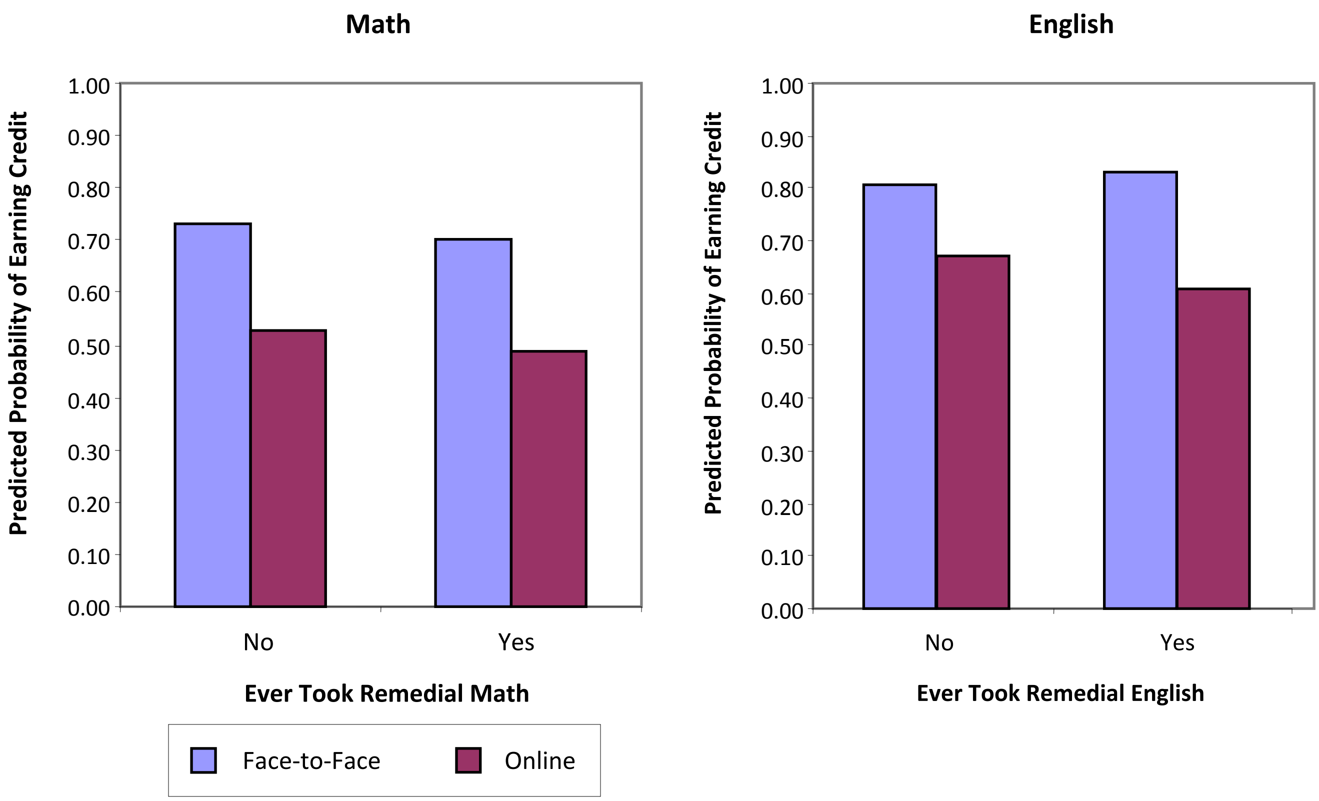

Figure B.3
Average Number and Percent of Credits Taken Online Among 2008 Cohort: All Students, Ever-Online Students, and Actively Online Students in Each Semester Enrolled