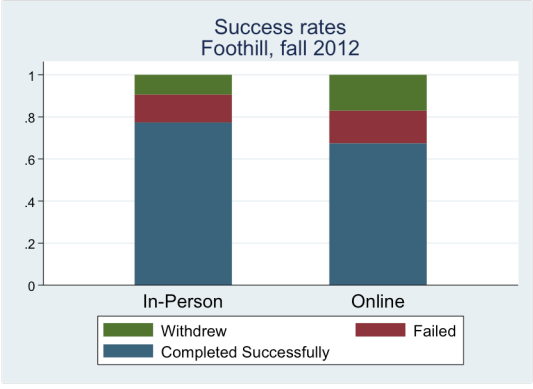
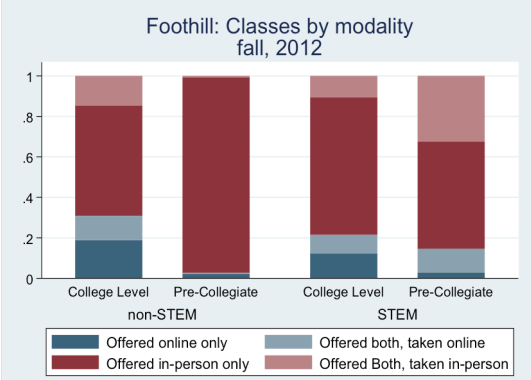
Executive Summary: Online Learning at Foothill Community College

Foothill Community College has longstanding experience in delivering online classes, which provides a unique opportunity to study the greatest strengths and challenges in online education today. Such **research can help support effective online learning at Foothill and beyond, as online education undergoes unprecedented expansion at the state and national levels**. In this document, we summarize the initial work of a research partnership between Foothill Community College and the Stanford University Graduate School of Education, formed to examine what predicts success in online courses, and whether there are early warning signs that could trigger extra supports to help students succeed.



In our preliminary analyses, we find that **online learners are more likely than in-person learners to fail or drop out of a class** (right figure). On its surface, this finding casts doubt on the potential for online education to improve college access, expand educational flexibility, and contain rising college costs.



However, it is possible that the kinds of classes offered online, as opposed to the online format itself, explains poorer online performance. For example, if particularly difficult courses are offered online, this difficulty (as opposed to the online format itself) could account for poorer outcomes. In support of this possibility, we find there is only minimal overlap between the largest-enrollment departments and the largest-*online*-enrollment departments at Foothill, and college-level sections are more often taken online than pre-collegiate sections (left figure), aligning with the possibility that more difficult sections may more often be taken online.

Another explanation for why online learners succeed less than in-person learners could be that different kinds of students are drawn or driven to online learning. For example, if students who choose the flexibility of an online format are more often balancing their coursework with employment or parenting, it may be these conflicting demands, as opposed to the online format itself, that hinder performance. In support of this possibility, we find that students who *choose* to take a class online when it is offered both online and in-person are even less likely to succeed than students enrolled in classes only offered online. Additionally, we observe demographic differences in who is more likely to choose online classes: while a slightly greater proportion of Asian and White students are enrolled online (as compared to other races/ethnicities), they are actually slightly *less* likely to choose online classes when given the choice. This aligns with the argument that different kinds of students may choose to study online.

To take multiple factors into account simultaneously, we ran regressions predicting the likelihood that subgroups of students (e.g., by gender or race/ethnicity) would withdraw from a course, or if they did not withdraw, the likelihood they would pass. Among other interesting outcomes, we find that **the higher the percentage of classes a student takes online, the less likely he is to pass an online class** (though their probability of passing an in-person class does not similarly decrease). We also find interesting variations by gender and race/ethnicity, e.g., **male students are more likely than female students to withdraw from an online class, but they are no more likely than female students to withdraw from an in-person class**. These preliminary findings are described and discussed in detail below.

Online Learning at Foothill Community College

Research provided by the Stanford Graduate School of Education

Foothill Community College, along with its sister-school De Anza Community College, has longstanding experience in delivering online classes, which provides a unique opportunity to examine what works in digital education. Indeed, analyses of Foothill's rich data can:

- shed light on the greatest strengths and challenges in online education at Foothill today
- suggest potential interventions, which may be studied to learn definitively *what works* in online education using the methodological gold standard of an experimental design
- shape effective online education at the state and national levels by sharing research findings broadly in the midst of today's unprecedented expansion in online learning

Introduction

Located midway between San Jose and San Francisco, Foothill and De Anza Community Colleges comprise one of the largest community college districts in the nation, providing credit classes to approximately 43,000 students per quarter.

The student body is not only large but also diverse. Over a third of students are the first generation in their family to attend any college, and about two-thirds of students have parents with less than a Bachelor's degree. About one-in-three students has an annual family income below $25K, and over half of students have annual family incomes below $50K. Additionally, a large proportion of students (62% at Foothill and 78% at De Anza) are racial/ethnic minorities.

This white paper takes a preliminary look at which courses are offered online at Foothill, who takes them, and who completes them successfully. A sister-paper explores these same questions for De Anza Community College. Ultimately, our goal is to understand what predicts success in online courses, and whether there are early warning signs that could trigger extra supports for students to help them succeed.

It is worth noting that this white paper merely skims the surface of what is possible with Foothill's rich longitudinal data. This first snapshot uses only one academic term of data and a relatively limited set of variables. However, building on this initial work, future analyses may examine extensive longitudinal data to extensively address these and many more questions.

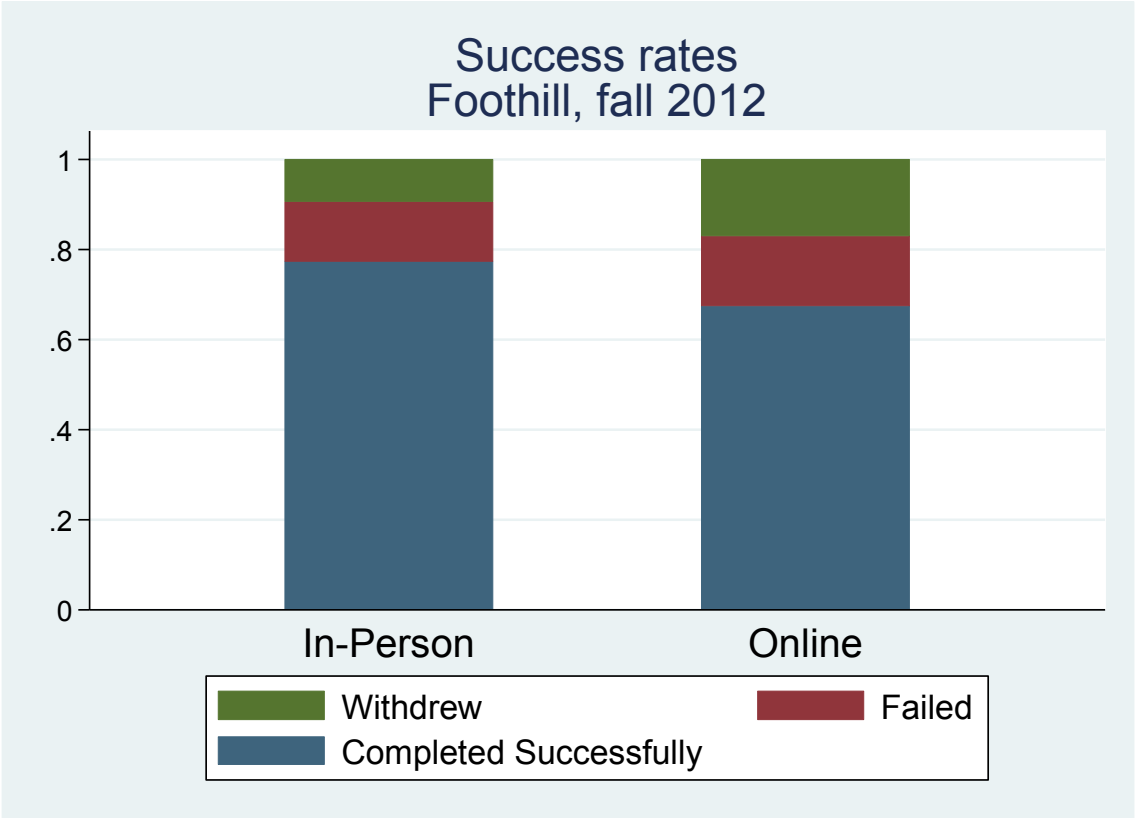
Finding 1: Less Success Online

Taking a simple look at online versus in-person learners, the first trend that jumps out is students' lower success rates in online classes: online learners are more likely to fail or drop out of a class as compared to in-person learners.

This trend is illustrated in Figure 1, wherein the left bar shows student outcomes for in-person courses and the right bar shows student outcomes for online courses. The lowest/blue portion of bars represents students who succeeded by completing the course with a grade of C or better. The middle/red portion of bars represents students who completed the course with a grade lower than C. The highest/green portion of bars represents students who withdrew.

What Figure 1 makes clear is that students at Foothill Community College are doing worse in online courses than in in-person courses: online learners are both more likely to fail and withdraw from courses than are in-person students, as illustrated by the taller stretches of red and green for online learners in Figure 1.[1]

Figure 1.



Before concluding that online learning is less effective than in-person learning, it is important to consider that different classes are offered online and in-person, and different students may choose to study online versus in-person. Disparate outcomes may not be due to the online format itself. Rather, they could be attributable to the kinds of classes offered online, or the kinds of students drawn (or driven) to online learning.

[1] Of note, where the balance is tipped towards slightly more online students withdrawn than failed at Foothill, the opposite is true at De Anza, with slightly more online students failed than withdrawn.

For example, if particularly difficult courses are offered online, this difficulty (as opposed to the online format) may account for poorer student outcomes. Likewise, if students who choose the flexibility of an online format are more often balancing their coursework with employment and/or parenting, it may be these conflicting demands on their time, as opposed to the online format, that hinder performance. Or, some online enrollees may be seeking an "easy" course to attend from their couch, either hoping for an easier degree or striving to balance a particularly heavy or challenging in-person course load, and this same "easy" motivation could lessen their effort and lower their performance.

Of course, it is also possible that something about the online format in particular limits learning and lowers performance. Disentangling correlation from cause-and-effect is difficult. To shed some light on this problem, in the following pages we explore which courses are offered online versus in-person, and the kinds of students that more often enroll in online verses classroom offerings. In so doing, we provide an initial comparison of online verses in-person learning at Foothill Community College.

Finding 2: Online vs. in-person offerings vary

One reason students at Foothill are less likely to succeed online may be the kinds of classes offered online: if online classes are consistently more difficult than those offered in-person, we would expect students to more often struggle regardless of course format.

To explore this possibility, Table 1 lists the departments with the largest enrollments at Foothill Community College, and Table 2 lists the departments with the largest *online* enrollments.

Table 1. Student enrollment by department

Rank	Department	Students enrolled in all sections
1	Mathematics	3096
2	Physical Education	2978
3	English/Writing	2451
4	Music	1614
5	Biology	1367

Table 2. Online enrollment by department

Rank	Department	Students enrolled in online sections
1	Music	1382
2	Accounting	962
3	Computer science	655
4	English	337
5	Geography	306

Immediately evident, only two departments appear in both tables: Music and English. Indeed, while physical education courses account for the second-most enrollments at Foothill, by their very nature most of these courses are unlikely to be offered online. Similarly, it is not surprising to find departments focused on computer technology—such as "Computer science" and "Accounting"—particularly likely to enroll students online.[2]

This comparison underscores the possibility that students may have less success online than in-person due to the kinds of classes offered online, rather than the online format itself.

Further exploring this possibility, Figure 2 goes beyond departmental differences in online offerings to illustrate course-types offered online, differentiating among STEM (science, technology, engineering, and mathematics) versus non-STEM sections, and college-level versus pre-collegiate sections.

To read Figure 2, note that each bar documents a different category of course section. The left-most bar captures college-level non-STEM sections, the second bar captures pre-collegiate non-STEM sections, the third bar captures college-level STEM-sections, and the final right-most bar captures pre-collegiate STEM-sections.

Within each of these categories, bars differentiate online versus in-person offerings. Red segments indicate in-person sections, while blue segments indicate online sections. Within each color, light sections are offered both online and in-person (i.e., students choose their format), whereas dark sections are only offered in one format (i.e., in-person *or* online). Put another way, dark red sections are only offered in-person, light-red sections indicate students *choosing* to study in-person, dark blue sections are only offered online, and light-blue sections indicate students *choosing* to study online. Worth noting, online and in-person sections are of similar sizes at Foothill College.

The overriding message evident in Figure 2 is that there are meaningful differences in the content of online versus in-person sections: the balance of red-to-blue differs from bar to bar. This bolsters the argument that disparities in online versus in-person performance may be due to content rather than (or in addition to) format.

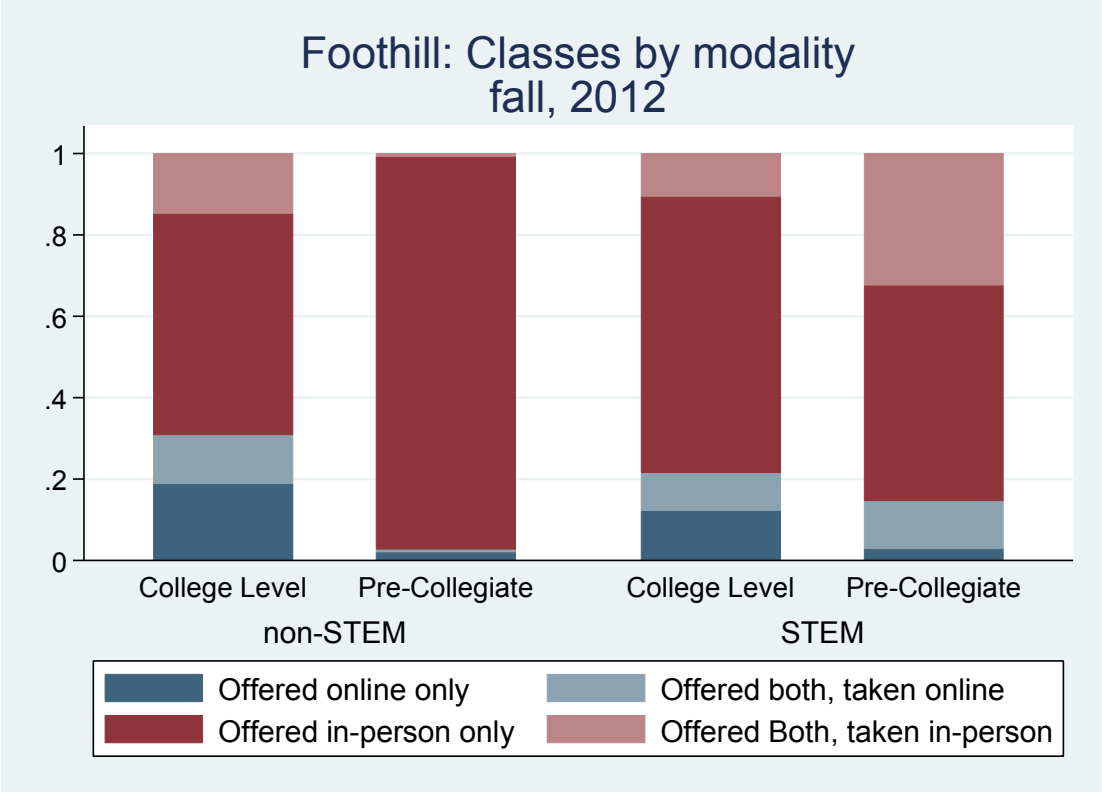
Consider the balance of red versus blue in Figure 2. The red segments dominate: the majority of sections at Foothill are held in-person. Further, the dark-red segments (i.e., in-person only

[2] At De Anza Community College, there is no overlap between top-enrolling and top *online*-enrolling departments: top-enrolling departments include Mathematics, Physical Education, English/Writing Accounting, and History, while top-*online*-enrolling departments include Computer Information Systems, Computer Applications, Intercultural Studies, CAD and Digital Imaging, and Health Technologies. However, with both Accounting and English appearing among the top-five overall at De Anza and top-five online at Foothill, it is possible students to some extent select their campus for these subjects based on which format they prefer.

sections) are by far the most common, while light-red segments (i.e., choosing in-person sections) number far fewer.[3]

Nevertheless, online (blue) sections are not uncommon, particularly for college level courses and STEM courses. While virtually no pre-collegiate non-STEM sections are taken online, a fair number of pre-collegiate STEM sections are taken online, and even more college-level (STEM and non-STEM) sections are taken online. The tendency for both STEM and especially college-level sections to more often be taken online aligns with the possibility that online offerings may be more difficult, which could account for students' poorer performance. In other words, these tendencies may tip the balance towards more challenging courses being offered online, accounting for students' typically lower performance. In fact, northern California Community College researchers commented that professors have sometimes said they purposely make their online offerings harder than their in-person classes.[4]

Figure 2.



[3] It should be noted that to be considered an online class at Foothill College, the class must meet online 100% of the time. At De Anza, the class must only meet online 51% or more of the time, so findings for Foothill and De Anza are not entirely comparable on this front.

[4] This was noted at an October 18, 2013 meeting hosted by *The R.P. Group* at De Anza Community College.

In sum, it is certainly possible that differences in student success online versus in-person may be attributable to differences in the departments and sections with online offerings—that is, differences in the content of online courses rather than the online format itself.

Even beyond this possibility, differences in the departments and sections that offer online versus in-person learning may draw different kinds of students, further explaining differences in performance. In other words, different kinds of students may pursue studies in mathematics, physical education, and biology (which enroll among the most students in-person, see Table 1) as compared to accounting, computer science, and geography (which enroll among the most students online, see Table 2). Likewise, different kinds of students may pursue college-level and STEM courses (which more often include online sections) compared to pre-collegiate and non-STEM courses (which less often include online sections, see Figure 2). Therefore, differences in student success online versus in-person may be attributable to the kinds of students that select each of these areas of study, rather than (or in addition to) differences in the format or content of these courses. Finding 3 (below) explores these possible *student* differences in more detail.

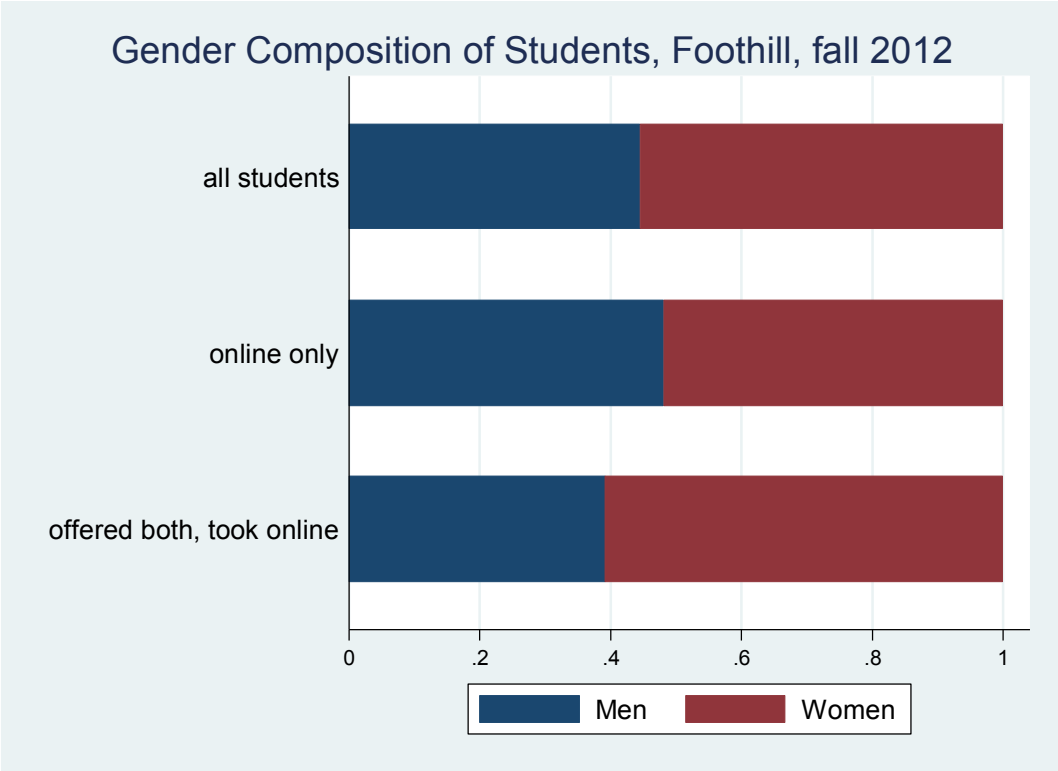
Finding 3: Online vs. in-person students vary

It is clear that online classes look different from in-person classes in some very basic ways at Foothill. Do online students look different, too? To begin to investigate this, consider the gender distribution of Foothill students.

Figure 3 includes three bars: one illustrating the gender balance among all students at De Anza, one illustrating the gender balance in classes only offered online, and one illustrating the gender balance in classes students *choose* to take online (i.e., online classes that are also offered in-person). Blue represents the proportion of classes that is male, while red represents the proportion that is female.

The balance of male-to-female students in these three categories of classes tells an interesting story: overall, there are somewhat more females than males enrolled at Foothill. Likewise, there are marginally more females than males enrolled in classes that are only offered online; online classes are ever-so-slightly more gender-balanced that all classes. However, the distribution tips notably towards more females in classes taken online *by choice,* with females comprising more than three in five students who choose the online format. It seems that females are more likely than males to select online learning when given the option. This supports the possibility that different kinds of students choose online classes.

Figure 3.



Next, Figure 4 presents the racial/ethnic distribution of students at Foothill College. The upper-left pie chart shows that just over a third of all Foothill students are White (36%), just over a quarter are Asian (26%), one-in-five is Latino (20%), and less than one-in-ten is Black (5%), Filipino (4%), Pacific Islander (1%), Native American (1%), or of unknown race/ethnicity (5%). By comparison, the upper-right pie chart describes students enrolled in at least one online course, and reveals a very slight tipping towards more Asian (27%), Black (7%), and Filipino (5%) students and fewer White students (34%) enrolled online. (Other racial/ethnic categories are equivalent.)[5]

Likewise, the lower-left pie chart in Figure 4 reveals *fulltime* Foothill students to be 32% Asian, 29% White, 19% Latino, 6% Black, 4% Filipino, 1% Pacific Islander, 1% Native American, and 7% of unknown race/ethnicity. Among fulltime students, those taking at least one class online are very slightly more likely to be White (30%) or Black (7%) and less likely to be Asian (31%) or Latino (18%), though these differences are truly tiny.

[5] By comparison, De Anza College enrolls more Asian (37%) than White (23%) students, and shows a very slight tipping towards more Asian and fewer Latino students enrolling online.

Figure 4.

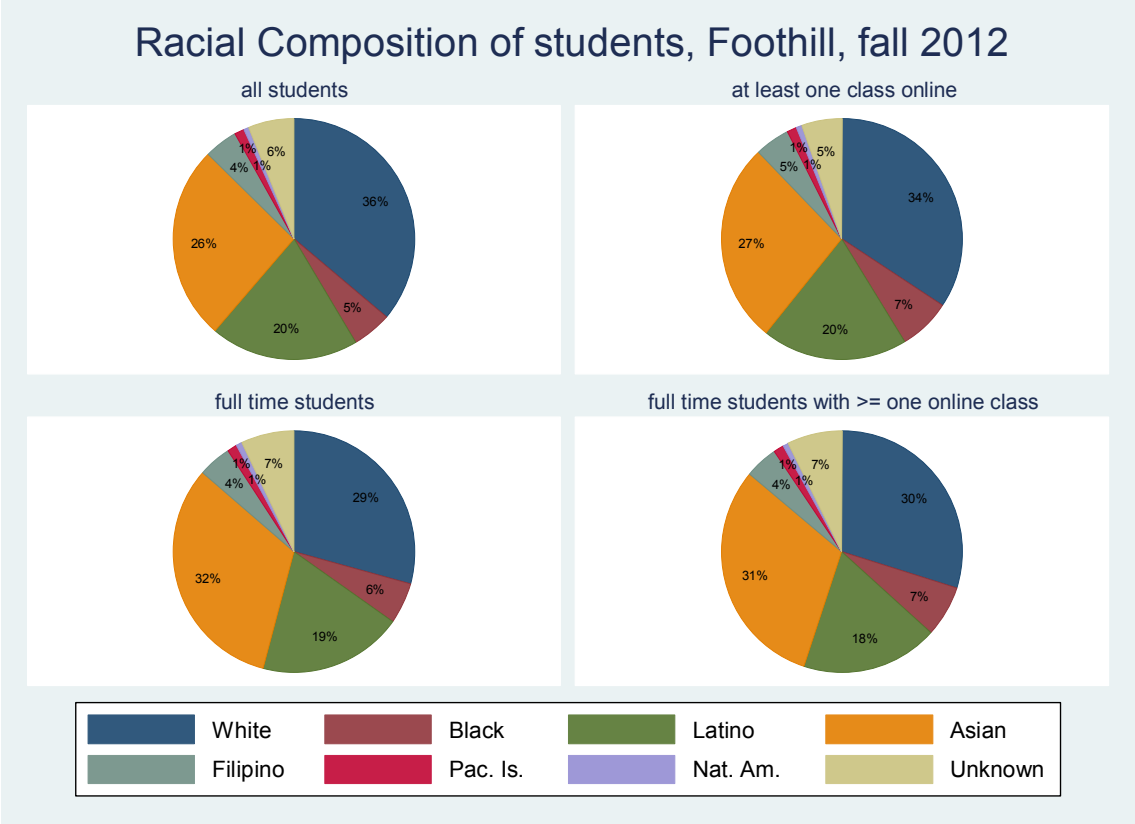
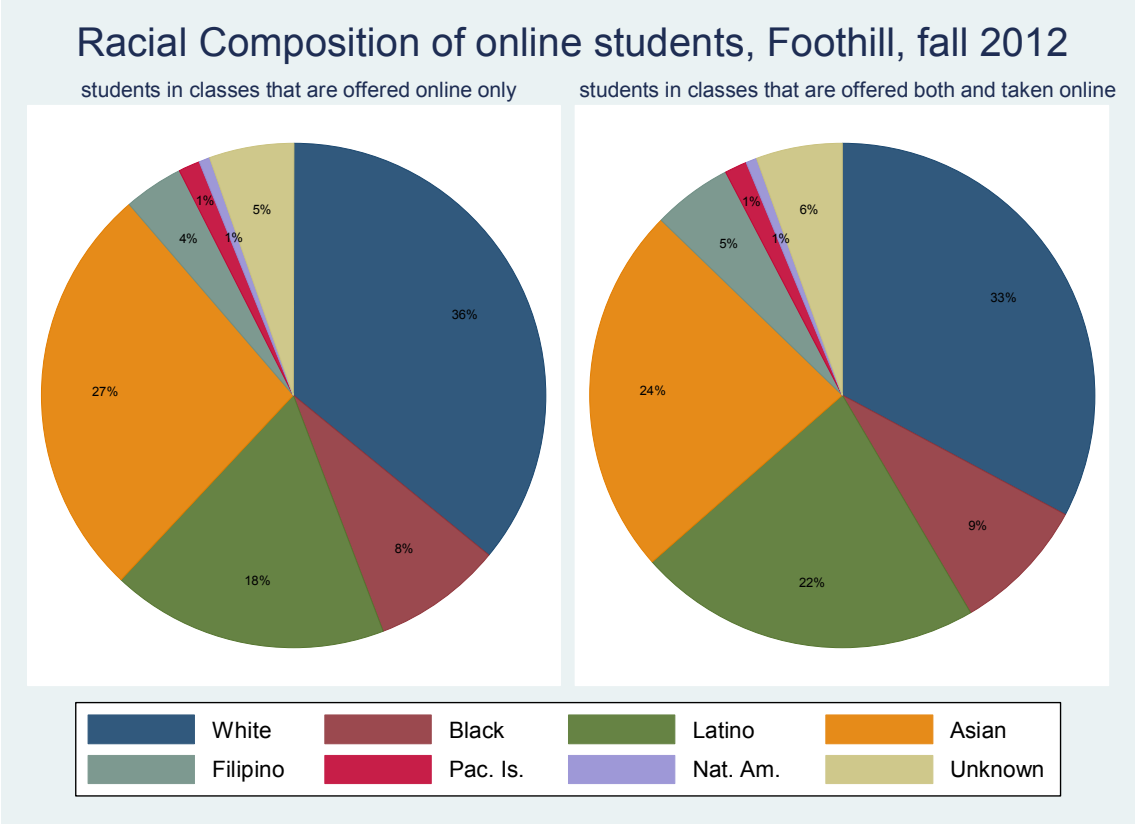


Figure 5 takes another look at racial/ethnic distributions at Foothill Community College, this time comparing classes only offered online (in the left pie chart) with classes for which students choose an online format over an in-person format (in the right pie chart). While Whites and Asians are slightly more represented in online-only classes (36 and 27%, respectively) than among online-choosers (33 and 24%, respectively), Latinos, Blacks, Filipinos, and multiple-race students are slightly more represented among online-choosers (22, 9, 5, and 6%, respectively) than in online-only classes (18, 8, 4, and 5%, respectively). What is interesting here is that while a slightly greater proportion of Asian and White students are enrolled online (as compared to other races/ethnicities), they are actually slightly less likely to *choose* online classes when given the choice.

Figure 5.

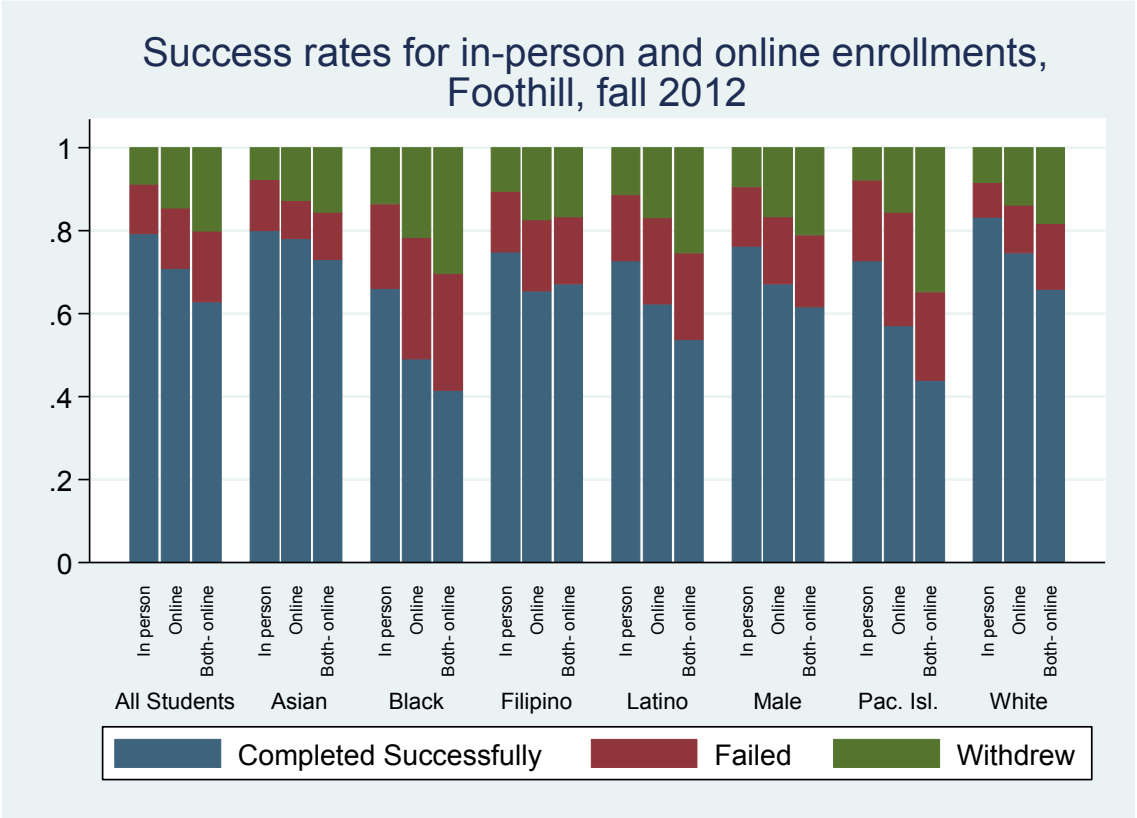


Summarizing what is illustrated in Figures 3, 4, and 5 it is clear that online and in-person students are not identical. There are differences by gender and race/ethnicity in who is enrolled in online courses (regardless of choice), and in who chooses to enroll in online courses (when given the choice). This supports the possibility that poorer performance online could be attributable either to the online format itself or to differences in the kinds of students enrolled online.

Finding 4: Less Success Online—*particularly* by choice—for all racial/ethnic groups

Figure 1 (above) revealed that students are less likely to earn a C or better in online versus in-person classes. But Figures 4 and 5 (also above) illustrated how the racial/ethnic composition of online versus in-person classes varies. Further parsing these findings, Figure 6 (below) illustrates that success rates (i.e., earning a C or better) are lower online for *every* racial/ethnic group. Even more, success rates are lowest among students who *choose* to study online, as compared to students enrolled in classes only offered online.

Figure 6.



To revisit the overriding theme of this paper, there are a couple of ways to understand this finding. For one, we know that different kinds of classes are offered online (more often college-level or STEM) versus in-person (more often pre-collegiate or non-STEM), which may account for these different rates of success. Additionally, we know that there are differences in the students who tend to enroll online versus in person, and this may also help to explain differential success. There are many ways in which online students may be different from in-person students – students may look for online classes to ease balancing roles as parents or employees alongside their studies, and they may be particularly likely to *choose* online over in-person classes in an effort to juggle many roles – which could account for these differences. Nevertheless, Figure 6 shows lower success online across racial/ethnic groups.

Finding 5: Taking multiple factors into account

In order to take multiple factors into account simultaneously, we next ran regressions predicting the likelihood that subgroups of students (e.g., by race/ethnicity or gender) would withdraw from a course, or if they did not withdraw, the likelihood they would pass.[6]

[6] We used linear probability models, with observations for each course in which each Foothill student was enrolled. Regressions included whether a course was taken online, whether it was in basic skills, the total number of credits students attempted, whether students were foreign or full-time, students' race/ethnicity,

We learned that some subgroups of students disproportionately withdraw from online classes as compared to in-person classes. Black and Latino students are both more likely than White students to withdraw from in-person classes (by four and two percentage points, respectively) and this gap grows in online classes (to eight and five percentage points). Male students are one percentage point more likely than female students to withdraw from in-person classes, and this gap grows to three percentage points in online classes.

Additionally, students who take a higher percentage of classes online are more likely to withdraw from their online classes though they are no more likely to withdraw from their in-person classes. Likewise, students in pre-collegiate classes are less likely to withdraw than students in college-level classes when the classes are in-person, but more likely to withdraw when the classes are online. In contrast, the gap between the withdrawal rates of foreign and non-foreign students doesn't grow between in-person and online classes; foreign students are less likely to withdraw in both (by five percentage points) modalities.

We also examined students' likelihood of passing a class, conditional on not withdrawing. Again, we see some gaps in success rates between in-person and online classes grow and some remain the same. We find that Black students are about thirteen percentage points less likely than White students to pass an in-person class, and this gap grows to twenty-one percentage points for online classes. Asian students are slightly less likely than White students to pass in-person classes, but slightly more likely to pass online classes. Foreign students are about three percentage points more likely than their non-foreign peers to pass an in-person class, and this gap grows to seven percentage points in online classes. However, there are some groups for whom the gap does not change between online and in-person classes. Latino students are less likely to pass in-person classes than White students, and this gap does not grow for online classes. Similarly, male students are less likely than female students to pass in-person classes, and this gap remains the same in online classes.

However, it is worth noting that the amount of variation in student outcomes explained by this set of variables is minimal (i.e., the r^2s are small). In other words, the bulk of variation in student outcomes is explained by factors not included in these models.

Conclusion and Next Steps

In sum, online learners at Foothill Community College are more likely to fail or drop out of a class compared to in-person learners, though differences in outcomes may be due to the difficulty of the subject matter offered online versus in-person, the kinds of students drawn or driven to subjects offered online versus in-person, or the online versus in-person format itself. Each of these possibilities must be further explored to better understand these outcomes. In fact, work is already underway to do so.

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gender, socioeconomic status (measured approximately by the wealth of the students' zip-code), interaction-terms between each of these characteristics and whether the course in question was online, and terms that indicated which department offered the course. The interaction-terms are of particular interest, as they indicate how different subgroups of students' performance vary in online versus in-person classes.

Building on this first glimpse into Foothill's online offerings, Foothill and De Anza Community Colleges and the Stanford Graduate School of Education have together proposed a research partnership. Our collaboration is founded on the fact that the vast majority of American college students study at broad-access institutions like Foothill and De Anza Colleges, defined as schools that accept all or most of those seeking enrollment. Given state and national calls to deliver more efficient and effective postsecondary education to increasing numbers, it is vital to build a stronger understanding of the greatest strengths and opportunities in broad-access higher education. Further, online learning is changing postsecondary education in dramatic yet minimally understood ways. Foothill and De Anza Colleges have longstanding experience in online offerings, which provides a unique opportunity to examine what works in digital education as it undergoes unprecedented expansion.

Foothill and De Anza faculty and administrators have an unparalleled understanding of the benefits their colleges provide, as well as the challenges their students face. Policy makers and policy researchers would benefit from this local understanding. In fact, Foothill and De Anza could well serve as national models of effective broad-access education. In turn, Foothill and De Anza faculty and administrators—as well as faculty and administrators throughout higher education—would benefit from better-informed research and policy. The Stanford Graduate School of Education's extensive research capacity could provide a valuable complement to Foothill and De Anza's rich longitudinal data and on-the-ground perspective on broad-access higher education.

Indeed, the potential for productive future research in online learning is great. To offer just one example, there is an opportunity to study the tension between two policy goals: college access and completion. While online courses can increase access by lowering costs and providing versatile accessibility, the preceding pages make clear that they are also associated with lower completion rates. Indeed, success in online courses at Foothill Community College is especially low for racial/ethnic minorities, and there are differences by socioeconomic status in how ready students are for college and *in particular* online learning. There is no standardized, validated tool to determine who is well prepared, and how to help students better prepare for digital education. In future joint endeavors between Foothill and Stanford, we can begin to address this gap.

Indeed, by combining Foothill and De Anza Colleges' local knowledge and rich data with the Stanford Graduate School of Education's analytic expertise and commitment to understanding and improving broad-access education, our partnership can provide actionable answers to some of the most important questions in postsecondary education today.