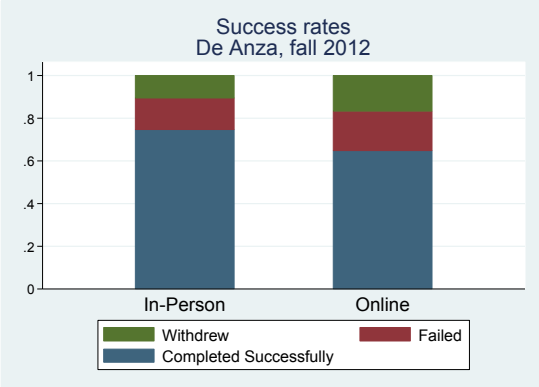
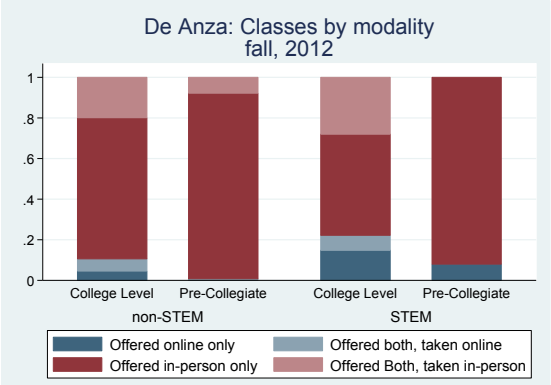
Executive Summary: Online Learning at De Anza Community College

De Anza 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 De Anza 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 De Anza 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 at De Anza. 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 no overlap between the five largest-enrollment departments and the five largest-*online*-enrollment departments at De Anza, and college-level and STEM (science, technology, engineering, and mathematics) sections—which may be particularly challenging—are more often taken online than pre-collegiate and non-STEM sections (left figure).

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: Asians and Whites are more likely to take classes only offered online, and Latinos are more likely to take classes only offered in-person, but *when given the choice*, Asian and White students lean slightly towards in-person learning while Latinos (along with Blacks and Filipinos) lean slightly towards online learning. 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., Filipino students are more likely than White students to withdraw from an online class, but they are no more likely than White students to withdraw from an in-person class. These preliminary findings are described and discussed in detail below.

Online Learning at De Anza Community College

Research provided by the Stanford Graduate School of Education

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

- shed light on the greatest strengths and challenges in online education at De Anza 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, De Anza and Foothill 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 (78% at De Anza and 62% at Foothill) are racial/ethnic minorities.

This white paper takes a preliminary look at which courses are offered online at De Anza, who takes them, and who completes them successfully. A sister-paper explores these same questions for Foothill 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 De Anza'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.

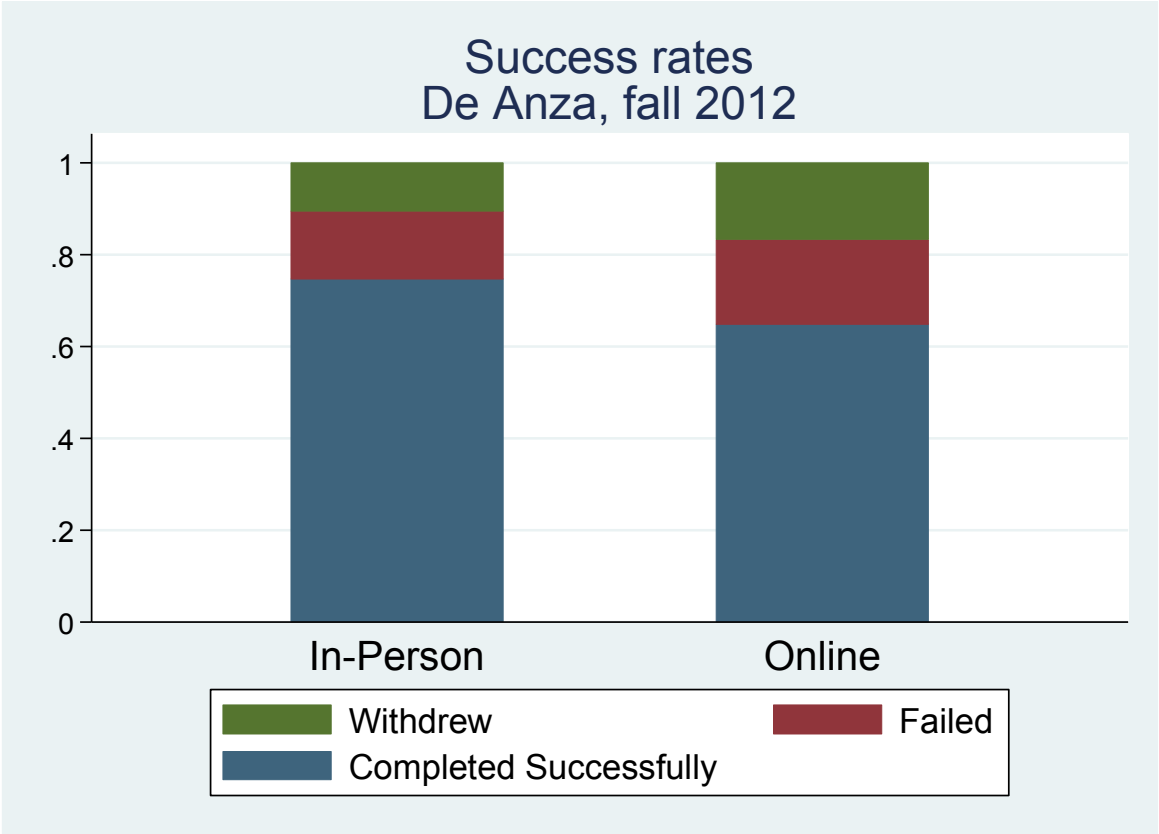
Finding 1: Less Success Online

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 De Anza 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 failed than withdrawn at De Anza, the opposite is true at Foothill, with slightly more online students withdrawn than failed.

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 De Anza Community College.

Finding 2: Online vs. in-person offerings vary

One reason students at De Anza 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 De Anza 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	6720
2	Physical Education	4685
3	English/Writing	4503
4	Accounting	2037
5	History	2026

Table 2. Online student enrollment by department

Rank	Department	Students enrolled in online sections
1	Computer Information Systems	1272
2	Computer Applications	557
3	Intercultural Studies	369
4	CAD and Digital Imaging	276
5	Health Technologies	244

Immediately evident, there is no overlap between the five largest-enrollment departments and the five largest-*online*-enrollment departments at De Anza. Indeed, while physical education courses account for the second-most enrollments at De Anza, 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—"Computer Information Systems," "Computer Applications," "CAD and Digital Imagining," and to some extent "Health Technologies"—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 De Anza 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 De Anza are held in-person. Further, the dark-red segments (i.e., in-person only sections) are by far the most common, while light-red segments (i.e., choosing in-person sections) number far fewer. [3]

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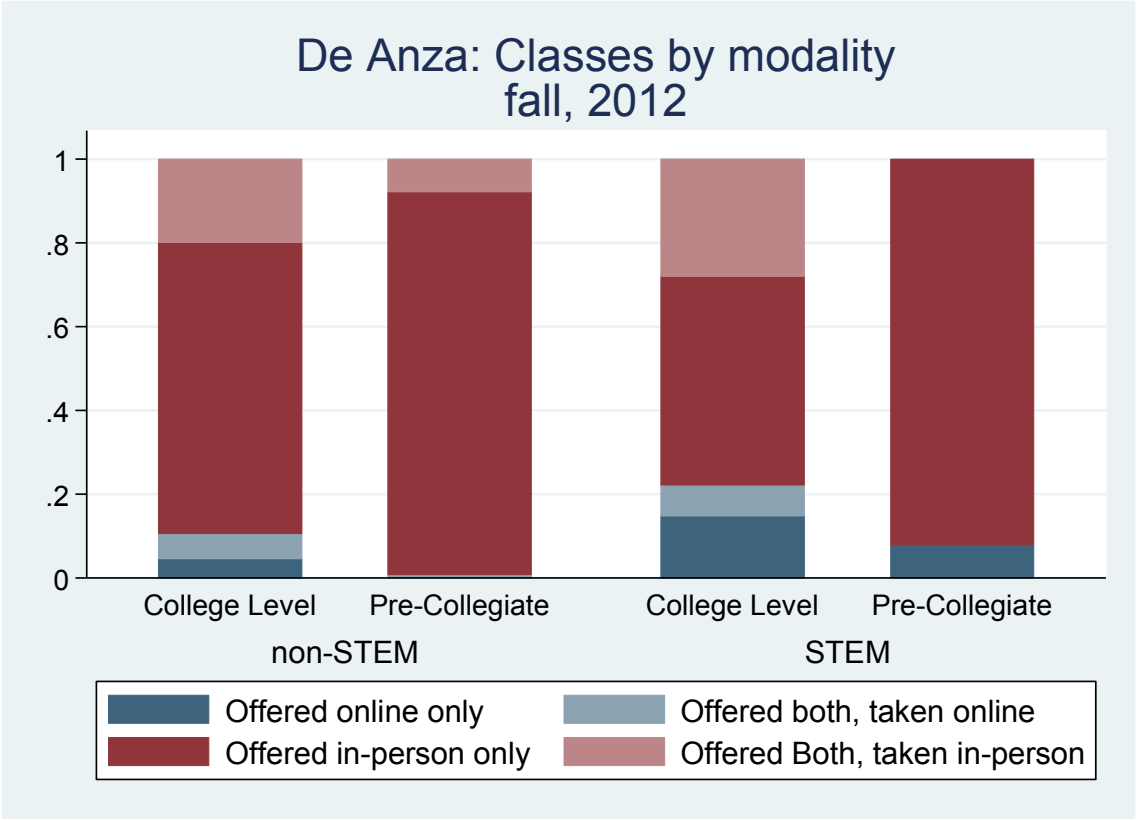
[2] In contrast, at Foothill Community College, two departments appear on the top-five list both overall and online – Music and English – and Accounting is also among the top-five online departments. Of note, with Accounting and English appearing among the top-five overall at De Anza and top-five online at Foothill, it is possible students to some extent select their campus for these subjects based on which format they prefer.

[3] It should be noted that to be considered an online class at De Anza, the class must meet online 51% or more of the time. At Foothill College, in comparison, to be considered an online class the course must

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, some pre-collegiate STEM sections are taken online, a few more college level non-STEM sections are taken online, and quite a few college-level STEM sections are taken online. The tendency for both college-level and STEM 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 taken online, accounting for students' typically lower performance. In fact, anecdotally, 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.



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.

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meet online 100% of the time, so findings for De Anza and Foothill 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.

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, English/writing, accounting, and history (which enroll the most students in-person, see Table 1) as compared to computer information systems, computer applications, intercultural studies, CAD and digital imagining, and health technologies (which enroll 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.

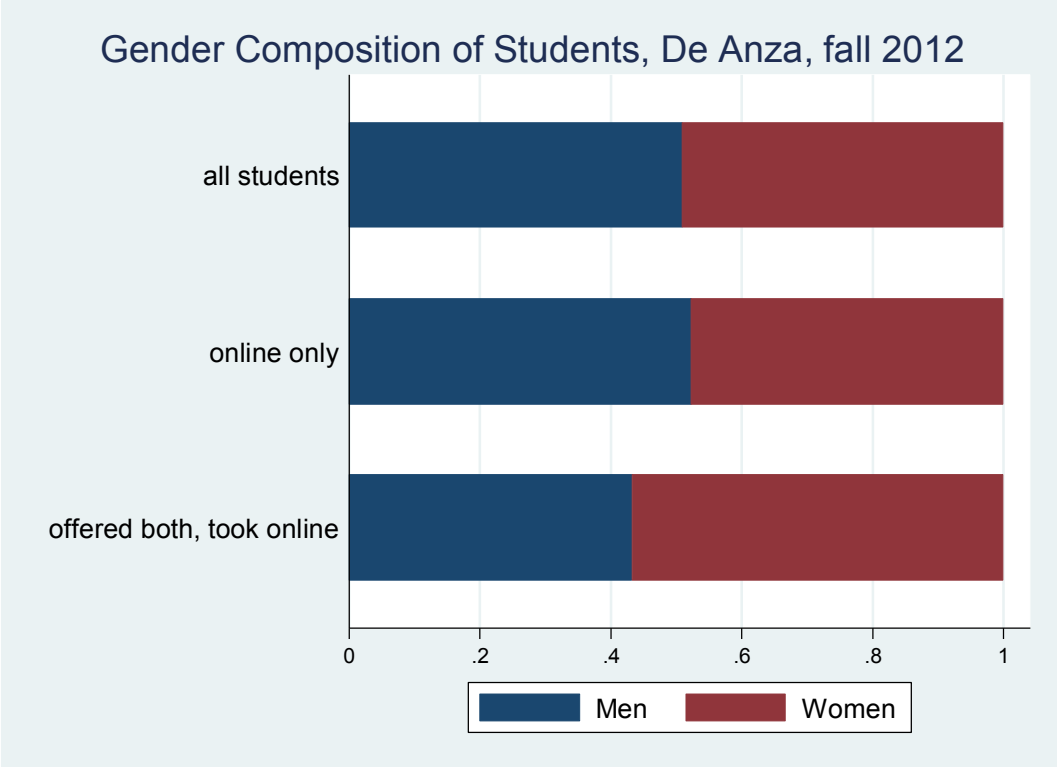
Finding 3: Online vs. in-person students vary

It is clear that online classes look different from in-person classes in some very basic ways at De Anza. Do online students look different, too? To begin to investigate this, consider the gender distribution of De Anza 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: among all students, the balance of males to females is essentially equivalent. Likewise, in classes that are only offered online, the gender balance is quite even. However, the distribution tips notably towards more females in classes taken online *by choice*. 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 De Anza College. The upper-left pie chart shows that just over a third of all De Anza students are Asian (37%), just under a quarter are White (23%) and Latino (22%), and less than one-in-ten is Filipino, Black, Pacific Islander, Native American, or of unknown race/ethnicity. By comparison, the upper-right pie chart describes students enrolled in at least one online course, and reveals a slight tipping towards more Asian students (41%) and fewer Latino students (18%) enrolled online. (Other racial/ethnic categories are equivalent.)[5]

Likewise, the lower-left pie chart in Figure 4 reveals *fulltime* De Anza students to be 44% Asian, 21% Latino, 17% White, 7% Filipino, 5% Black, 1% Pacific Islander, 1% Native American, and 5% of unknown race/ethnicity. Once again, among fulltime students, those taking at least one class online are slightly more likely to be Asian (47%) *or White* (19%), and slightly less likely to be Latino (16%).

[5] By comparison, Foothill College enrolls more White (36%) than Asian (26%) students, and shows a very slight tipping towards more Asian and Black students enrolling in at least one class online.

Figure 4.

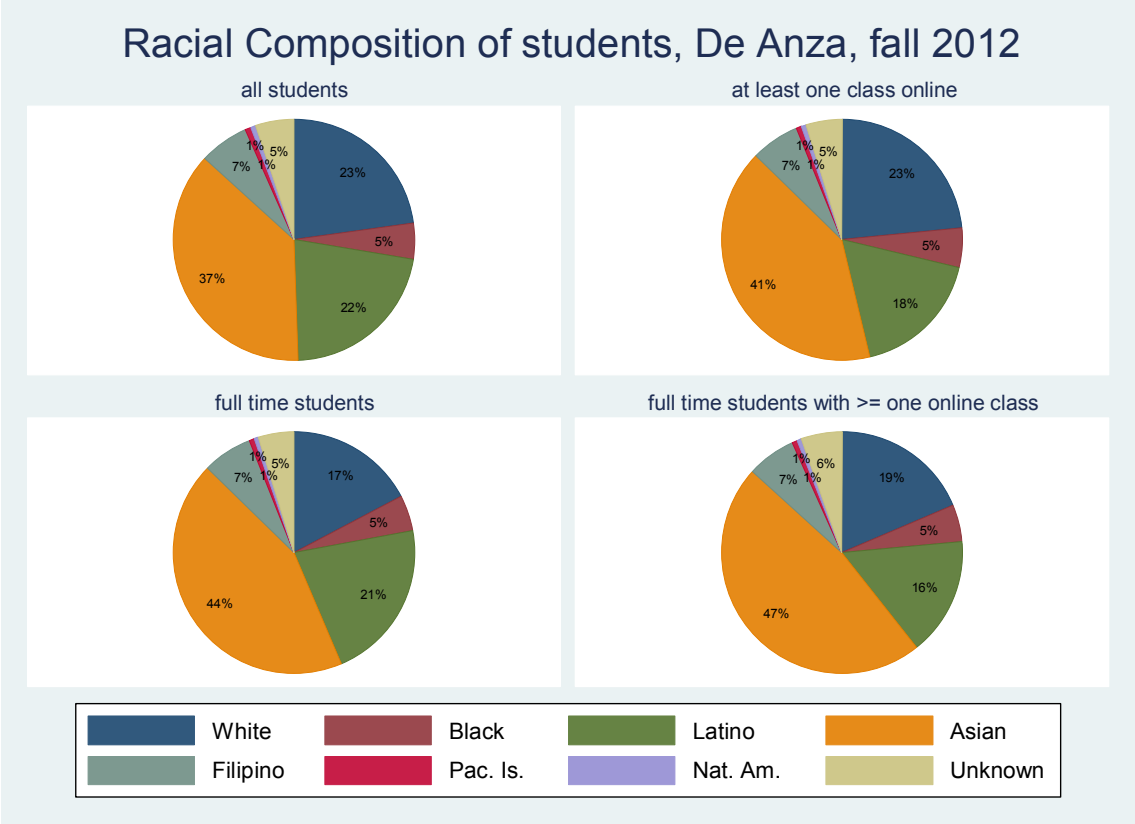
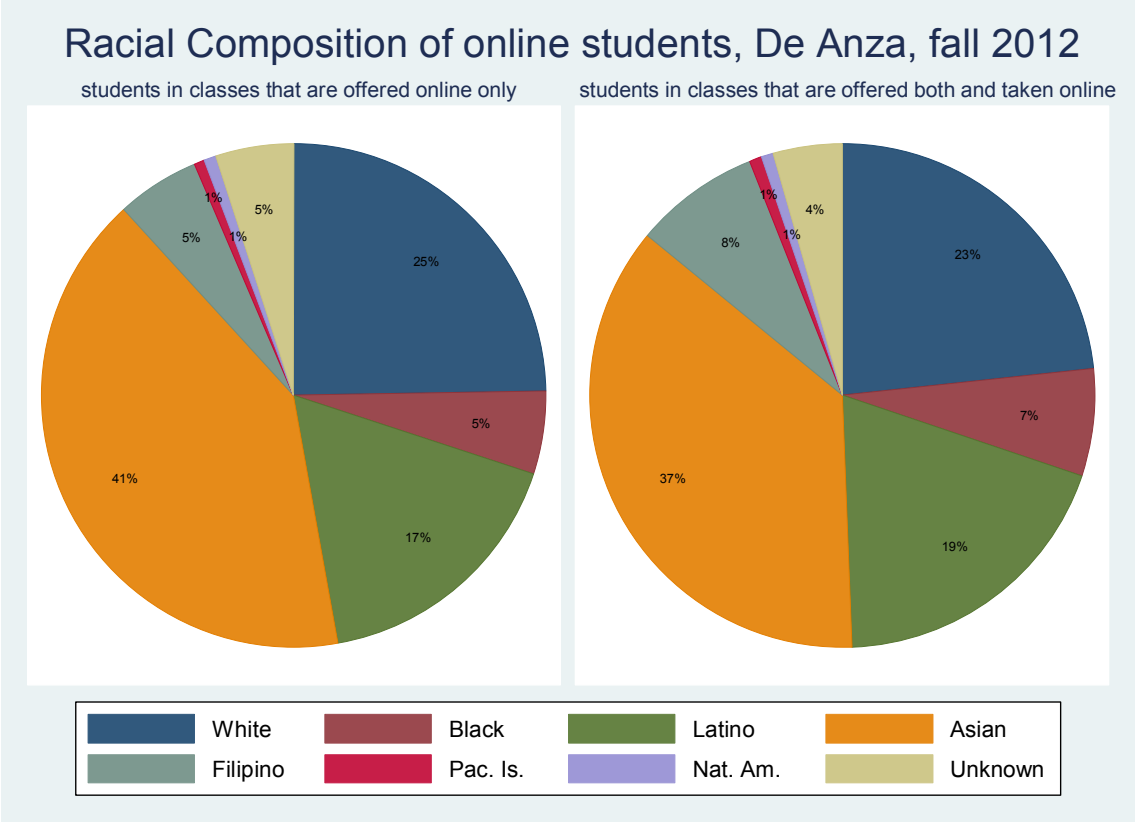


Figure 5 takes another look at racial/ethnic distributions at De Anza Community College, this time comparing classes only offered online (in the left pie chart) with classes for which students choose an online format over an in-person format (in the right pie chart). What is interesting here is that Asians and Whites actually represent a smaller proportion of students *choosing* online formats (37 and 23% respectively) than they do among students enrolled in online-only classes (41 and 25% respectively), despite the fact they were slightly more represented among all online students (above). In turn, Latinos, Blacks, and Filipinos are slightly more represented among online-choosers (19, 7, and 8% respectively) than among online-only enrollees (17, 5, and 5% respectively).

In other words, the slightly greater proportion of Asian and White students enrolled online (above), and the slightly lower proportion of Latino students enrolled online (also above) is explained by the kinds of classes Asians, Whites, and Latinos take. It appears Asians and Whites are more likely to take classes only offered online, while Latinos are more likely to take classes only offered in-person, but when given the choice, Asian and White students lean slightly towards in-person learning while Latinos (along with Blacks and Filipinos) lean slightly towards online learning.

Figure 5.

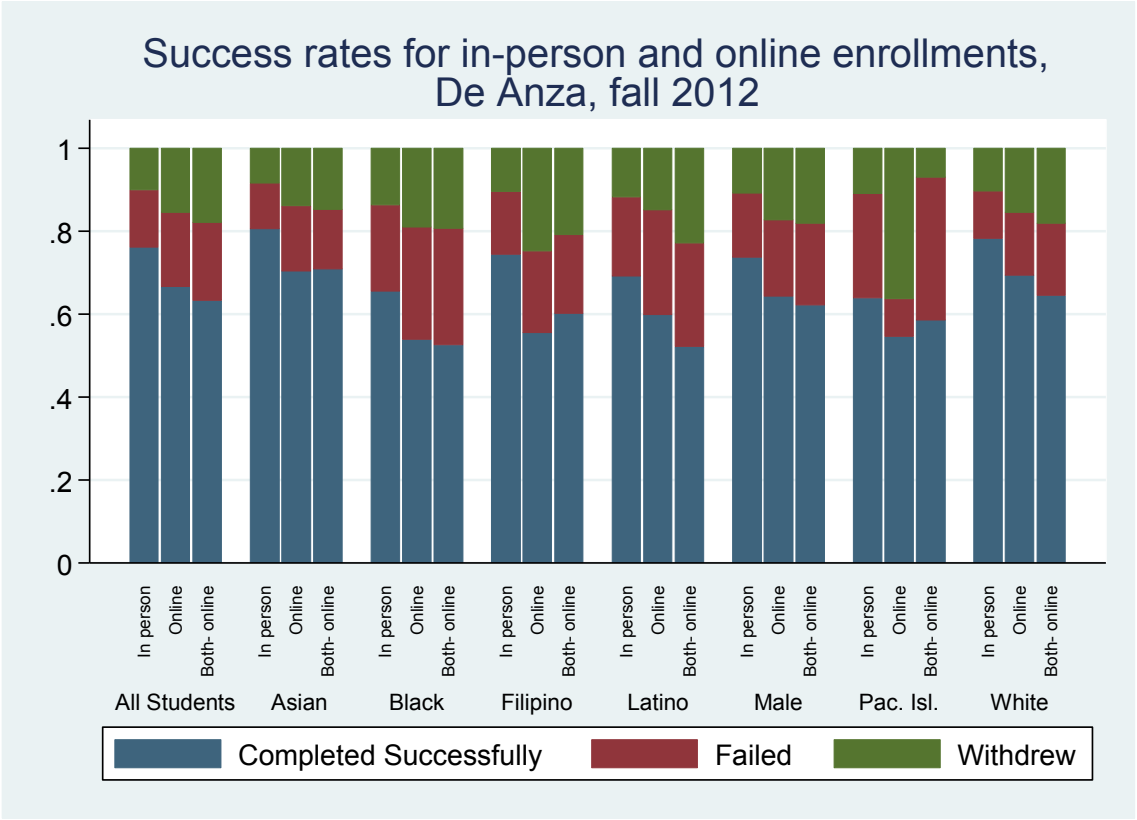


Summarizing what is illustrated in Figures 3, 4 and 5, it is clear that online and in-person students are not identical. There are differences by gender and race/ethnicity in who is enrolled in online courses (regardless of choice), and in who chooses to enroll in online courses (when given the choice). 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 De Anza student was enrolled. Regressions included whether a course was taken online, whether it was in basic skills, the

We learned that some subgroups of students disproportionately withdraw from online classes as compared to in-person classes. For instance, Filipino students are no less likely than their White peers to withdraw from in-person classes, but they are six percentage points more likely than White students to withdraw from online classes. Foreign students are less likely than non-foreign students to withdraw from in-person classes (by five percentage points) and this gap grows for online classes (to eight percentage points).

However, for some groups, the gaps in withdrawal rates are no bigger in online than in-person classes. For example, Black and Latino students are both more likely than White students to withdraw from in-person classes, and these gaps do not grow in online classes. Similarly, Asian students are less likely to withdraw from in-person classes than White students, and this gap does not change for online classes.

We also examined students' likelihood of passing a class, conditional on not withdrawing. Again, we saw some gaps in success rates between in-person and online classes grow and some remain the same. For example, Latino students are nine percentage points less likely than White students to pass an in-person class, and this gap grows to eleven percentage points in online classes. Foreign students are more likely than non-foreign students to pass an in-person class, but less likely to pass an online class.

There were also some gaps that did not change between in-person and online classes: Black students are thirteen percentage points less likely than White students to pass in-person classes, and this gap does not grow in online classes; male students are four percentage points less likely than females to pass in-person classes, and this gap remains the same in online classes.

Interestingly, we further found that the higher the percentage of classes a student takes online, the less likely he is to pass an online class, though his likelihood of passing an in-person class does not change.

It is also 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 De Anza 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

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total number of credits students attempted, whether students were foreign or full-time, students' race/ethnicity, 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.

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.

Building on this first glimpse into De Anza's online offerings, De Anza and Foothill Community Colleges and the Stanford Graduate School of Education have formed a research partnership. Our collaboration is founded on the fact that the vast majority of American college students study at broad-access institutions like De Anza and Foothill 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. De Anza and Foothill Colleges have longstanding experience in online offerings, which provides a unique opportunity to examine what works in digital education as it undergoes unprecedented expansion.

De Anza and Foothill 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, De Anza and Foothill could well serve as national models of effective broad-access education. In turn, De Anza and Foothill 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 De Anza and Foothill'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 De Anza 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 De Anza and Stanford, we can begin to address this gap.

Indeed, by combining De Anza and Foothill 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.