

Effect of Covid-related Changes on Student Success for Fall 2020

The Covid epidemic forced multiple changes to instruction, grading and withdrawal policies, and student behavior that might have affected how well students did in their courses during the Fall 2020 (F20) semester. While the switch of most classes from in person to either synchronous (30% of all enrollments in F20) or asynchronous (66%) online instruction was probably most consequential, other changes such as many students being at a distant location, faculty and staff not being available for in-person meetings, illness, stress caused by the epidemic, loss of jobs, etc., all probably also contributed to making F20 a particularly difficult semester. To compensate for these issues grading and withdrawal policies were modified to make withdrawals much easier and available through dead week, all WU (unauthorized withdrawals) and F grades were automatically converted to No Credit (NC), and students had the option to convert any grades to NC –this was primarily used to convert ~20% of Ds to NC).

Part I of this report looks at the effects of these many changes on overall student success in the classroom as measured by changes in the percentage of D, F, WU, NC, and W grades (DFW rate), the grade distribution, Grade Point Averages (GPAs) and the number of units “lost” –units attempted but not passed, so the course must be taken over. Part II examines the effects of the Covid related changes on the DFW rates of specific groups of students such as under-represented minorities (URM) or freshmen, while Part III examines the effects on DFW rates of different course characteristics such as online vs in-person, class size, class level, GE status, etc.

The two most important results from this analysis are that the DFW rate increased from an average of ~11% in the semesters from F13 to S20 to 15% in F20, a 36% increase in the DFW rate, and that while all groups of students saw increases in their DFW rates, the negative effects were uneven, with URM and freshmen and sophomore students much more negatively affected than others. Within the URM black students were the ethnic group most harmed, and URM students from outside the Chico service area and URM First-Generation students were also negatively affected, though by smaller amounts. However, the normal large gender DFW gap did not increase, so not all DFW gaps were increased by the Covid effects.

There were also some instructionally related effects. Lower division classes had a larger increase in DFW rates than upper division, and this was not just a factor of having more freshmen or larger class sizes. About half of the four-percentage point increase in DFW rates from 11% to 15% can be explained by the switch to online instruction, which has historically had about a two-percentage point higher DFW rate than in person classes. While synchronous online classes had lower DFW rates than asynchronous, the effect was relatively small, only 0.5 percentage points. Class size, an important factor in FTF instruction, was much less important in the online environment, with little effect on DFW rates for classes with more than 20 students.

Appendix A has a bulleted list of the main quantitative results of the 20 figures included in the main body of this report.

Methods

The raw data for this analysis was extracted from the Cognos “Faculty Grades” data module assembled from the Data Warehouse by Tom Rosenow in Institutional Research, and all analysis was done using the Tableau business intelligence program. The data set used for this analysis is the 1.2 million grades given out during the fall and spring semesters from Fall 2013 to Fall 2020, an average of 82,000 grades a semester over 15 semesters, with 79,000 of the grades from Fall 2020. While the majority of the grades come from normal graded sections (86%) with 6% from CR/NC sections and the rest from Administrative withdrawals and small numbers of grad classes, developmental math and English classes, audits, etc. For S20 and F20 the number of normal grades declined to 81% and 78%, respectively, as the number of withdrawals and the use of “Student Option” increased. Most of this analysis uses counts of grades, not students, so it will be biased by the fact that students who take more units will be over-represented in the DFW ratio, and to the extent that stronger students take more units, this will produce lower ratios of poor grades (DFW rates) than would be found if the measure was the number of students getting poor grades.

As many of the figures in this report are comparisons of a single term, F20, with the prior 14 terms from F13 to S20, and as there are two other terms, F18 and S20, with potentially anomalous grade results, box plots, also called box and whisker plots, are frequently used in place of the more common bar graphs. The box plots show the values of all 15 terms for each condition, with a box around the values making up the central 50% (1st quartile to 3rd quartile). The “whiskers” mark the furthest values from the median that are within 1.5 times the size of the box (the inner quartile distance). Points beyond that are considered outliers. These plots make it easier to see how F20 values compare to the distribution of values for the prior 14 semesters.

Part I: Overall Effects of Covid-related Changes on DFW rates, GPAs and Units Lost

In the semesters prior to F20 the primary learning mode used was in person, though this had decreased from 92% in F15, the first term where learning mode was tracked, to 88% by S20 as the amount of online or hybrid online instruction increased by 50% over that period, from 8% to 12% of all instruction. However, in F20, in-person instruction dropped to less than 2% of all grades, with two thirds of grades coming from synchronous online classes and 30% from asynchronous classes. In the second half of S20 all instruction also switched from in-person to all online, though there is no way to know how much of the online instruction was synchronous. For both S20 and F20 students were allowed to withdraw at any point in the semester through dead week with no reason needed, and almost all students getting an F had their grade automatically switched to a No Credit (NC) grade. Student’s also had the option of replacing other grades with NC by request.

DFW rates are a commonly used measure of student success as they capture two different types of harm caused by poor classroom performance, decreases in GPA and the loss of units. Student’s whose overall GPAs fall below 2.0 go on probation, and if they are unable to raise their GPA in subsequent semesters they can be disqualified from the University. This is particularly a problem for first-time freshmen, as they don’t have a buffer from earlier semesters with higher GPAs, so getting a GPA below 2 in their first semester immediately puts them on

probation. Thus, high DFW rates are strongly associated with students not persisting and this is a primary cause of most of the equity gaps in graduation, [Analysis of dismissal and dropout rates for the 2009-2011 first time freshmen cohorts \(2018\)](#).

In addition, withdrawals, F, and NC grades result in no units being gained, requiring students to repeat courses (this is also true for some Ds). This delays student progress towards a degree and increases the costs of a degree, both of which can result in a failure to graduate.

The unusual grading policies in S20 and F20 decouple these two effects as some D and all F grades were converted to NC grades, which are not used in the computation of GPA. Thus, most students will have GPAs over 2.0, avoiding probation and disqualification. However, the units are still lost and DFW rates will still be a good measure of how well students succeeded in passing their courses, though high DFW rates won't be as harmful as in normal semesters. GPA will be a poor measure of student success in these semesters as GPAs will be higher than usual, even if students do worse than normal.

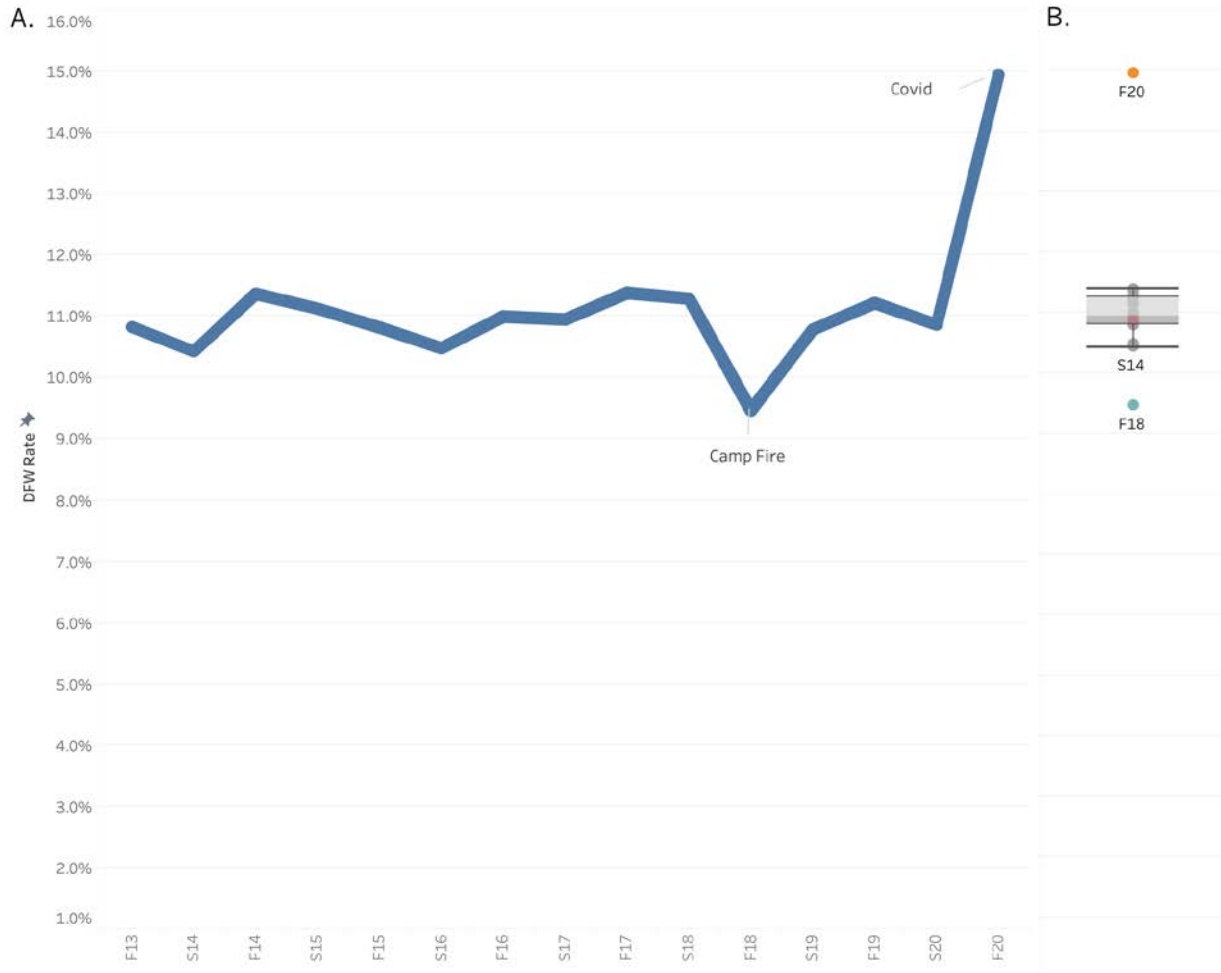


Figure 1. Percentage of grades that are DFW (D+, D, F, WU, W, or NC grades) by term, Panel A, or in a box plot, Panel B.

DFW Rates

Since F13 the percentage of DFW grades has been ~11%, varying in a tight range between 10.4% and 11.4%, Fig. 1A. Over the 15 terms from F13 to F20 there has been no evidence of either improving or declining trends in DFW rates, but there are two outlier terms in the last several years, F18 and F20, Fig. 1B. In F18 the Camp Fire caused the cancellation of over a week of classes and changes to most final exams. Surprisingly, this resulted in a 14% decrease in the DFW rate to only 9.5%, either because of easier finals or because faculty lowered their grading criteria to compensate for the interruption and extreme stress many students had been under. In F20, however, the switch to almost exclusively online instruction and the effects of Covid on students and instructors led to a 36% increase in DFW rates, from ~11% to 15%, Figure 1A&B. This 15% DFW rate is over three standard deviations from the normal range giving a p value well below 0.01. Thus, over 3,000 additional DFW grades were given to students in F20 then would be expected in a normal term (4% more of the 79,000 grades in F20 were DFW). The increased DFW grades came from a higher rate of F grades, which increased over 50%, from a normal 3.9% of all grades to 5.7% in F20, and a more than four-fold increase in Ws, from a normal 1.4% of all grades to 6.2% in F20 (see Fig. 2 for official grades, data not shown for Instructor grades). In the official grades all of the Fs and some Ds were converted to NC grades, so the NC category also grew from a normal 0.7% to 6.4% of all grades in F20, while the number of Fs dropped to zero and the number of Ds declined from 3% to 2.5%, so students converted 17% of their D grades to NC.

Surprisingly, while the second half of S20 was also taught almost entirely online and the modified grading policies were introduced then, there was no increase in DFW rates. This suggests that the change in grading policies did not cause an increase in DFW rates, and, thus, that the change to all online instructions for the whole term and/or the effects of Covid caused the large increase in DFW rates in F20.

Grade Distribution

While the percentage of DFW grades increased by 4 percentage points in F20, the percentage of A and A- grades increased even more, from 35.8% in prior terms to 42.6% in F20, a 6.8 percentage point increase, and a 19% increase in the proportion of As, Figure 2. The increase in As could be because of more assignments relative to tests in the online format, because of issues with doing online exams causing faculty to either rely on them less or making changes to fit the online format that lead to more As (and more Fs), or because some students are more successful in the online environment than in person. It is also possible that there was a large increase in cheating in the online environment, though that should have led to fewer Fs instead of the large increase in Fs – Fs increased from a normal 4.8% of all grades to 6.2% in S20 and 7.4% in F20, Figure 3A, which were converted to NC grades along with ~20% of D grades in S20 and F20, Figure 3B. An analysis of grade book data from Blackboard could separate some of these possibilities out, or a survey of faculty could help identify the causes of these changes in grading patterns.

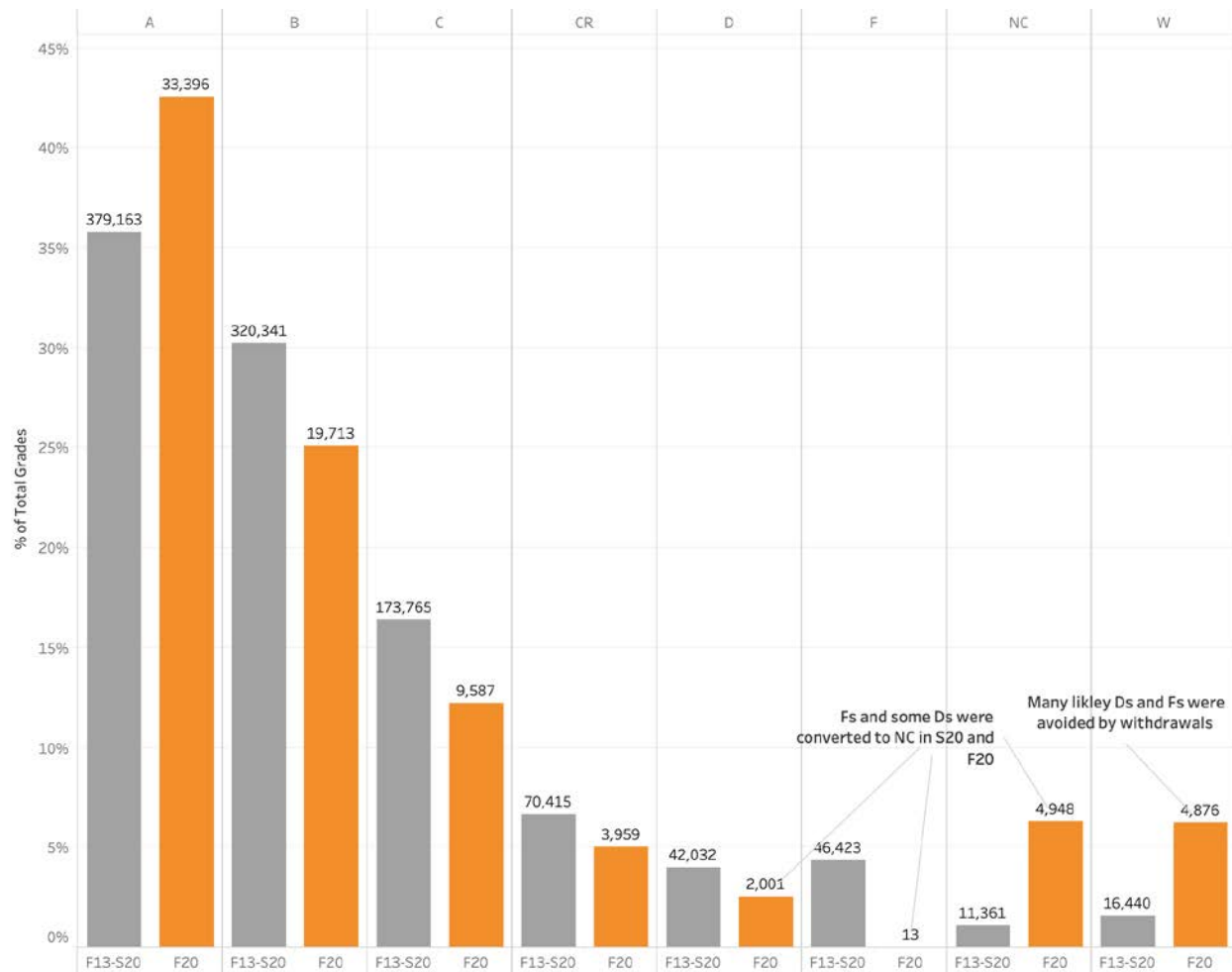


Figure 2. Comparison of the percentage of grades between the Fall 2013 to Spring 2020 (excluding Fall 2018) and Fall 2020 Semesters. Numbers above the bars are the number of grades in that category.

If the 3.7 percentage point increase in withdrawals from a normal 1.5% to 6.2% in F20, Figure 2 and 3B, was primarily a result of students doing poorly in their classes, then that together with the increase in Fs to 7.4%, Figure 3A, implies that over 10% and as many as 11% of students failed courses in the F20 term compared to the normal 4.8% rate, a 130% increase in students failing courses. That the percentage of instructor Ds declined from a normal 4.1% to 2.6% in S20 and 3% in F20 is surprising. While it is likely that the majority students who would normally have gotten Ds instead got Fs instead as the 3.7 percentage point increase in Ws and 2.6 percentage point increase in Fs adds up to a 6.3 percentage point increase in students failing or withdrawing classes, far more than the 4.1% of student who normally get Ds, it is odd that more C students didn't get Ds instead in S20 or F20. In conjunction with the large increase in As and decline in Bs and Cs, it appears that the Covid changes had opposite effects on the students who normally did well in particular classes and the students who normally struggled, with the students who normally would have done well doing better than normal, while the students who would normally struggle doing much worse than normal. Thus, there was a large increase in the variance of grades, with many more grades at both ends and fewer in between.

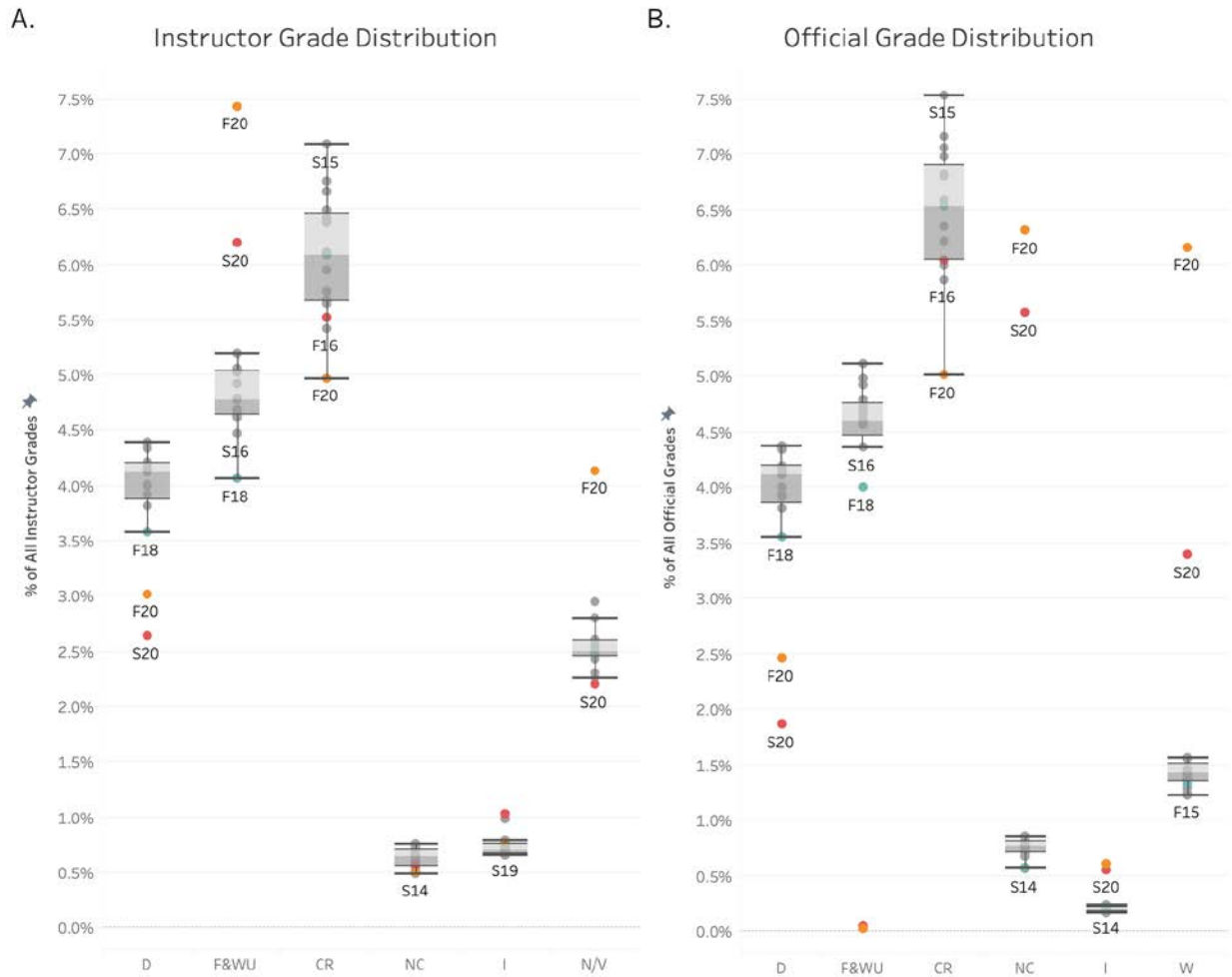


Figure 3. Percentage of all instructor grades that are D (D+, D), F and WU, CR, NC, I (incomplete), or W by term, Panel A. Percentage of all official grades that are D (D+, D), F and WU, CR, NC, I (incomplete), or W by term, Panel B.

GPA

The increase in As, Fig. 2, and conversion of Ds, Fs and WUs to NCs and Ws in S20 and F20 increased the average GPA from the normal 2.85 to 2.93 range to ~3.2, Figure 4A&B, over three standard deviations from normal. Note that unlike DFW rates, which only increased in F20 and were unaffected in S20, the average student GPA also increased to ~3.2 in S20. The increase in average GPA in S20 and F20 was because of the changes in grading policy. The changes in grading policy were designed to correct for expected student difficulties as a result of the pandemic and did their job in F20 when the large increase in DFW rates in F20 had little effect on the average student GPA compared to S20. In hindsight, the grading policy changes weren't needed in S20, as there was no increase in DFW rates, just a 10% increase in GPAs from the policy changes.

The policy changes were needed in F20 as otherwise the increase in the DFW rate would have dramatically lowered the average GPA and led to many more students being on academic probation in S21 or disqualified from the University. Thus, the grading policy changes prevented

some of the harmful effects of Covid-related changes on student's success, but also had the effect of helping students who would have normally struggled.

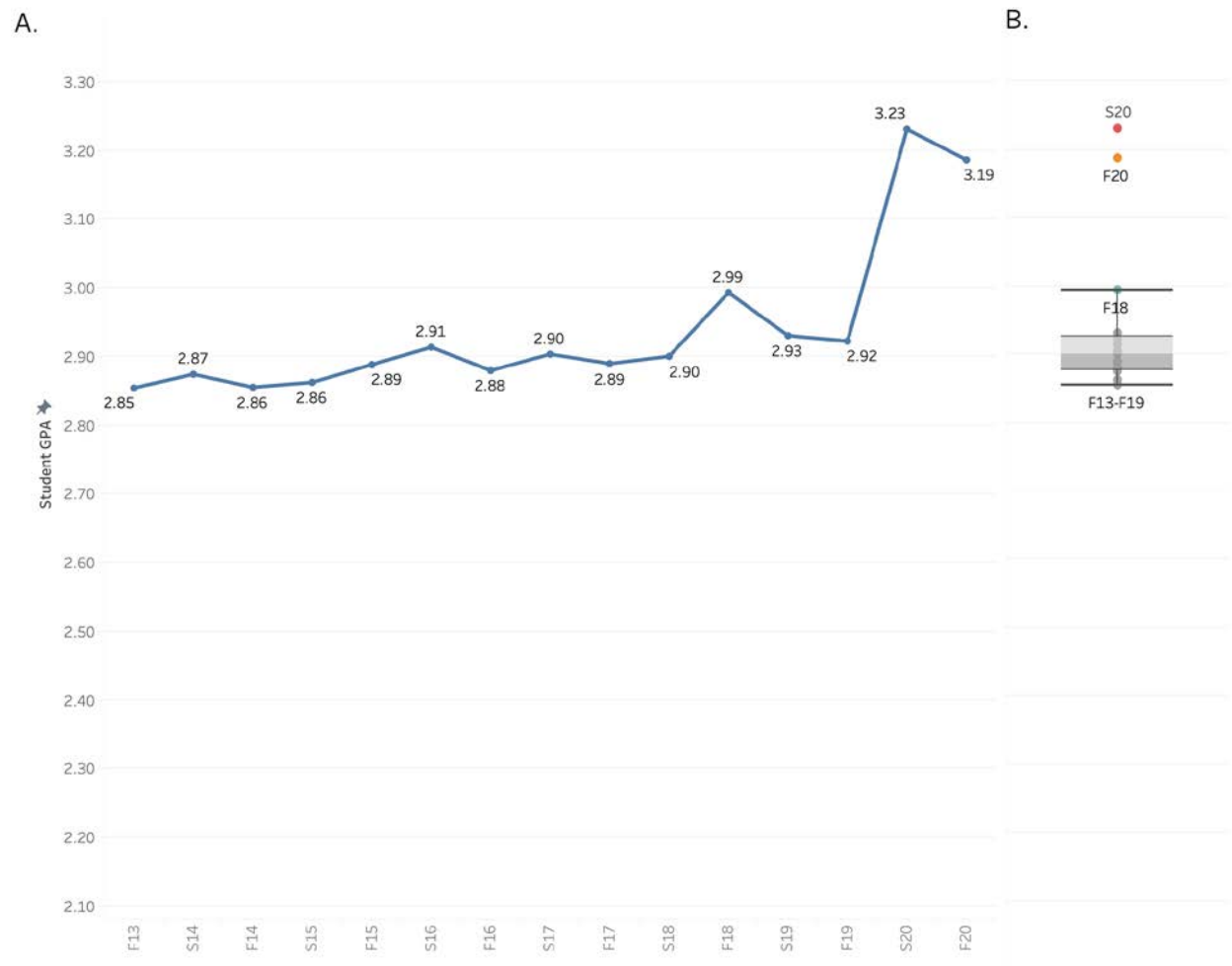


Figure 4. Average student GPA by term, Panel A, or in a Box plot, Panel B.

As the modified grading policies will be in place for at least one more semester, if not more, there will be other unexpected consequences, such as 50% more students on the Dean's list, more students qualifying for Honors and many scholarships, etc. As many efforts to track student success normally use GPA as a measure, the changes in grading policy will make comparisons with prior terms very difficult and GPA probably should not be used as a measure of student success for the S20, F20 or S21 terms.

Units Lost

While the grading policy changes more than compensated for the effect of the increased DFW rate on GPAs, another consequence of the higher DFW rate that wasn't compensated for was a decrease in units passed and an increase in units "lost" (units attempted minus units passed). The percentage of classes taken that did not result in the accumulation of units increased from 7% in F19 to 12% in F20, a 70% increase in classes taken that do not yield units toward graduation (data not shown). As a result, students attempted a typical 14 units in F20, however units lost

increased from an average of 1.3 in prior terms to 1.9 in F20, Figure 5A&B. As the typical class is 3 units, this 0.6 increase in units lost is from ~20% of students failing an additional course in F20 and losing 3 units. While the grading policy changes protected these students from a hit on their GPA, the loss of 3 units will delay at least some of their graduations, causing additional financial hardships several years from now. This is an underestimate of harm as some D grades do not count towards graduation (GE Area A, etc.) resulting in unusable units and classes that also must be repeated.

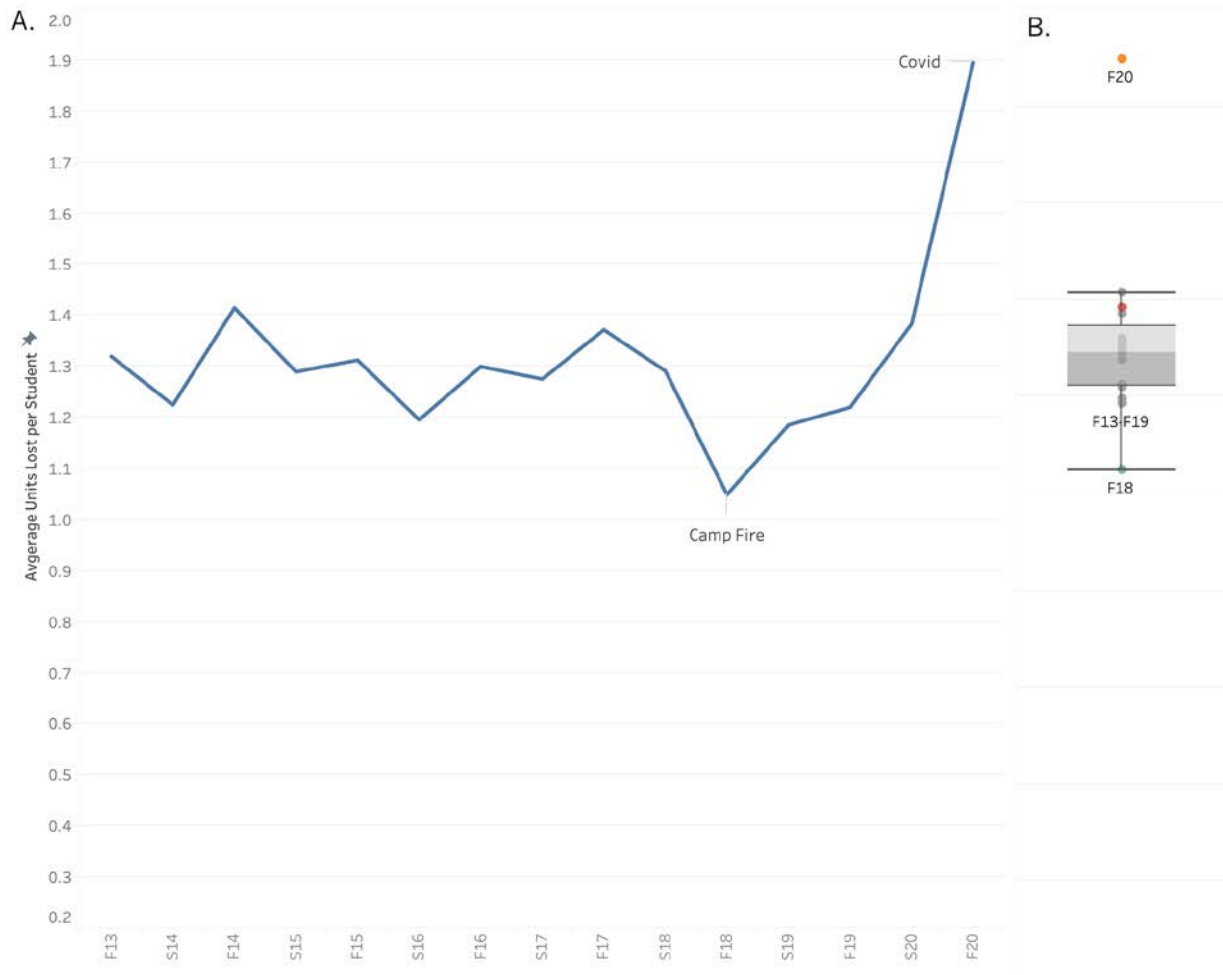


Figure 5. Average units lost per UG student by term, Panel A, or in a box plot, Panel B.

Part II: Identifying students most at risk from Covid-related changes in F20

Student Class Level DFW Rates

A population of students potentially at greater risk from Covid issues and the switch to online instruction are the youngest and least experienced learners, freshmen and sophomores. The first and most obvious result is that for all terms before F20 the DFW rate is highest for freshmen, averaging a DFW rate of 16.1%, and decreases for each class level with sophomores at 13.6%, juniors at 11.3%, seniors at 8.3% and post-bacc and grad students down at around 2%. This downward trend could be from a selection effect where students with poorer academic

performance are more likely to drop out or be disqualified as freshmen, and their absence in later levels leads to a lower percentage of students who get DFW grades. Another explanation could be that as students take more college classes, they get better at passing college classes. It is also possible that upper divisions classes are easier to pass than lower division classes due to smaller class sizes, better instruction, etc.

Figure 6 also shows that the Covid-related increase in DFW rates in F20 was much worse for the youngest students with DFW rates for freshmen students increasing in F20 by a large 48%, from 16.1% to 23.6%. Sophomores had almost as large an increase, going from a DFW rate of 13.6% to 19% in F20, a 40% increase in the DFW rate. Juniors had a smaller 33% increase, from 11.3% to 15%. Meanwhile seniors had their DFW rate increase by only about 29%, from 8.3% to 10.6% in F20, and post-baccalaureate and graduate students had no increase in their low DFW rates. Thus, as expected, the greatest harm to student success occurred amongst the youngest and least experienced students. As the post-baccalaureate and graduate students were not affected and have small numbers relative to the other levels of students, the rest of this analysis will use only undergraduate (UG) data.

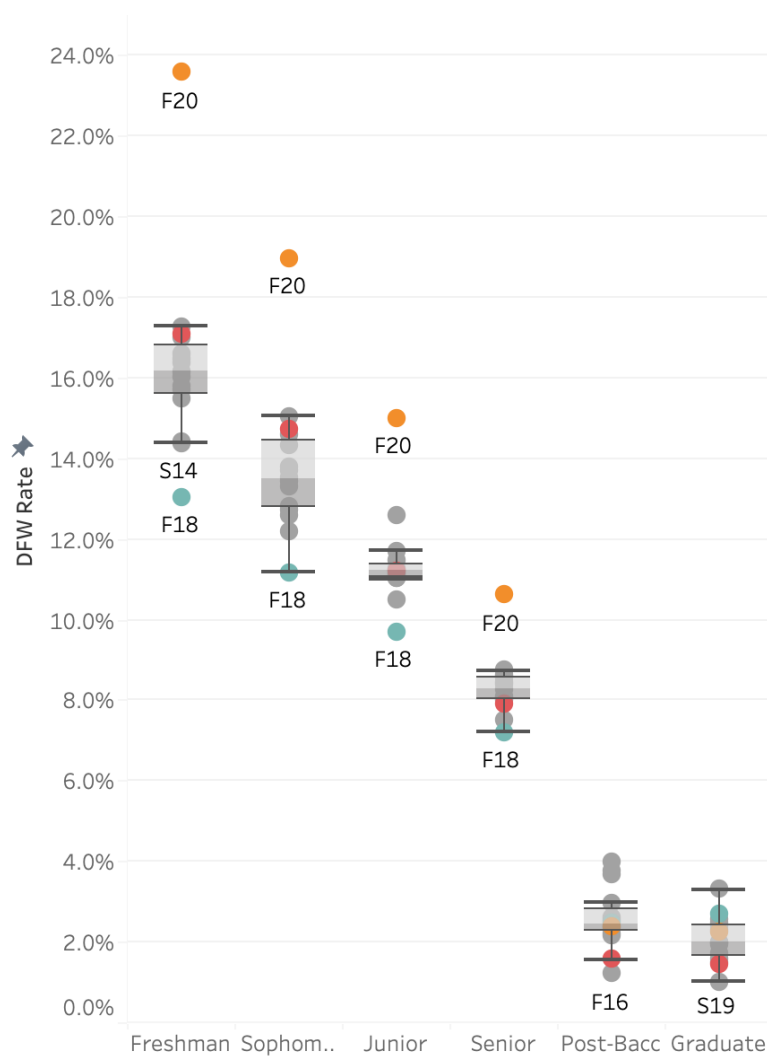


Figure 6. DFW rates for the F13 to F20 semesters by student level.

Under-Represented Minorities (URM) DFW Rates

As it is possible that Under-Represented Minority (URM) students will have more difficulty in the new online environment either due to more technology issues (low bandwidth at home, no computer access, etc.) or home and work environments that make taking online courses more challenging, Figure 7 shows a comparison of changes in the DFW rate for URM and non-URM undergraduate students between prior terms and the F20 term. From F13 to S20 non-URMs had an average DFW rate of 10.2% while URMs had a 14.3% rate, a 4.1 percentage point equity gap, so URM's were 41% more likely to get a DFW grade than non-URM students. This DFW equity gap is a primary driver of the equity gap in graduation rates (see "[Analysis of dismissal and dropout rates for the 2009-2011 first time freshmen cohorts](#)"). In F20 the non-URM DFW rate increased to 13.3%, a 3.1 percentage point increase and a 30% relative increase of the DFW rate, while for URMs the DFW rate increased to 19.6%, a 5.3 percentage point increase and a 37% relative increase. This increased the URM DFW equity gap from 4.1% to 6.3%, a 54% increase in the size of the gap. This large increase in the DFW equity gap is likely to significantly increase the graduation equity gap over the next several years, especially if this pattern continues for the next couple of semesters.



Figure 7. DFW rates for the F13 to F20 semesters by URM and non-URM status.

DFW Rates by Student Level and URM status

While some of the URM DFW gap is due to the class level gaps as URM students make up a higher percentage of Freshmen and Sophomore students than of Junior and Senior students, the class level and URM gaps are fairly independent, Figure 8. As a consequence, the DFW rate for freshmen URM students was over 27% in F20, up 8 percentage points from the average of 19% in prior terms, and 36% greater than the 20% DFW rate for non-URM freshmen. Note that even senior URM students suffered a 50% larger increase in DFW rates than senior non-URMs, though it was only a three-percentage point increase in DFW rates compared to the two-percentage point increase for non-URMs. Thus, the ~40% equity gap in DFW rates between non-URMs and URMs does not change as students age and become more experienced at taking college classes and increased to over 50% at all class levels in F20.

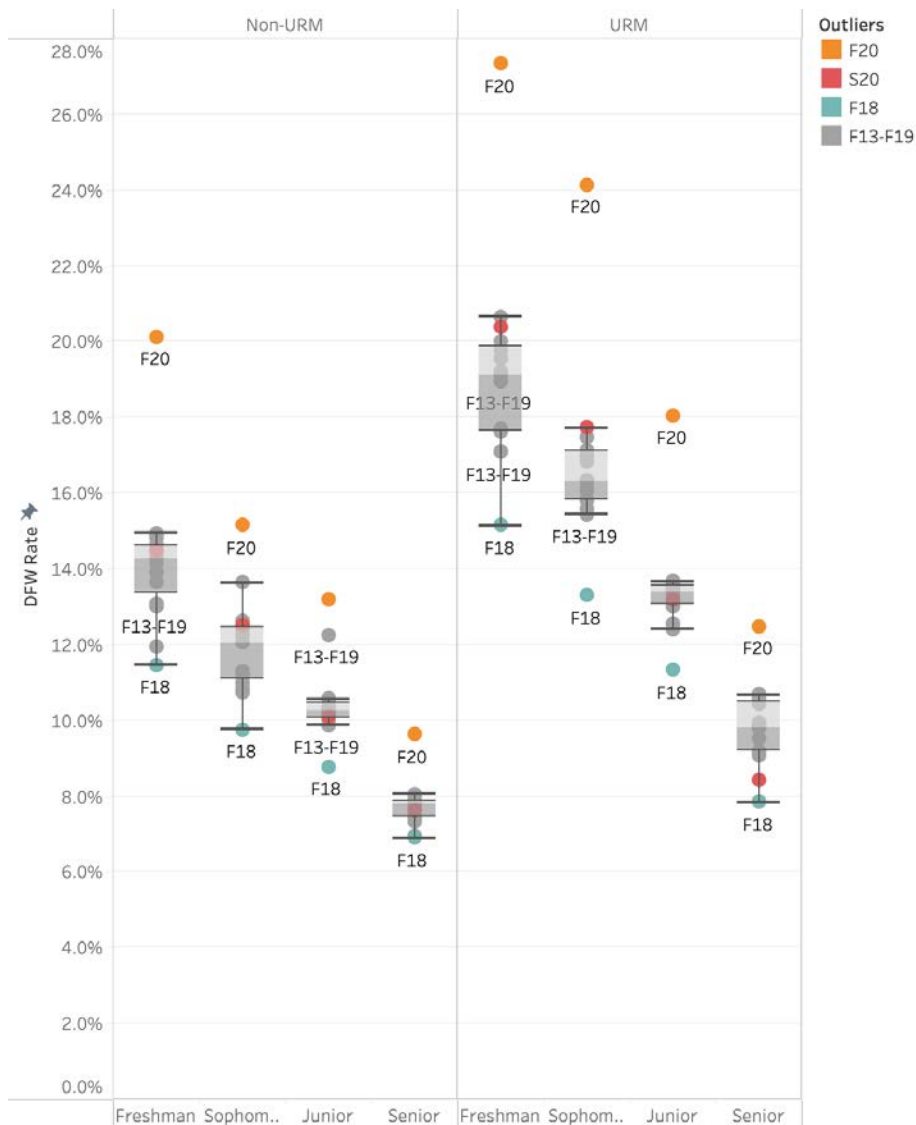


Figure 8. DFW rates for the F13 to F20 semesters by URM and non-URM categories for each UG class level.

URM and Student Level Units Lost

Figure 9 shows the major impact the increased DFW rate in F20 had on the number of units students lost (units attempted minus units passed), especially for freshmen and sophomore URM students. Non-URM freshmen and sophomores averaged 0.8 and 0.6 more units lost in F20, respectively. As would be predicted from their higher DFW rate in F20, the damage was greater for URM students, with freshmen URM going from losing an average of 2.7 units in prior semesters to losing 3.6 units in F20, 0.9 more units lost, increasing the gap in units lost between non-URM and URM to one unit in F20. There was a similar increase to a one-unit gap between non-URM and URM units lost for sophomores. Again, as would be expected from the DFW rate differences between levels (see Fig. 5), the units lost gap was smaller for juniors and seniors, 0.6 and 0.3 more units lost in F20, but increased ~50% over the gaps in prior terms. While the average loss of an extra one-unit for freshmen and sophomores is spread over ~2,500 URM freshmen and sophomores, this was more likely ~800 freshmen and sophomore URM students losing 3 units each. If the same thing happens in the spring semester it is likely that many URM students will have lost six units or more, easily delaying graduation by a semester. This will reduce graduation rates and increase equity gaps, along with adding to many students debts when they do graduate.

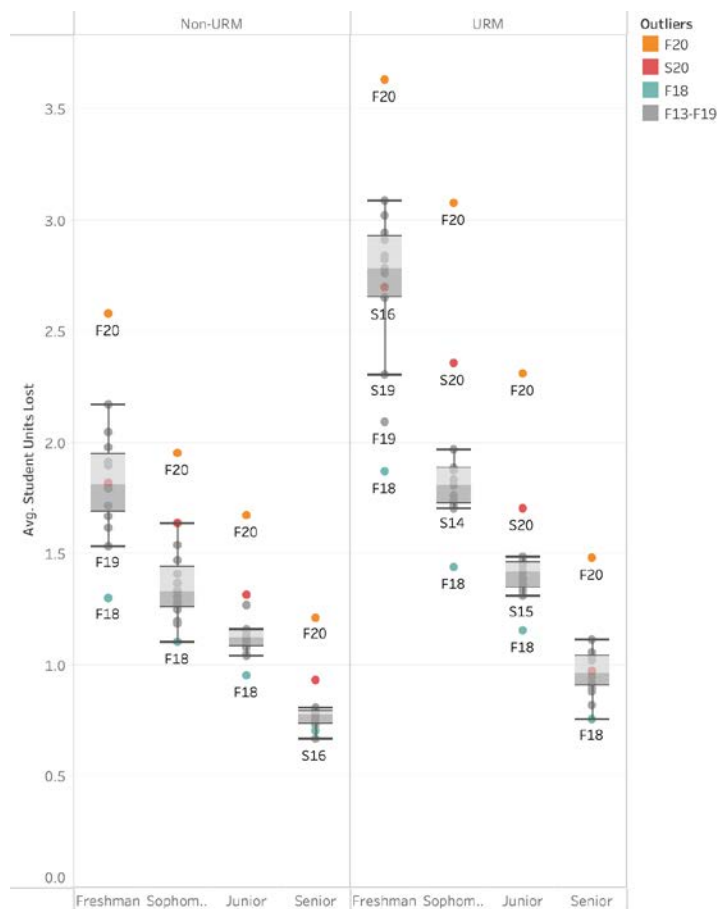


Figure 9. Average units lost per student in a term by URM and Student Level.

Ethnicity DFW Rates

Looking at the various ethnic groups within the URM and non-URM categories shows some real differences between the ethnic categories, Figure 10. Within the URM population, the black students had both a much higher DFW rate of 19.5% before F20, and a larger increase to 29.9% in F20, a 10.4 percentage point increase and a 53% increase in the DFW rate, than the LatinX students. As the LatinX students make up over 90% of the URM category, the LatinX DFW rates are basically the same as the URM rates, with an ~14% DFW rate in prior terms and an increase to 19% in F20. Native American DFW rates are based on small samples sizes, ~60 students per term, and vary greatly term to term, but appear to be similar to the LatinX rates.

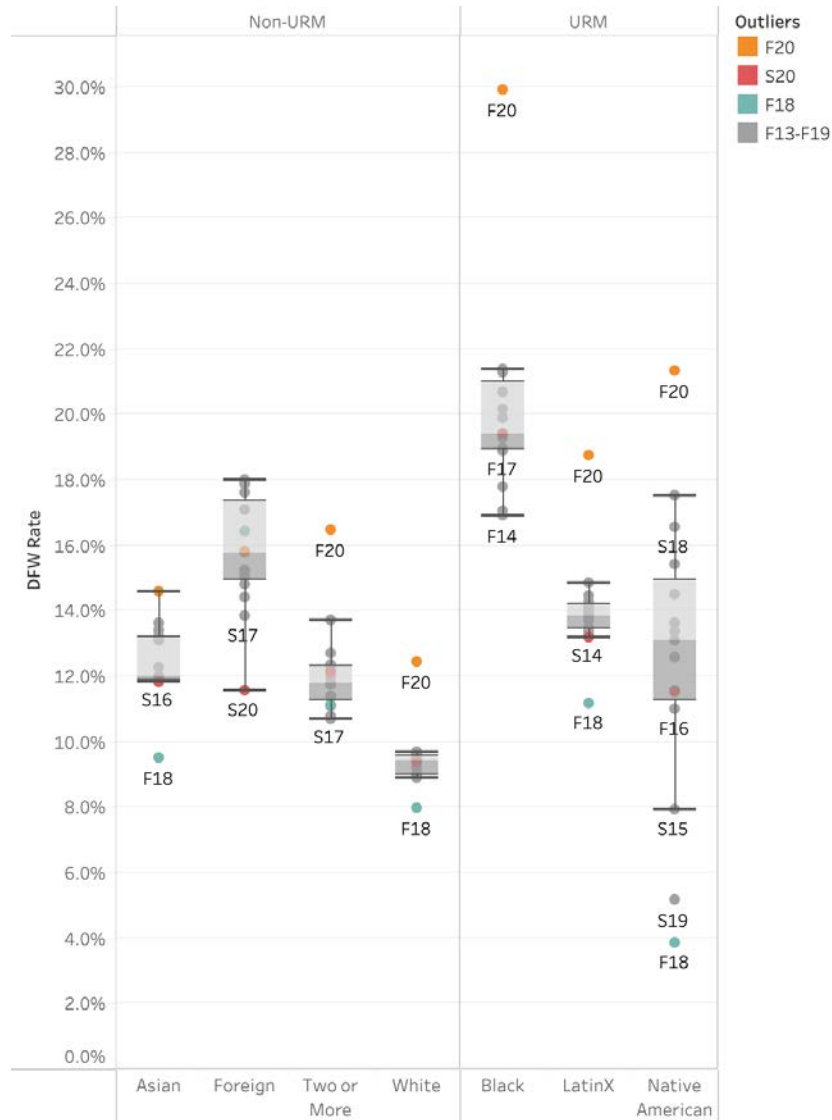


Figure 10. DFW rates by term for the ethnicities in the URM and non-URM ethnic categories.

Interestingly, while having higher overall DFW rates than the white students, the Foreign and Asian students that also make up the non-URM category had no significant increases in DFW rates in F20. White students saw their DFW rate increase by 3.2 percentage points, from 9.3% to 12.5% in F20. Thus, the ethnic groups most affected by the Covid driven changes in Fall 2020

were black and LatinX, while foreign and Asian students were the least affected by Covid-related effects. Despite a 33% increase in DFW rates for white students in F20, the DFW rates for white students were still less than the normal rates for all the other ethnic groups, and they increased less in F20 than any of the URM groups, so the equity gaps between the white students and the various URM ethnicities all increased in F20.

First Generation (FGEN) DFW Rates

Another population of students that might be expected to struggle under the Covid conditions are First-Generation (FGEN) students. There is a small 0.8 percentage point difference between the non-FGEN DFW rate of 11.1% and the 11.9% rate for FGEN in prior terms and the gap increased greatly in F20 as the DFW rate for non-FGEN increased by only 3.5 to 14.6% while for the FGEN it increased by 5.5 to 17.4%, Figure 11A. As there is significant overlap between the URM and FGEN populations, Figure 11B shows the DFW rates by term for First-Generation and URM status for the F13 to F20 terms. Interestingly, when separated out by URM or non-URM status there is no gap between non-URM FGEN, 10.2%, and non-FGEN, 10.0%, DFW rates in the prior terms, Figure 11B. Nor is there a gap between URM FGEN, 13.9%, and non-FGEN, 14.2%. The FGEN gap seen when URM status is not accounted for is a result of the FGEN population having a much higher proportion of URMs, 46% URM, with their ~4 percentage point higher DFW rate, then the non-FGEN population, only 27% URM (data not shown).

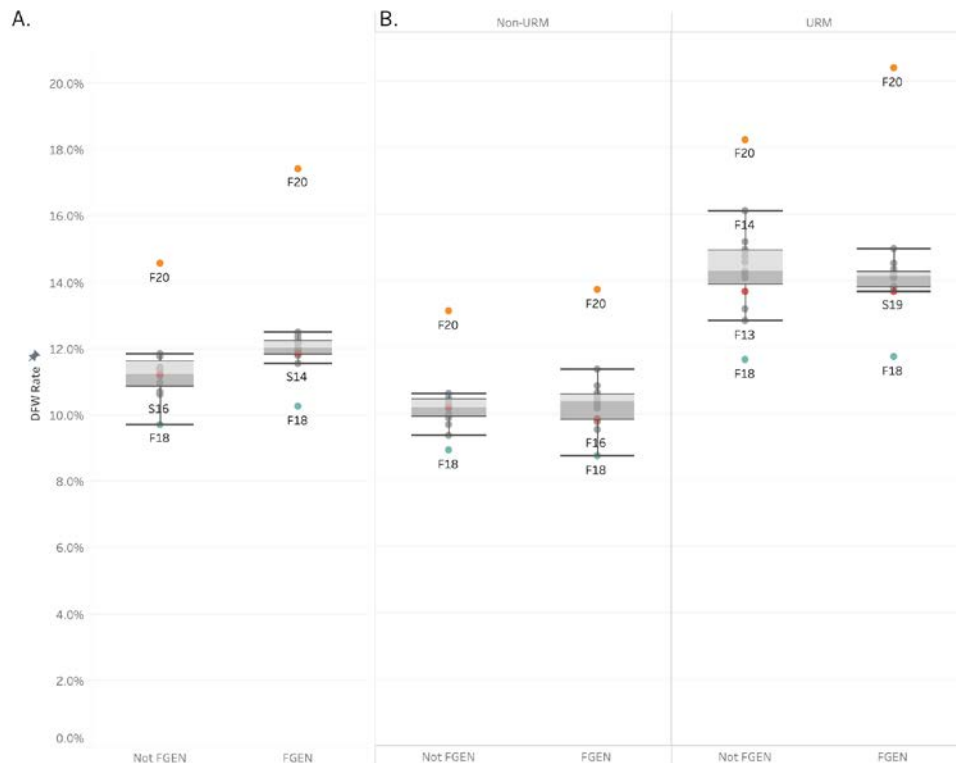


Figure 11. DFW rates for the F13 to F20 Semesters by term and First Generation (FGEN) status, Panel A, and by term, First Generation (FGEN) status and URM status, Panel B.

In F20 the URM and FGEN population suffered a much larger increase in DFW rates than the other groups, increasing from 13.7% to 20.4%, a large 6.7 percentage point increase and a relative increase of 49%. While not as dramatic, the non-FGEN URM also suffered a larger increase in DFW rates than the non-URMs, even though there was little difference between FGEN and non-FGEN in the smaller DFW rate increase for non-URMs. Why URM FGEN were more negatively impacted by the Covid changes than URM non-FGEN while non-URM FGEN had only a slightly (0.4 percentage points) larger increase than non-URM non-FGEN is unknown.

Chico Service Area DFW Rates

Similar to First Generation students, it is possible that students from outside the Chico Service Area (the local counties of Butte, Colusa, Glenn, Lassen, Modoc, Plumas, Shasta, Siskiyou, Suter, Tehama, Trinity, and Yuba) would struggle more during the pandemic if distance from campus exacerbates the issues with online learning. Figure 12A shows that in prior terms the 11.7% DFW rate for students from out of the service area was about 1.1% higher than the 10.6% rate for students from the Chico area. In F20 this gap tripled to a more than a three-percentage point difference as the DFW rate increased to 16.7% for the out of area students but to only 13.2% for the Chico Service Area students.

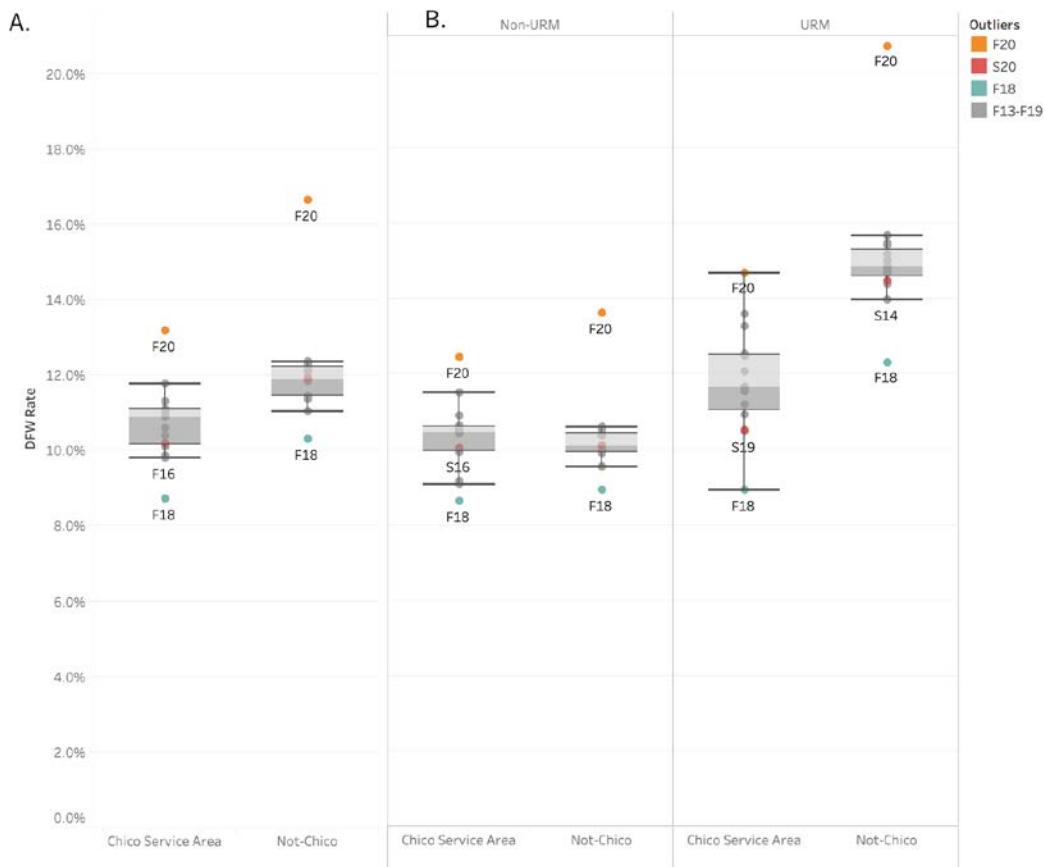


Figure 12. DFW rates by term and student origin, Panel A, or by term, student origin and URM status, Panel B, for the F13 to F20 Semesters.

While there is a difference in the proportion of URM students between the Chico Service Area, 27% URM (data not shown), and the students from outside the area, 37% URM, splitting out the URM students from the non-URM shows that all of the difference in DFW rates between in area and out of area comes from the URM students, not from the non-URM, where there is no difference in DFW rates in the prior terms and only a small 1.1 percentage point difference in F20, Figure 12B. There is over a three-percentage point difference in URM DFW rates between Chico area, 11.6%, and out of area, 14.7%, in prior terms and this doubled to a six-percentage point gap with a URM DFW rate of 14.7% for Chico area students and 20.8% for out of area URM students. Why URM students were so much more adversely impacted by coming from out of area, and why the Covid-related change in F20 made this so much worse, is unknown.

Gender and DFW Rates

Prior research has shown that there is a strong gender effect on DFW rates, however Figure 13 shows that the gender gap, unlike the URM equity gap, was unchanged by the increase in DFW rates in F20. Prior to the F20 term female students had an average DFW rate of 9.6% while the male students DFW rate of 13.9% was 4.3 percentage points higher, similar to the 4.1 percentage point URM gap. In F20, the female DFW rate increased by 4.3 percentage points to 13.9% and the male rate increased by 4.2 percentage points to 18.1%, thus the gender equity gap decreased by 0.1 percentage points to 4.2 percentage points, essentially the same as before. This suggests that the increase in the DFW equity gap for URM students in F20 was not driven by the Covid changes having a greater effect on poor performing students, as male students, who, on average, have similar success rates to URM students (13.7% male DFW rate vs 14.3% for URM in prior semesters), had “only” a 4.2 percentage point increase while URM students had a 5.4 percentage point increase, Fig. 6. As the gender and URM effects on DFW rates are independent and additive to all of the variables examined here (data not shown) and did not change in F20, you can get the male DFW rate by adding two percentage points to the DFW rate for a group, and the female rate by subtracting two percentage points.

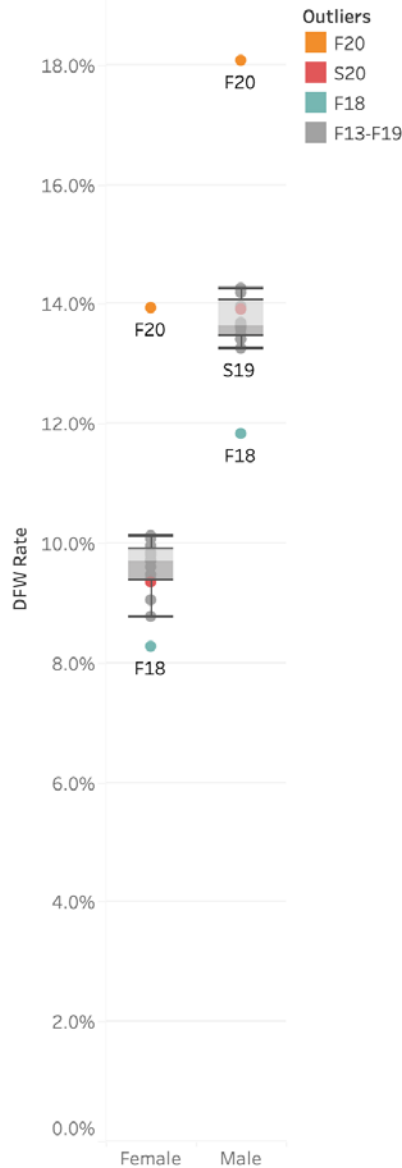


Figure 13. DFW rates by term for females and males for the F13 to F20 semesters.

Part III: Identifying Course Characteristics correlated with greater decreases in student success

Course Level DFW Rates

As would be expected from the high DFW rates for freshmen and sophomores, lower division courses (LD) had a much higher DFW rate of 14.9% in prior semesters and 19.8% in F20 compared to upper division (UD) DFW rates of 8.2% in prior semesters and 12.3% in F20, Figure 14A. While the sample size for pre-collegiate courses is small (702 grades in F20), the very large increase in DFW rates to over 27% in F20 suggests that there may have been some specific issues in those courses, though this may also be a result of the recent EO 1110 mandated changes. While student composition explains some of the 6.7 percentage point LD to UD DFW

gap in prior semesters and the 7.5 percentage point DFW gap in F20, most of the gap is from some other difference between LD and UD classes, Figure 14B.

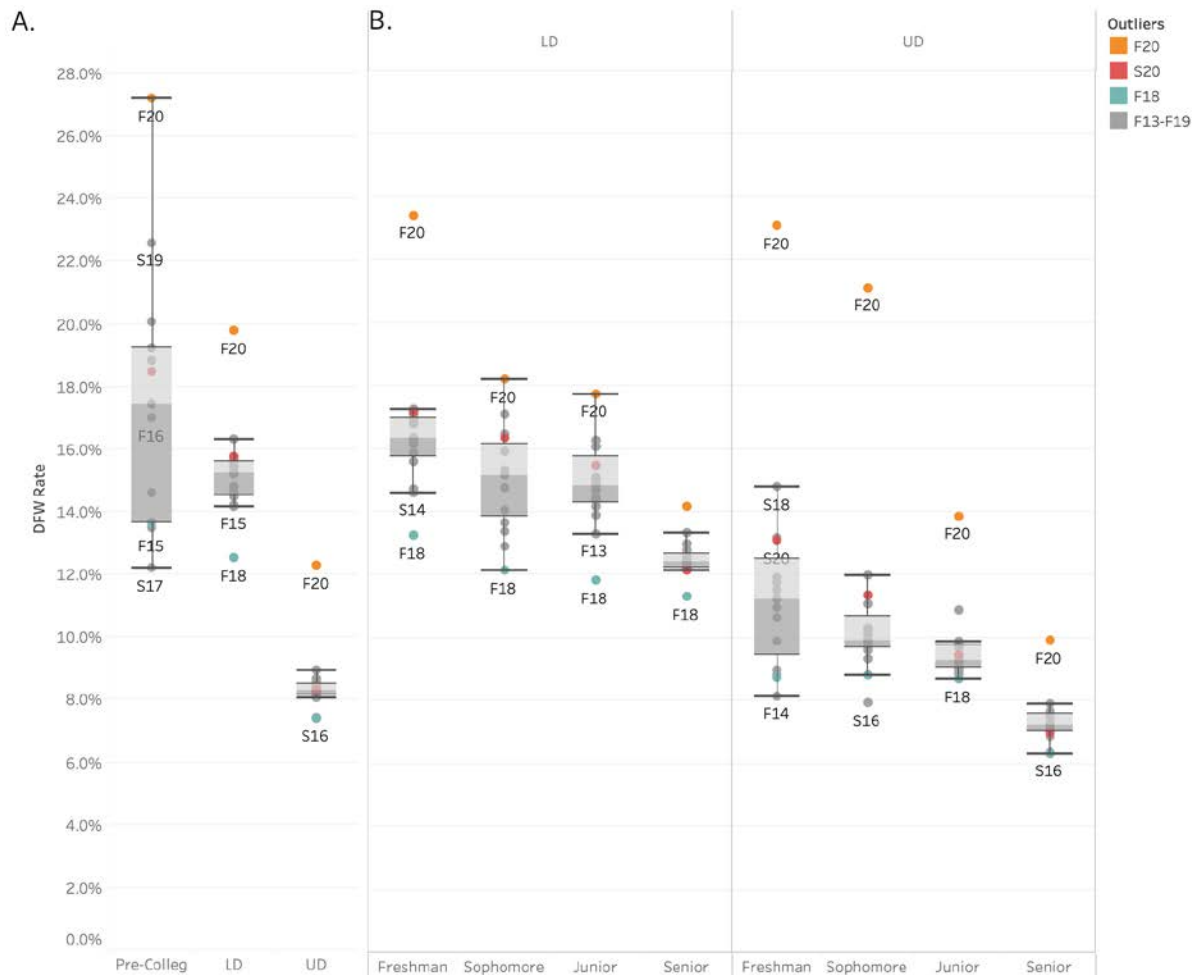


Figure 14. DFW rates for the F13 to F20 semesters by term and course division, Panel A, or by term, course division and student class level, Panel B.

Course Level and Student Level Effects on DFW Rates

While it would be expected that seniors would have a lower DFW rate in LD classes than in UD classes, they actually have a DFW rate of 12.4% in LD classes and 7.1% in UD classes in prior semesters, so they do 5.3 percentage points worse in LD classes, and 14.2% vs 9.9% in F20, so the gap shank in F20 to “only” 4.3 percentage points, Figure 14B. This five-percentage point poorer performance in LD classes is true for all academic levels and explains most of the 6.5 percentage point difference in DFW rates between LD and UD classes, Figure 14A. This suggests that the primary reason for the higher DFW rate in LD classes is some other factor besides student composition. This also implies that much of the higher DFW rate for freshmen ($5.3/6.5 = 82\%$), though not all, is because they are taking almost all LD classes, 96% normally and 98% in F20, and not because of any characteristic of freshmen.

However, we do see again that freshmen and sophomores were much more strongly affected by the changes in F20, with DFW rates for freshmen soaring above 22% in both LD and UD classes, up by as much as 11 percentage points in UD classes, while seniors were affected much less, suffering only an approximately two-percentage point increase in DFW rates in both LD and UD courses. The relatively larger increase in UD classes for freshman and sophomores caused the DFW gap between LD and UD classes to shrink in F20 for freshman, and even reversed for sophomores, suggesting that the Covid related changes had a greater effect on freshman and sophomore success in UD classes. This is might be due to part of the UD classes advantage coming from smaller class sizes, a less important factor in the online instruction environment of F20 (see Figure 16). However, freshman and sophomores were less likely to take UD classes in F20, while juniors and seniors were less likely to take LD classes (data not shown), so the DFW gap between LD and UD classes increased despite this.

Online DFW Rates

One key difference between classes in F20 and prior semesters was the switch to all online instruction, either synchronous or asynchronous. In prior terms the small amounts of online instruction, up to 11.9% by S20, had about a one percentage point higher DFW rate than in person, 12% vs 11%, Figure 15A, however this is an artifact of three times as many seniors, with their low DFW rates, taking online courses than freshmen (data not shown), with their high DFW rates, Figures 6, 8B and 15B. Broken out by student level, students in online courses in prior terms had DFW rates ~2 percentage points higher than students at the same student level in FTF classes, twice as big a gap as seen if student level is not used, Figure 15B. Thus, approximately half the four-percentage point increase in DFW rates in F20, Fig. 1, can be explained by the switch to 98% online instruction in F20. While the DFW rate for seniors in online courses in F20 increased by only 2.4 percentage points from the rate in prior terms, the younger the students the bigger the increase in the DFW rate in F20, with the maximum increase being the 8-percentage point increase for freshmen. Thus, all of the F20 increase in DFW rates for seniors can be explained by the switch to online instruction—the senior online DFW rate in F20 is within the normal range of online rates from prior terms, Figure 15B, but the large increase for freshmen was a combination of factors, including the switch to online instruction.

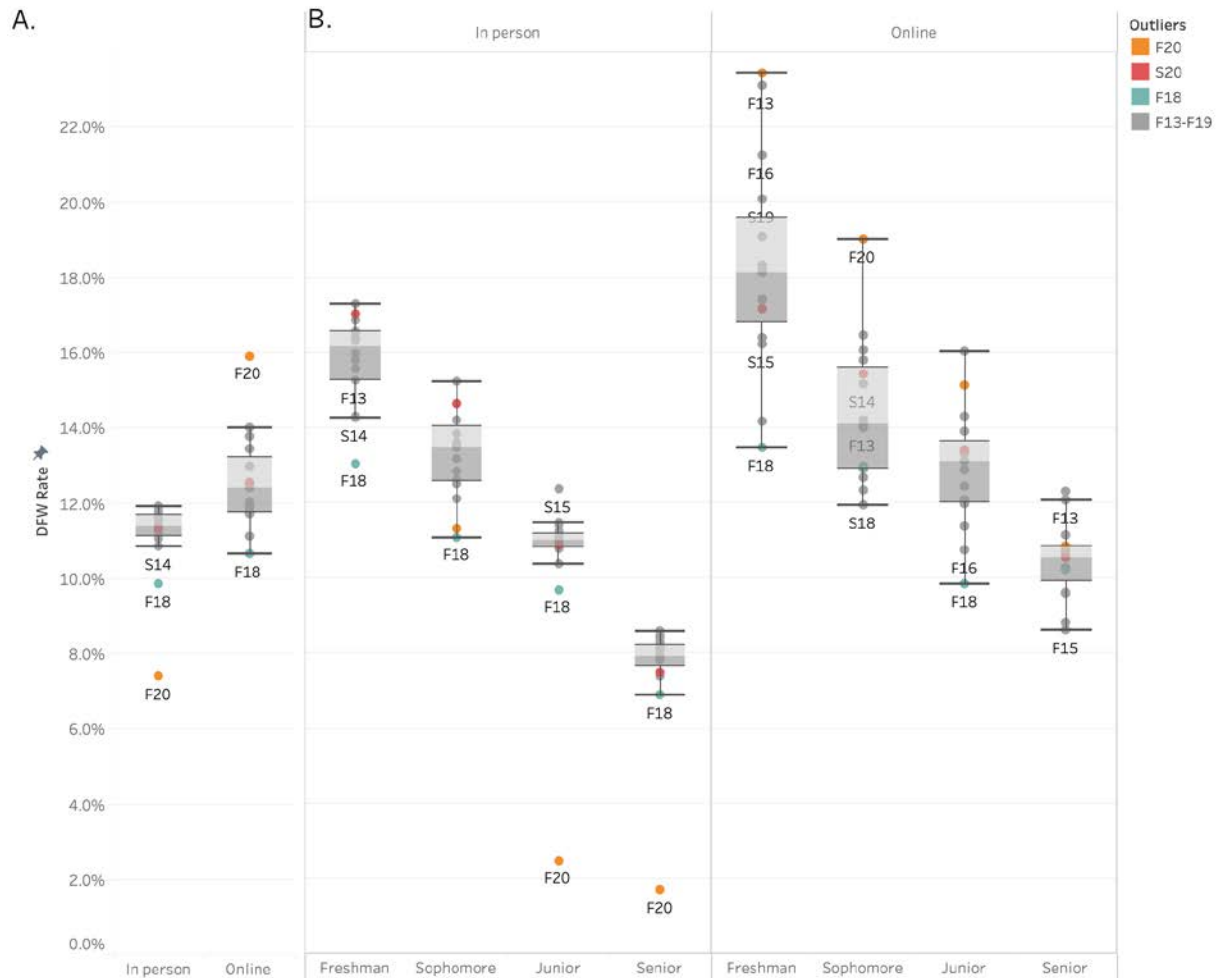


Figure 15. DFW rates for the F13 to F20 semesters by term and online instruction, Panel A, or by term, online instruction and student class level, Panel B. The In-person DFW rate of 45% for freshmen in Fall 2020 not shown due to too small a sample size.

Class size and DFW Rates

While a previous analysis of the effects of class size on student success found that, unlike in-person classes, DFW rates in online classes are not affected by class size except for the smallest classes (see Fig. 7 in “[Analysis of DFW Rates for the Fall 2013- Spring 2017 CSU Chico Classes](#)”), that was with a much smaller sample size and with experienced online instructors. Figure 16 shows that in F20 there was also little effect of online class size on DFW rates except for classes with enrollments less than 20, as had been observed before. This was true for both synchronous and asynchronous teaching modes (data not shown, but see Fig. 17 for the general lack of effect of synchronous vs asynchronous). As DFW rates for both LD and UD classes are independent of class size, the higher DFW rates in LD classes are not a consequence of their larger class sizes, they have much higher DFW rates (~7 percentage points) at the same class size as UD for all class sizes, Figure 16.

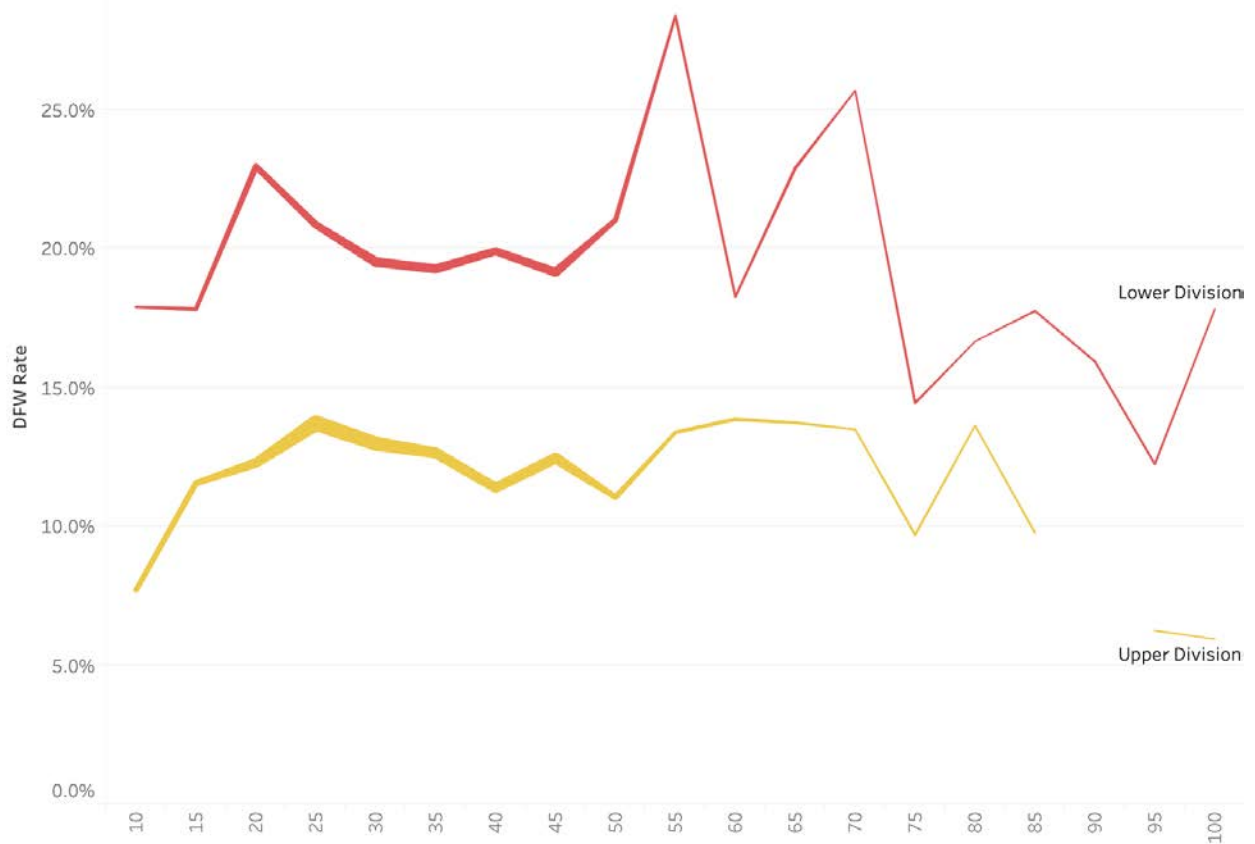


Figure 16. Comparison of DFW rates in F20 by online class size and class level. Each class size bin includes that class size and all larger class sizes up to the next bin – “10” is classes of size 10-14, “15” is 15-19, etc. The thickness of the line represents the number of grades from >6,000 for the thickest to ~200 for the thinnest line segment.

Synchronous and Asynchronous Online

Anecdotal evidence from faculty suggests that students were struggling more with asynchronous online classes in F20 than with synchronous online classes. A direct comparison of synchronous and asynchronous online classes in F20 finds similar undergraduate DFW rates of 15.7% and 15.3%, Figure 17, with synchronous actually having the higher DFW rate. However, when broken out by class level asynchronous online classes have an 0.4 percentage point higher DFW rate than synchronous, 20.0% vs 19.6% in LD, while asynchronous has an 0.5 higher DFW rate in UD classes, 12.4% vs 11.9%. The reason that all classes combined show a decreased rate for asynchronous vs synchronous is because a higher percentage of the synchronous classes, 48%, were LD classes, with their very high DFW rates, while only 38% of the asynchronous grades were from LD classes, lowering the overall DFW rate for asynchronous. Thus, students did better in synchronous classes, but the effect is small and easily overwhelmed by other factors, such as the increased difficulty of LD classes.

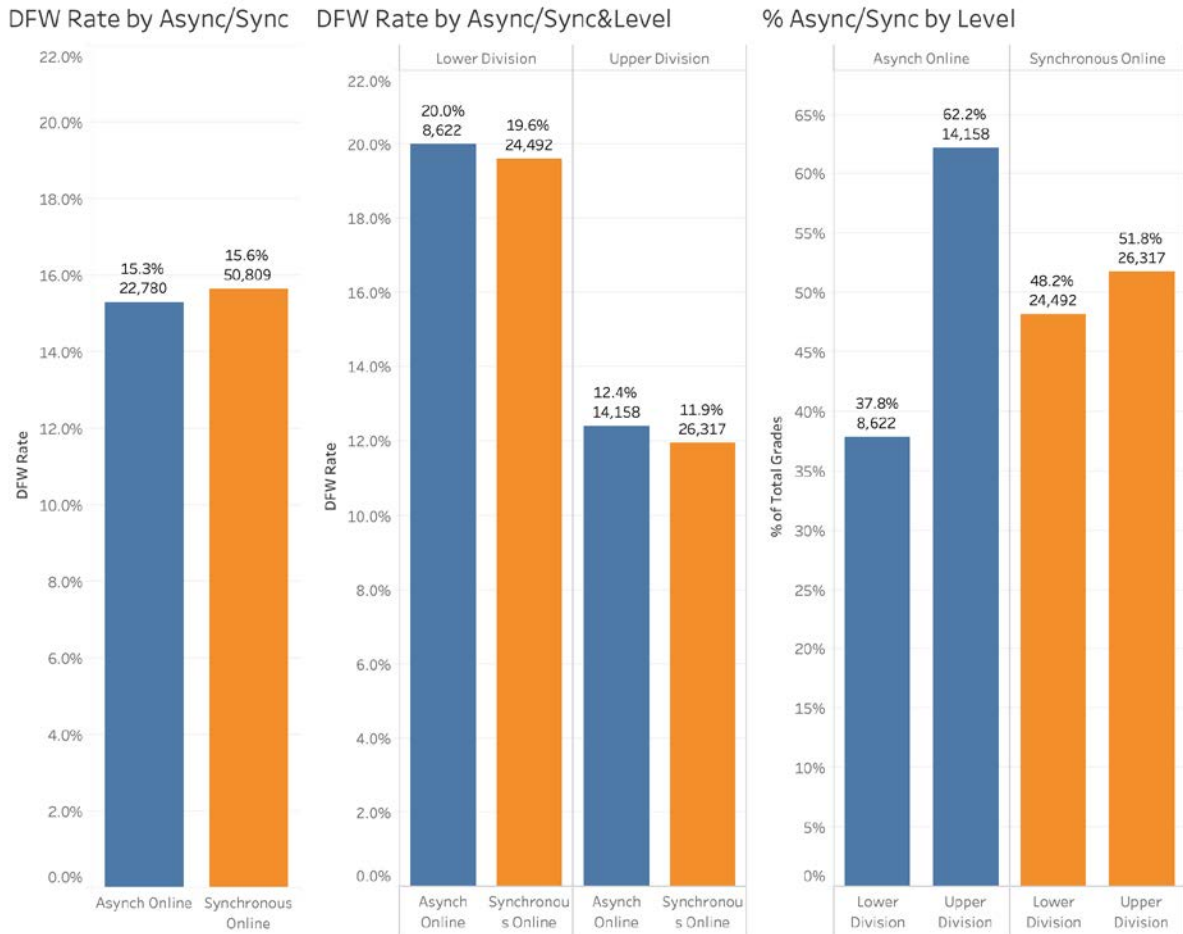


Figure 17. Comparison of DFW rates in Fall 2020 for synchronous or asynchronous online classes by class level. The panel on the right shows the percentage of instruction in the different modes and levels. Numbers above the bars represent the total number of grades in each category, the DFW rate in the two left panels, and the percentage of grades by level.

General Education Foundation Courses and DFW Rates

As freshmen struggled the most in Fall 2020 and one common element in their instruction is the GE foundation courses, the DFW rates for the foundation courses are compared to non-foundation LD courses, Figure 18. Interestingly, there were much larger increases in DFW rates for the two communication foundations, oral and written, with DFW rates for both increasing by over six percentage points relative to their prior term rates, than for the other foundation categories or other LD courses. Surprisingly, F20 DFW rates in the other four foundation areas were within the range of prior terms with two, quantitative reasoning and the life sciences, even below the mean for that area. The other common factor between the foundation areas with little or no increase in DFW rates in F20 was that they all had above average DFW rates in the prior terms. Why the switch to online and other Covid effects would make courses students were doing well in so much more challenging while not making courses students already struggled with any more difficult is puzzling.

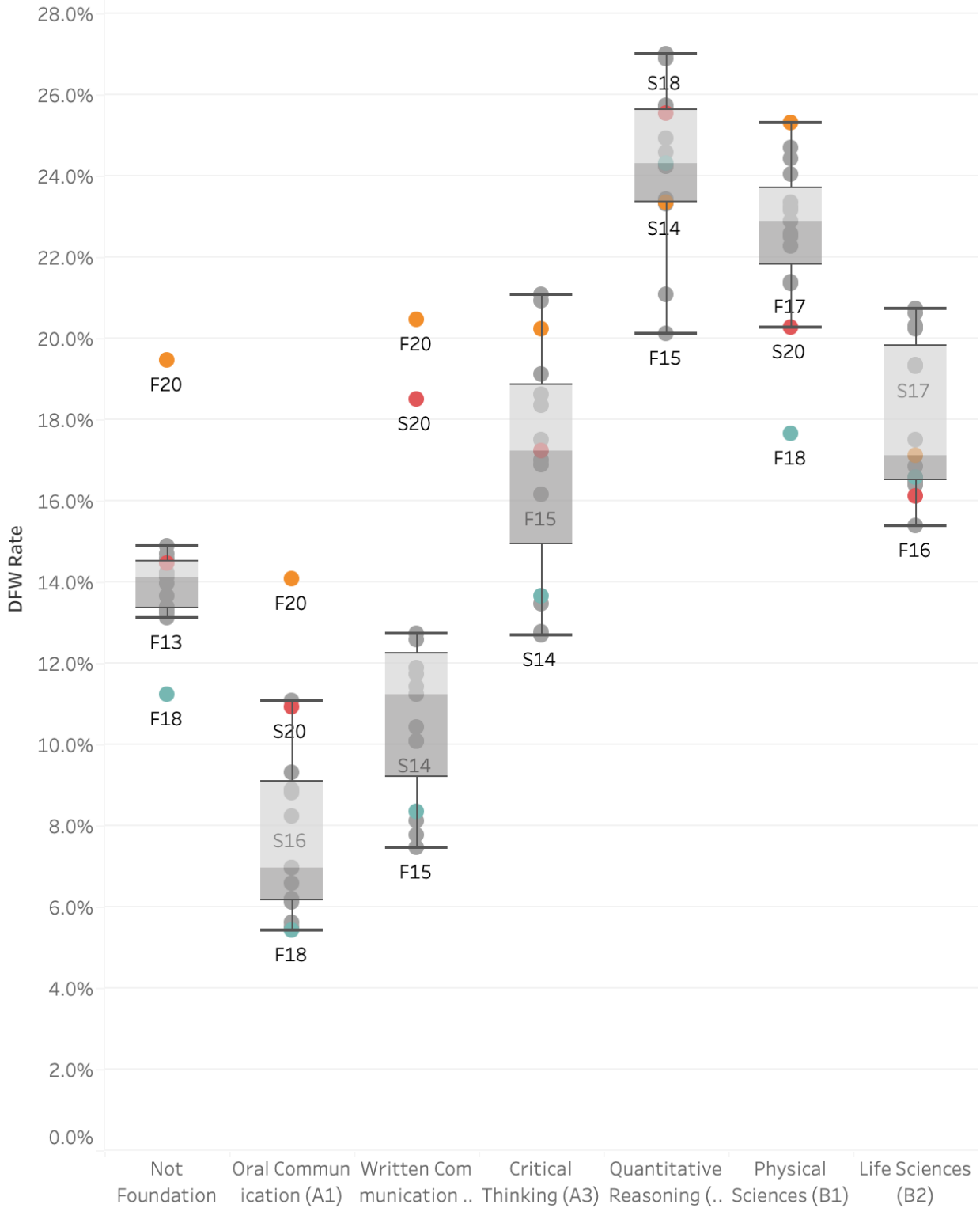


Figure 18. Lower Division DFW rates for the F13 to F20 semesters by semester and GE Foundation area.

As the differences between the changes in DFW rates in F20 for the GE Foundation areas suggests that some subjects might be more amenable to online instruction, or that faculty in

particular fields might have been better prepared for the switch to online instruction, or that already difficult courses did not become more difficult when moved online, etc., the changes in DFW rates in F20 for colleges and departments were compared. Figure 19 shows that at the college level there were similar increases of four to six percentage points in DFW rates in F20 for all the colleges except for Natural Sciences (NS), which had only a one-percentage point increase in DFW rates in F20, within the normal variation. This was especially surprising as NS teaches a high percentage of freshmen, the most vulnerable population, and is heavily dependent on lab experiences that would not be expected to translate well to an online environment. Even if the GE foundation courses are removed, NS still had a well below average two-percentage point increase in DFW rates in F20. While NS also had the highest normal DFW rate, 17.1%, Engineering (ECC), the college with the next highest normal DFW rate, 13.4%, had a large increase in F20 to 18.6%, the highest DFW rate for any college in any term. Business (BUS) and Undergraduate Education (UED) where the next two colleges with low increases in F20 DFW rates, up ~three-percentage points, yet they normally have average or below average DFW rates. Thus, the simple hypothesis that the pre-Covid degree of difficulty of a course determined how much the DFW rate went up in F20, with larger increases the easier the course pre-Covid, does not seem to be correct.

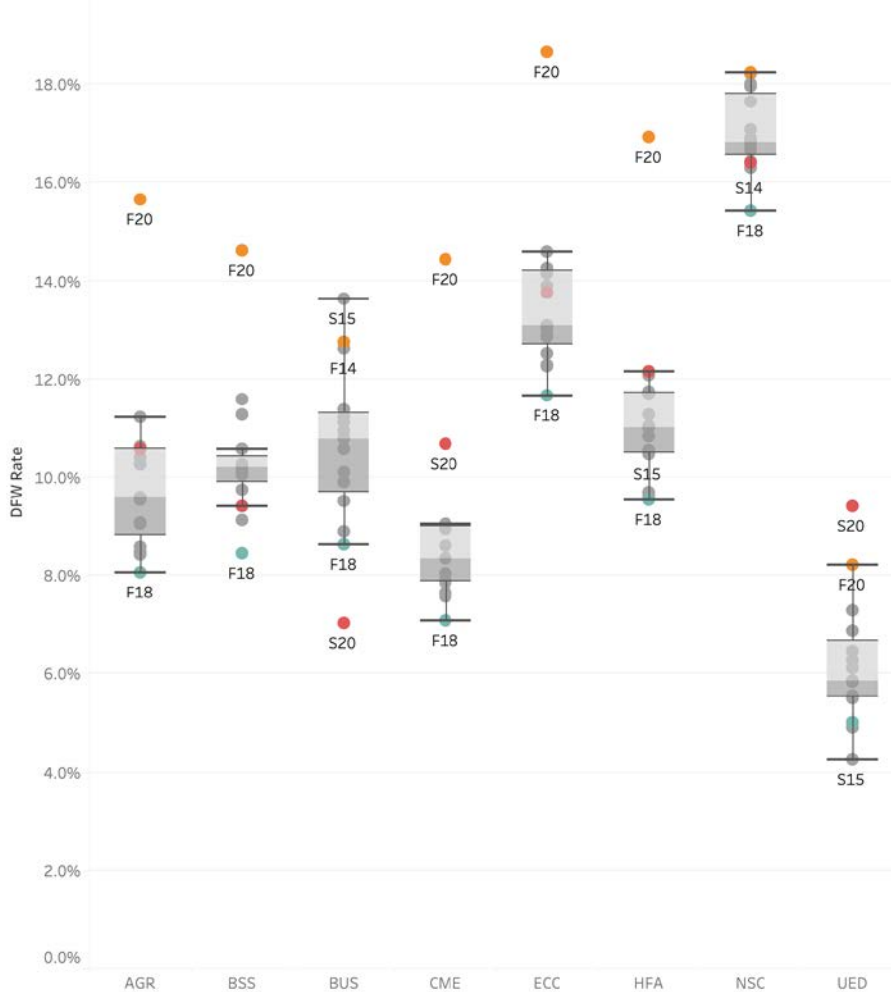


Figure 19. DFW rates for the F13 to F20 semesters by semester and College.

Looking at individual departments, Biology (BIOL) and Physics (PHYS) were the only two departments that significantly reduced their DFW rate in F20, by two and four-percentage points, respectively, and Chemistry (CHEM) and Nursing (NURS) were two of only three departments in the University with no change in their DFW rate compared to prior terms, with Accounting (ACCT) as the only other department with no increase in F20, Figure 20. Comparing their normal DFW rates to the increase in F20 shows that there is no significant correlation between a department's prior DFW rate and the increase caused by Covid-related changes in F20, $R^2=0.09$ and $p>0.05$. Why some departments had large increases in DFW rates while others had little change is unknown and probably has to do with a random mix of different faculty approaches to instruction during the pandemic. Thus, that NS had so many departments with unaffected or reduced DFW rates in Fall 2020 is most likely a random event.

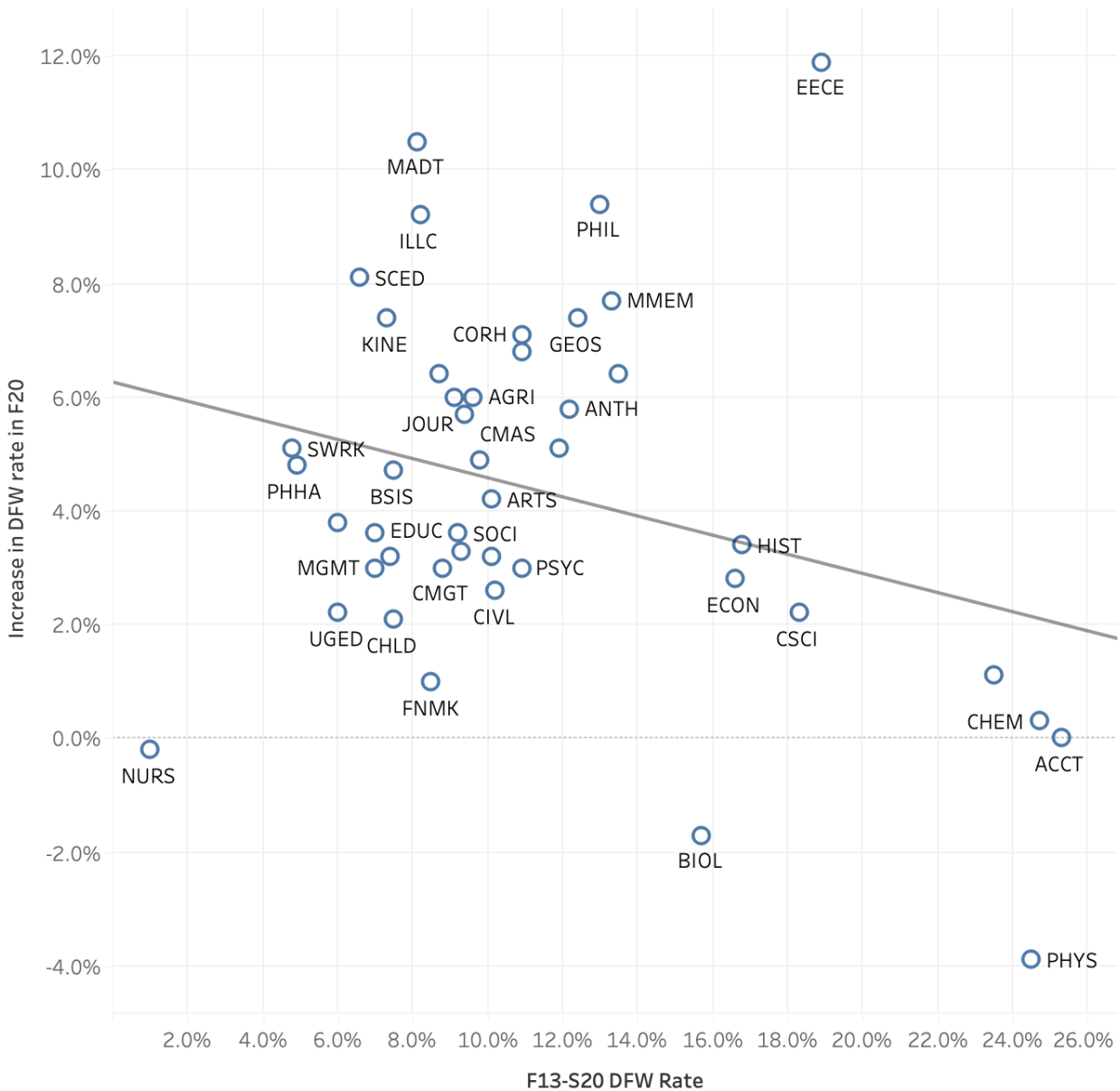


Figure 20. DFW rates for the F13 to F20 semesters by semester and College.

Discussion

Student success in CSU Chico courses in Spring and Fall 2020 was impacted by three major changes – Covid related changes in student life outside of campus, a change of most instruction from face-to-face to online instruction, and major changes in grading and withdrawal policies (easier withdrawals, all Fs converted to NC, student option to convert Ds to NC). The changes in grading and withdrawal policies were designed to correct for anticipated academic problems students might have as a result of the Covid epidemic. Thus, two important questions are, how much did the epidemic and change to online instruction affect student success? And, how much of this effect was ameliorated by the changes in grading policy?

For all undergraduate students there was no increase in DFW rates in S20 but a large 36% increase in DFW rates in the F20 semester. Thus, there was no need for the grading and withdrawal policy changes in S20, but they were needed in the Fall term. There are two ways students are harmed by DFW grades – DFW grades lower a student's GPA and can result in their disqualification from the University if their GPA falls too low, and students lose units slowing their progress towards their degree. The changes in policy more than corrected for the problems caused by low GPAs as the changes in grading policy actually increased GPAs by ~10%, raising them from ~2.9 to ~3.2 in both S20 and F20. The reason GPAs increased was that students who normally would have failed or withdrawn from classes were also protected from the harmful effects of DFW grades on their GPAs. The grading policy changes will have greatly reduced the number of students on probation or disqualified from the University, so by these two measures students actually did better in F20 (and S20) than in prior terms. Interestingly, that DFW rates did not increase in S20 despite the changes in withdrawal and grading policies strongly suggests that the policy changes were not the cause of the increase in DFW rates in F20. DFW rates would have increased in Spring 2020 if students were more likely to give up on classes knowing their GPA wouldn't suffer, but that didn't happen.

However, the average units passed declined by 5% in F20. Thus, the changes in grading policy more than compensated for the increased DFW rates effect on GPA (and probation and disqualification) but did not correct for the loss of units caused by the higher DFW rate. Over the short term the changes in grading policy will more than compensate for the increased DFW rates and should increase student retention. This is because, in addition to saving the students who would have normally passed their courses but failed due to the Covid changes, students that would have normally been lost due to failing courses will have also been saved. Over the long term the issue will be whether the increase in GPA, or the prevention of a decline in GPA, compensates for the delay in graduation caused by lost units.

Future studies will be needed to determine the long-term effects of these three changes, Covid, online instruction, and policy. Will students who avoided disqualification due to the grading policy changes just fail later, or will this extra chance allow some of them to succeed that would have normally been lost? How will the loss of units together with an increased GPA impact student retention and eventual graduation? What will happen in F21 when freshmen who spent their entire senior year online attempt college classes, also in an online environment?

To help reduce the harms caused by Covid and the change to online instruction it is important to know if there are any particular groups of students who were more vulnerable to these changes. The harmful effects of Covid were not evenly distributed, with some groups of students doing significantly worse than others. In particular, Under-Represented Minority (URM) and freshmen and sophomore students had their risk of DFW grades increase by 50 to 100% more than non-URM or upper division students. Within the URM population, the Black students were the ones most adversely affected. The loss of units will handicap these students for the rest of their academic careers, decreasing graduation rates, increasing equity gaps, and costing them more money and time. Thus, the URM graduation equity gap is likely to increase in a few years as a result of what happened in F20 and is likely to happen in S21 and potentially in F21.

The other population that was more adversely affected by Covid or the switch to online instruction was younger students, with the DFW gaps for freshmen and sophomores increasing by more than double that of juniors and seniors. As this affect was independent of the URM affect, the population most harmed by the Covid changes was URM freshmen and sophomores. In addition to the measurable effect on their grades, there is also a possibility that despite the large increase in As, even students who passed their courses learned less than in normal terms. If so, this will show up in increased DFW rates in later terms, especially for the F20 freshmen cohort.

Surprisingly, FGEN students, a group of students that have historically had lower graduation rates than non-FGEN, did not have lower DFW rates in prior terms when separated out by URM status. The small DFW rate gaps seen between FGEN and non-FGEN in prior terms are caused by the FGEN students being more likely to be URM. The only increase in DFW rates for these students in F20 was that the URM FGEN students had a two-percentage point larger than average increase in DFW rates in F20, a relatively small effect.

As access to financial information is highly restricted, this potentially important factor was not examined in this study. However, as low socio-economic status is likely to be highly correlated with FGEN status, it is likely that the most important factor affecting DFW rates is URM status, with FGEN and low income being less important.

Students from outside the Chico Service Area had larger increases in DFW rates in F20 than the Chico Service Area students. This was especially pronounced for the URM students from outside the area, who suffered a six-percentage point increase in their DFW rates, twice the increase for the URMs from the Chico area. Why URMs from outside Chico have higher DFW rates and were more vulnerable to the Covid-impacts than Chico area URMs is another mystery.

That the gender DFW rate gap of four-percentage points did not increase in F20 is an important result as it shows that the large increase in the DFW gap for URM students was not because this population has a higher average DFW rate than non-URM students, i.e., poorer performing students were not disproportionately affected, it was URM students specifically that were disproportionately affected. This could have been because of Covid specific effects on this population (a higher rate of infection, more financial stress, etc.) or because of challenges created by the switch to online instruction (technological issues, more difficulty working from home, etc.).

While there were too few in person classes in F20 to be able to see directly how much of the increase in DFW rates came from the switch to online instruction, in prior terms online courses had DFW rates approximately two percentage points higher than in-person courses for students of the same class level. Thus, about half the four-percentage point increase in DFW rates likely came from the switch to online instruction. The remaining two percentage points of increase could be from Covid related effects outside the classroom (students or their family getting sick with Covid, students withdrawing due to Covid related job losses, etc.), because having all classes online is harder than having one online class and several in person classes, or because the many faculty new to online instruction did not do as well as the more experienced online instructors from prior terms.

Other instructional factors such as the use of asynchronous vs synchronous online instruction, differences between lower division and upper division classes, the effect of class size, and particular types of courses were examined for their effect on DFW rates.

Of these the one with the largest effect was the difference in DFW rate between LD and UD courses, with UD courses have a much lower (~7 percentage points) DFW rate. However, there was no change in this gap in Fall 2020 once the effect of the LD courses having more freshmen and sophomores, the group most impacted by Covid, was corrected for. Of particular interest is the much higher than expected DFW rates for juniors and seniors in LD courses, so DFW rates are higher in LD courses regardless of which students are taking the courses.

As the class level effect could be the result of their smaller class sizes, the effect of class size on online instruction was measured. As had been seen previously, unlike for in-person classes, where larger class sizes lead to higher DFW rates, DFW rates do not vary with online class size except for classes below 20-25 students. Thus, class size differences do not explain the much lower DFW rates for UD classes.

Despite faculty concerns about asynchronous online courses there was little difference between the DFW rates for asynchronous vs synchronous online courses, though synchronous may have a slightly lower DFW rate. LD courses were more likely to be synchronous, but the small advantage for synchronous classes was overwhelmed by whatever is responsible for the high DFW rates for LD courses.

The GE foundation courses, a major component of LD courses, had widely varying DFW rates and changes in DFW rates in F20. As a both Life Sciences and Quantitative Reasoning actually had declines in their DFW rates in F20, and Physical Sciences had a much smaller than normal increase, an investigation of why they weren't affected by the move to online might be fruitful. That some groups of courses did not see an increase in DFW rates in F20 suggests that the increases in DFW rates were course related, and not caused by withdrawals for financial reasons, etc. However, as the analysis moves to smaller and smaller sample sizes it becomes more likely that aberrant results are random statistical events. Repeating this study with the S21 data will be helpful in determining which results are real.

Two potential issues with this analysis are the existence of important factors not included in the analysis, and the reliance on correlations when many of the factors are interdependent. An example of a factor not used in this analysis that might be important is socioeconomic status. Student financial data was unavailable but is probably an important factor affecting student success, especially under the Covid conditions, and may be the underlying cause of some of the effects described in this report. There may be other factors that are also important but not included here such as whether students stayed here or tried to attend from their family home, etc.

The second issue is that many of these factors are not independent of one another and there were too many factors to test them all for independence. Some of these are easy to spot, such as the connection between academic level DFW gaps and the DFW gap between class levels, while others, like the disproportionate use of synchronous instruction in LD classes, can only be spotted if both factors are looked at simultaneously. However, many of these factors did turn out to be independent. An example of a factor known to be independent from the others is gender, which has been well studied before. As was seen in this analysis, class level effects were additive to URM effects as these were independent, so you can add DFW rates for class level, URM status, and gender to get DFW rates for URM senior males, etc.

A proper multifactorial statistical analysis could spot more of these and determine their statistical validity, though the sample size for F20 alone might be too small with the large number of factors involved. After the S21 results are in the sample size for “after Covid” will double, so it will be important to repeat this study after the Spring 2021 term.

For the S21 and F21 semesters this analysis suggests that more efforts must be made to help the most inexperienced learners, freshmen and sophomores in lower division classes, and URM students, with the biggest issue being freshmen male URM students from outside our service area. Hopefully, DFW rates will decline in the spring, if only because the students, faculty and advising services will be better prepared for the online environment. Note that while not highlighted in the report there was little evidence for any harm in S20, even though half of that semester was online. There are several reasons S20 might not have had any effect on DFW rates, from more experienced students, the first half of the semester being in-person eliminating some of the online effects, the shorter duration was below some threshold before the harmful effects kick in, etc. Further investigation of why there was no increase in S20 and of what happens in S21 will be helpful in understanding why DFW rates increased so much in F20.

Appendix A: A summary of all results

- All Students
 - Since F13 DFW rates have been unchanged except for two outlier terms
 - In F18 DFW rates declined from the normal 11% to 9.5%
 - In F20 the DFW rate increased from 11% to 15%, a 36% increase
 - 2.5% Ds and 12.5% NC or W
 - S20 did not have an increase in DFWs, despite the change in grading policies and going online for half the semester
 - As increased from a normal 36% to 43% of all grades in F20 while Fs increased from 4.8% to 7.4% and Ws increased from 1.5% to 6%, spreading out the grade distribution
 - Average GPA increased by ~10%, from 2.9 to 3.2 in both S20 and F20
 - No official Fs and a large increase in As
 - Units lost increased by 0.6 units, from 1.3 historically to 1.9 units lost per students in F20
 - This is equivalent to an additional 3,000 students losing one 3-unit course
- Student groups
 - DFW rates and increases in the rates were largest for the youngest students
 - Freshmen DFW rates increased 48% in F20, from 16% to 24%
 - Seniors rates increased 29%, from 8.2% to 10.6%
 - Sophomores, 40% increase to 19% and juniors, up 32% to 15%, were in between
 - Post-bacc and grad students have very low DFW rates, ~2%, and those rates did not increase in F20
 - URM
 - Prior to F20 UG non-URMs had a 10.2% DFW rate while the UG URM rate was 41% higher at 14.3%, giving a 4.1 percentage point equity gap,
 - In F20 the non-URM rate increased 30% to 13.3% while the URM rate increased by 37% to 19.6%
 - Thus the URM DFW rate equity gap increased by 6.3 percentage points, 19.6% vs 13.3%, and the URM rate was 54% higher than the non-URM rate in F20
 - The URM effect was independent of the class level effect, so the DFW rate for freshmen URMs increased to 27% in F20
 - As a result, on average freshmen URMs lost 3.6 units in F20
 - Within the URM, the group black students suffered the most in F20, with their DFW rate increasing 53% from 19.5% to 29.9% in F20
 - First Generation
 - In prior terms, while there is a small difference between FGEN and non-FGEN overall, there was no difference between FGEN and non-FGEN non-URMs or FGEN and non-FGEN URMs
 - The higher percentage of URMs in the FGEN population is the reason the FGEN population appears to have a higher DFW rate

- FGEN URMs had a much larger increase in DFW rates in F20 than non-FGEN URM, increasing by 6.3 percentage points from 13.7% to 20.4%, a 49% increase
 - The URM non-FGEN had a smaller 5.2 percentage point increase, from 13.1% to 18.3%
 - The non-URM FGEN and non-FGEN had the same DFW rates in prior terms and below average 3.1 and 3.5 percentage point increases in F20
 - Chico Service Area DFW Rates
 - In prior terms the DFW rate for out of area students, 11.7%, was 1.1 points higher than Chico area students, 10.6%
 - There is no difference in DFW rates for non-URM students
 - The Chico area URM DFW rate, 11.6%, is 3.1 points less than the out of area rate of 14.7%
 - Thus, all the difference in rates between in and out of area is from the URM students
 - In F20 the URM in area vs out of area gap doubled to 6.1 points, 14.7% vs 20.8%
 - Gender DFW rates
 - The four-point gender gap was unchanged by the increase in DFW rates in F20
 - Female DFW rates increased 4.3 points from 9.6% to 13.9% in F20
 - Males rate increased 4.2 points from 13.9% to 18.1%
 - Shows that the other increases in DFW rate gaps above were not simply caused by poorer performing students being more adversely affected by Covid-changes
- Course effects on DFW Rates
 - In prior semesters the LD course DFW rate of 14.9% was 6.7 points higher than the 8.2% UD rate
 - In F20 the LD rate increased by 4.9 points to 19.8% while the UD rate increased by 3.9 points to 12.3%, with the gap between LD and UD increasing to 7.5 points
 - Seniors have a much higher DFW rate in LD classes, 12.4%, than in UD classes, 7.1%
 - The five-percentage point gap between LD and UD is true for all student levels, from freshman to senior
 - Most (~80%) of the poor performance of freshman can be explained by their taking mainly LD classes
 - Online classes have historically had about a one-percentage point higher DFW rate than in person classes
 - After correcting for the three-fold higher rate of seniors taking online classes than freshman, online classes had a two-percentage point higher DFW rate than in person in terms prior to F20

- Freshman and sophomores DFW rates increased by as much as 11 percentage points in online UD classes in F20, while juniors and seniors had only a two-percentage point increase, the same as for LD classes
 - Thus, all of the senior increase in DFW rates in F20 can be explained by the switch to online instruction
- While class size has a strong effect on DFW rates in person, there was little effect of class size on DFW rates in online classes
 - While online DFW rates did not vary with class size for both LD and UD classes, LD classes had a 7-percentage point higher DFW rate at all class sizes
- In F20 synchronous classes had a DFW rate of 15.7% while the asynchronous rate was slightly less at 15.3%
 - However, asynchronous classes had higher DFW rates for both LD, 20.0% vs 19.6%, and UD, 12.4% vs 11.9%
 - Synchronous grades were more likely from high DFW rate LD classes, 48%, than asynchronous, 38%, explaining why the overall DFW rate was higher for asynchronous.
- Two of the GE Foundation areas commonly taken by freshman, oral communication and written communication, had over six percentage point increases in DFW rates in F20, while the other four areas had DFW rates in F20 that were similar to prior terms.
- All of the colleges had similar four to six-percentage point increases in DFW rates except for Natural Sciences (NSC), which had a DFW rate in F20 that was only one-percentage point above average, and well within the normal range.
 - Only two departments had lower DFW rates in F20 than in prior terms, Biology (BIOL) and Physics (PHYS), both from NSC, and three had no change, Accounting (ACCT), Chemistry (CHEM), and Nursing (NURS). Four of the five are from NSC
 - There was no correlation between the DFW rate for a department in prior terms and the increase in DFW rate in F20, so department with classes with high DFW rates were no more likely to see an increase, or a decrease, in F20 than departments with low normal DFW rate