

A Descriptive Report on Women, Underrepresented Minorities, and First Generation Students in STEM at California State University Chico

2022-11-08

##Summary of Data and Goals of this Report

This report is based on Class enrollment data, with each grade in a class having a row, and each attribute about the student taking the class, or the grade in the class being a column. There are 55 Columns and over 1,000,000 rows. The data spans all classes taken from Fall 2012 until Spring 2021.

The data has a STEM Flag, indicating if the student enrolled in the class is a STEM Major. For this Flag, we used the Department of Homeland Security’s definition of STEM, which is: “a field included in the CIP taxonomy that falls within the two-digit series containing engineering, biological sciences, mathematics and statistics, and physical sciences, or a related field, which generally involves research, innovation, or development of new technologies using engineering, mathematics, computer science, or natural sciences (including physical, biological, and agricultural sciences).”

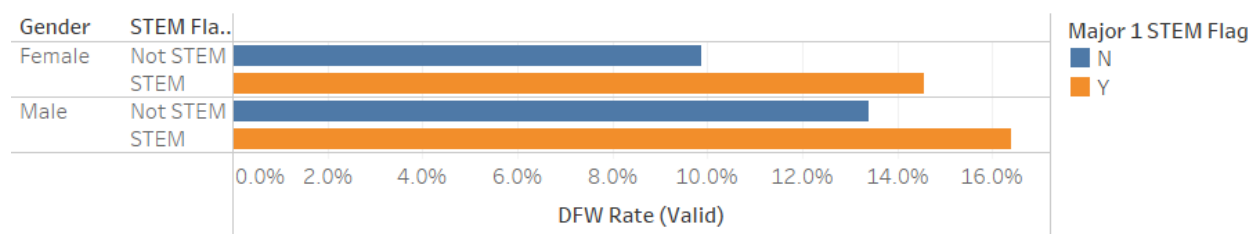
This report will look directly at the success of Female and Minority students at California State University Chico who are STEM Majors in their course work. Rates of success will be looked at mainly through DFW rates, as well as Grade Points Per Unit Earned.

DFW rates are the proportion of students within the category in question such as STEM or non-STEM who received a D grade, F grade, or withdraw grade from classes. Any of these three grades are regarded as a failing grade. There also may be reference to just the proportion of F grades throughout the report.

Grade Points Per Unit Earned is a measure of grades in a class, in proportion to the number of units the class is worth. Each class is worth a certain number of units, and how many units each class has will tell how much the class will effect GPA. Higher unit classes have more effect on GPA. As the grade earned in the class becomes lower, the grade points per unit earned become lower, consequently lowering GPA.

##DFW Rates

Gender/STEM Flag, DFW Rate

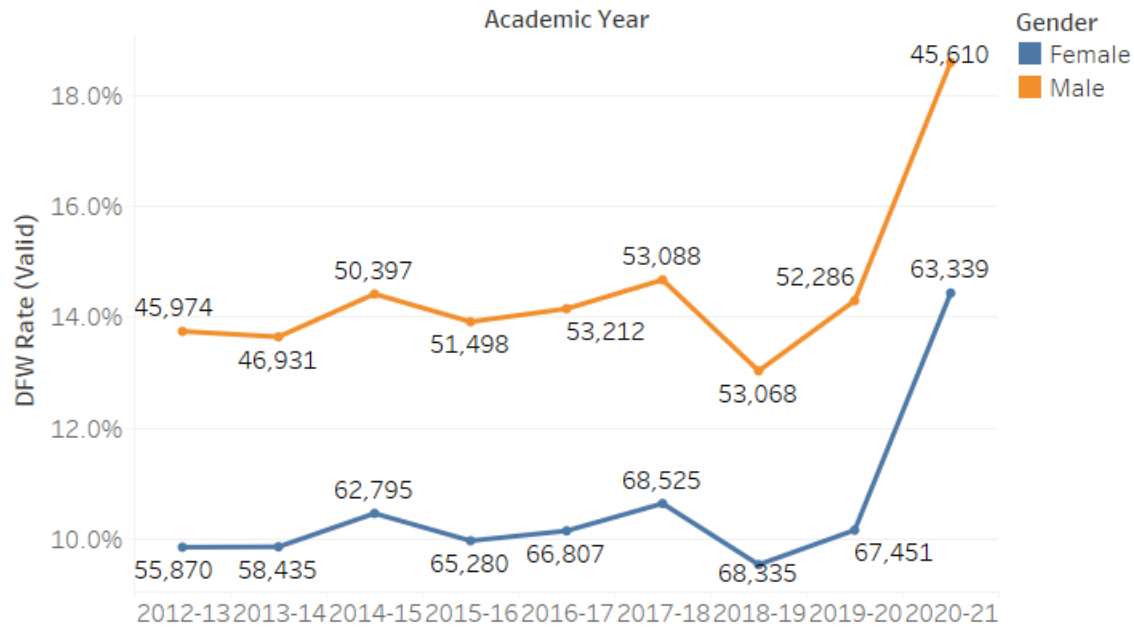


DFW Rate (Valid) for each STEM Flag Label broken down by Gender. Color shows details about Major 1 STEM Flag. The view is filtered on Gender and STEM Flag Label . The Gender filter keeps Female and Male. The STEM Flag Label filter excludes Null and Null.

Above, we can see the percentage of students who received a “DFW” grade, which stands for D Grade , Fail, With drawl. These grades bring down a students GPA, and are regarded as a failing grade.

From the graph above, it looks like within the general population of students, women are actually receiving less DFW grades, proportionate to men, for both women of STEM majors and non-STEM majors, although the gap is smaller within the STEM category.

DFW Rate Over Time by Gender



The trend of DFW Rate (Valid) for Academic Year. Color shows details about Gender. The marks are labeled by sum of Total Grade Pass Fail Withdrawal Count. The view is filtered on sum of Total Grade Pass Fail Withdrawal Count, DFW Rate (Valid) and Gender. The sum of Total Grade Pass Fail Withdrawal Count filter includes values greater than or equal to 10. The DFW Rate (Valid) filter keeps non-Null values only. The Gender filter keeps Female and Male.

Above, we can see the DFW Rate over time, from the 2012-2013 Academic School year, until the 2020-2021 Academic School Year. Again, we see that women have had lower DFW rates than men, however the fluctuation of both is very symmetric.

In the 2018-2019 school year we also see a spike in DFW rates, something that could possible be attributed to the campfire and its effects on Chico State students and their families.

In the 2019-2020 school year, we see a huge spike in DFW rates, which can likely be attributed to the COVID pandemic, which forced classes to switch fully online. The University also enforced a leniency plan, in which if you received a D or F grade, it could be changed to a with drawl, and when the class is retaken, there would be complete grade forgiveness. Complete grade forgiveness would mean that instead of averaging the two grades, as the university normally would do, and then having the average of the grades be reflected on GPA, the with drawl grade would be discarded, and only the most recent grade would affect the students GPA.

###DFW Rates Within Minoroty Populations

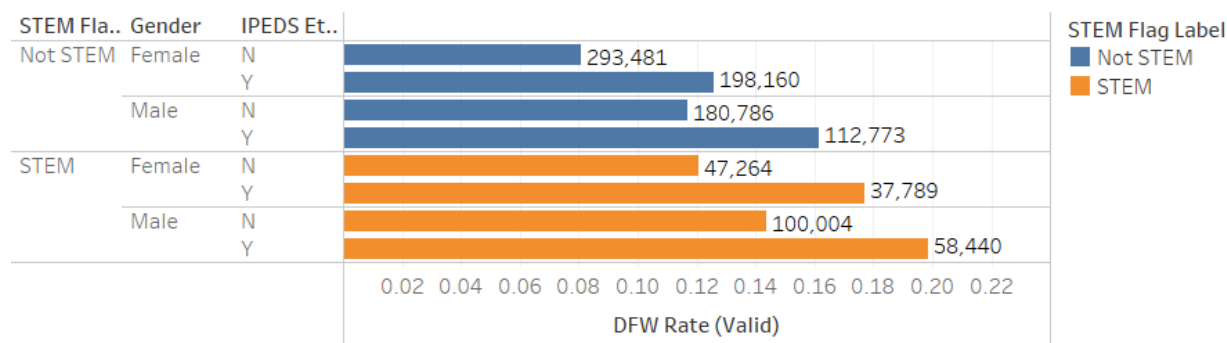
####Under Represented Minority Students

The below graph looks at the DFW rates of those who are categorized as URM Students, and the data is separated by gender as well as STEM or Not STEM. 39.5% of the classes taken in this data set were taken by URM categorized students. As we can see based on this visualization, females tend to have lower DFW rates than their male counterparts. The DFW rates for those who are STEM majors are slightly higher than the DFW rates for those who are non-STEM majors.

The counts on the right of the bar graphs are the counts of classes that have been taken by students in that respective category of interest that have received DFW grades.

In both categories, STEM and non-STEM, the DFW rates for students who are categorized as URM are higher than those who are the same gender and STEM status. This would lead me to believe that there could be a correlation between being a URM student and DFW Rates.

Gender/URM Flag, DFW Rate

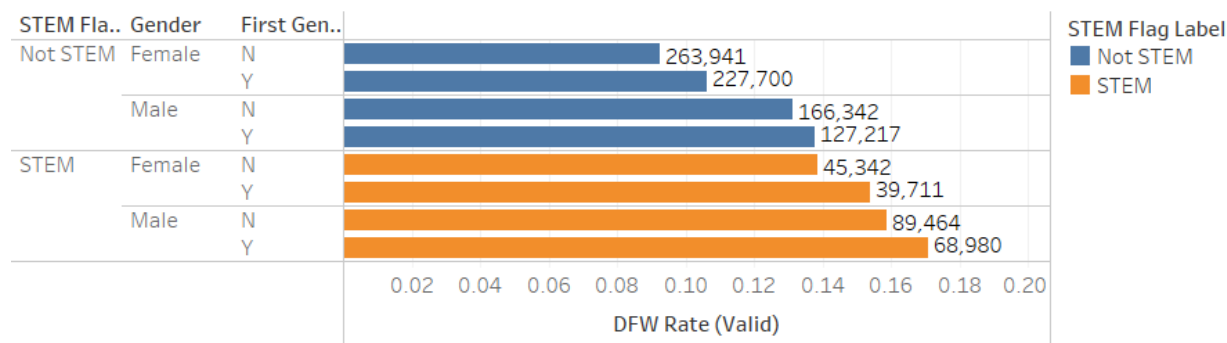


DFW Rate (Valid) for each IPEDS Ethnicity URM Flag broken down by STEM Flag Label and Gender. Color shows details about STEM Flag Label. The marks are labeled by sum of Total Grade Pass Fail Withdrawal Count. The view is filtered on Gender and STEM Flag Label. The Gender filter keeps Female and Male. The STEM Flag Label filter excludes Null.

###First Generation Students

The following graph represents the same DFW rates, separated by gender, except now we are examining if the students are First Generation Students, meaning that they are the first in their family to attend college.

Gender/First Gen Flag, DFW Rate



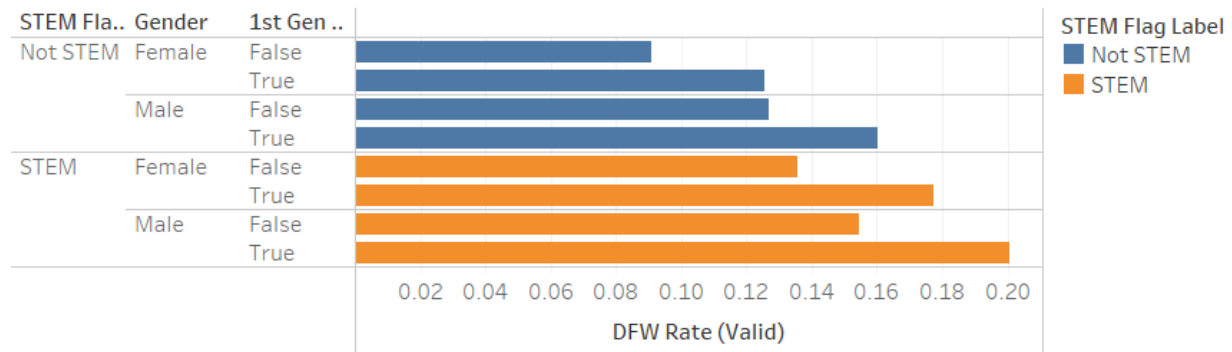
DFW Rate (Valid) for each First Generation Flag broken down by STEM Flag Label and Gender. Color shows details about STEM Flag Label. The marks are labeled by sum of Total Grade Pass Fail Withdrawal Count. The view is filtered on Gender and STEM Flag Label. The Gender filter keeps Female and Male. The STEM Flag Label filter excludes Null.

We can see that much like the URM category, Women have lower DFW rates than their male counterparts

in their respective STEM and First-gen categories, and that STEM majors have higher DFW rates than their non-STEM counterparts.

The gap though, between those who are First Gen or non First Gen is smaller, within their respective STEM and gender category, than the gap between URM and non-URM categorized students. This may lead me to believe that while being a First Generation student may be correlated to higher DFW rates, the correlation is not as strong as that of being a URM categorized student.

First Generation and URM Students, STEM Flag, and DFW Rate



DFW Rate (Valid) for each 1st Gen and URM broken down by STEM Flag Label and Gender. Color shows details about STEM Flag Label. The view is filtered on Gender and STEM Flag Label. The Gender filter keeps Female and Male. The STEM Flag Label filter excludes Null.

The above graph shows students who are categorized as both First Generation and URM and their respective DFW rates comparatively with students who are not URM and First Generation.

#####Conclusion about General Population of Students

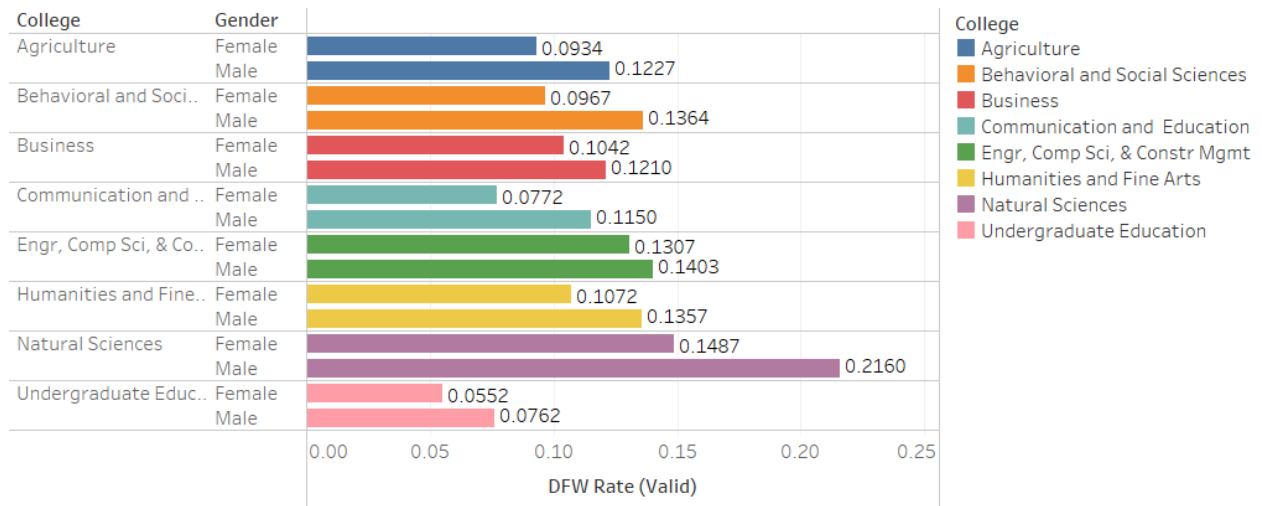
The difference in DFW rates for those who are categorized as URM is larger than that of those from the first gen students, which leads me to believe that being categorized as a URM student may have a higher effect on success in classes than being a first generation student.

#####Conclusion about the STEM Population of Students

The trend from the prior conclusion about the General Population remains true among STEM students as well, with the gap between students who are characterized as URM and non-URM being much larger than the gap between students who are First Generation, or non-First Generation. This would again, lead us to believe that URM categorization has a larger influence on success in classes than being a first generation student.

###DFW Rates by College

DFW Rate by College and Gender



Above, we can see the DFW Rate per College by Gender. Besides the college of Natural Sciences, where Males have a far higher DFW Rate than females, there is not any college that stands out as having a large gap between DFW rates of males and females.

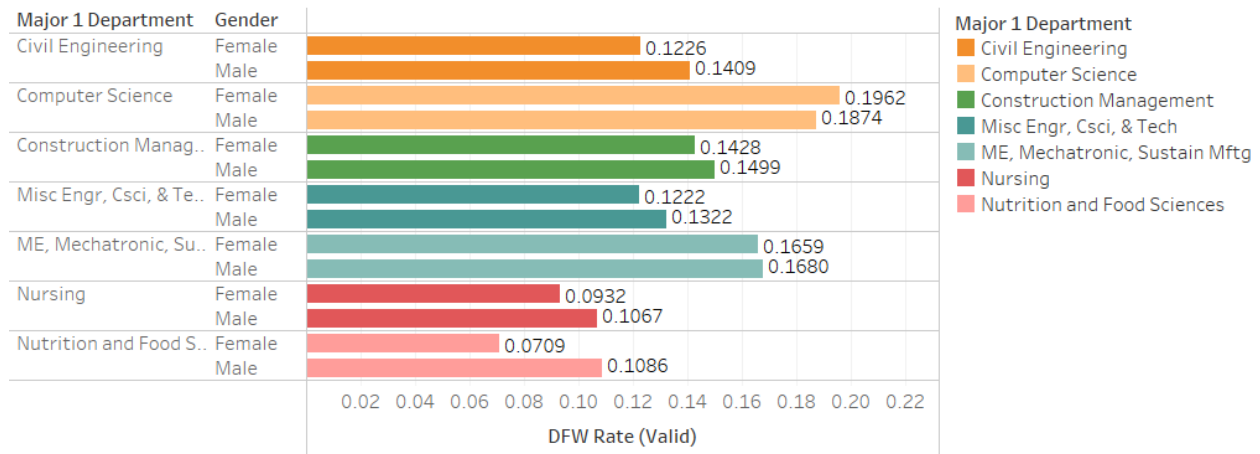
The counts on the right hand side of the bars represent the total count of classes taken that received DFW grades by students in that particular college. We can observe from this visualization that the college of Engineering, Computer Science, and Construction management has far more DFW grades recorded for males than females, however their DFW rates stay just a few percentage points apart. This would suggest that there are many more males enrolled in this particular college.

On the other hand, in the College of Natural Sciences, we can see that females have much lower DFW rates, while also having a higher count of classes in which female students received DFW grades. This may indicate that there are less male students in the College of Natural Sciences than females.

In a work or school environment that is dominated by peers of the opposite gender, an environment can be created that can prevent members of the minority gender from reaching their full academic potential.

The graph below shows the counts of grades recorded from each within the College of Natural Sciences as well as the College of Engineering, Computer Science, and Construction Management, filtered by gender.

College of Natural Sciences and College of Engineering, Computer Science, and Construction Management DFW Rates by Department and Gender

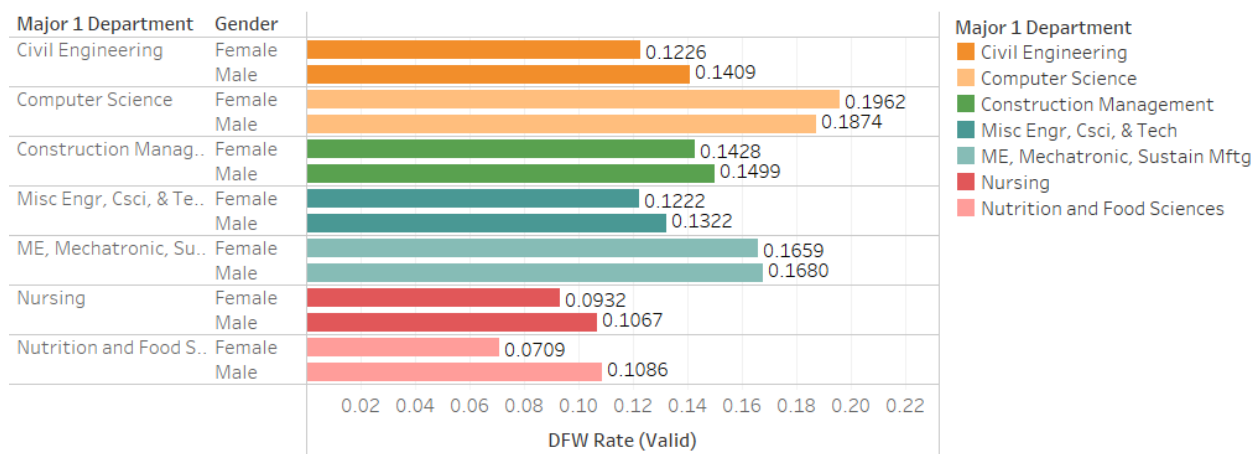


We can see that the Civil Engineering, Construction Management, Computer Science, Misc Engineering, CSCI and Tech, and ME, Mechatronic and Sustain Mftg are departments which are all predominantly male dominated.

On the other hand, Nursing and Nutrition and Food Sciences are predominantly female.

The following Graph will show the DFW rates between males and females comparatively, of classes taken by students within each of the departments that was mentioned above, as having a large disparity between enrollment of males and females.

College of Natural Sciences and College of Engineering, Computer Science, and Construction Management DFW Rates by Department and Gender



Throughout the departments that were male dominated: Civil Engineering actually had lower DFW rates for females, as well as Construction Management and Misc Engineering, CSCI and Tech.

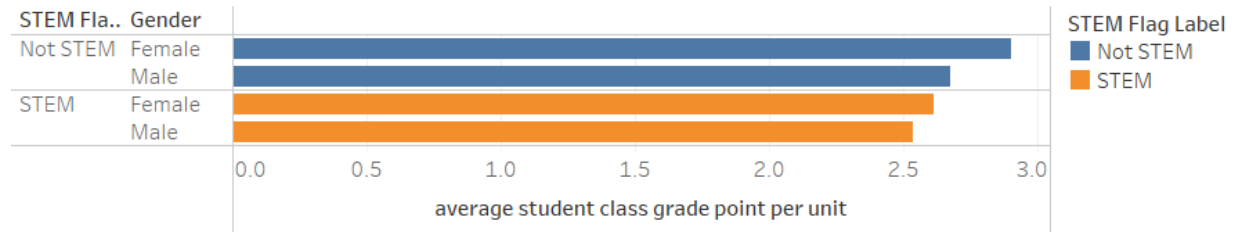
In Computer Science females had higher DFW rates than men, and in and ME, Mechatronic and Sustain

Mftg the DFW rates were virtually the same.

Throughout the Departments that are female dominated: Nursing and Nutrition and Food Sciences both had lower DFW rates for females than males which would be consistent with the fact that thy are both predominantly female departments.

##GPA

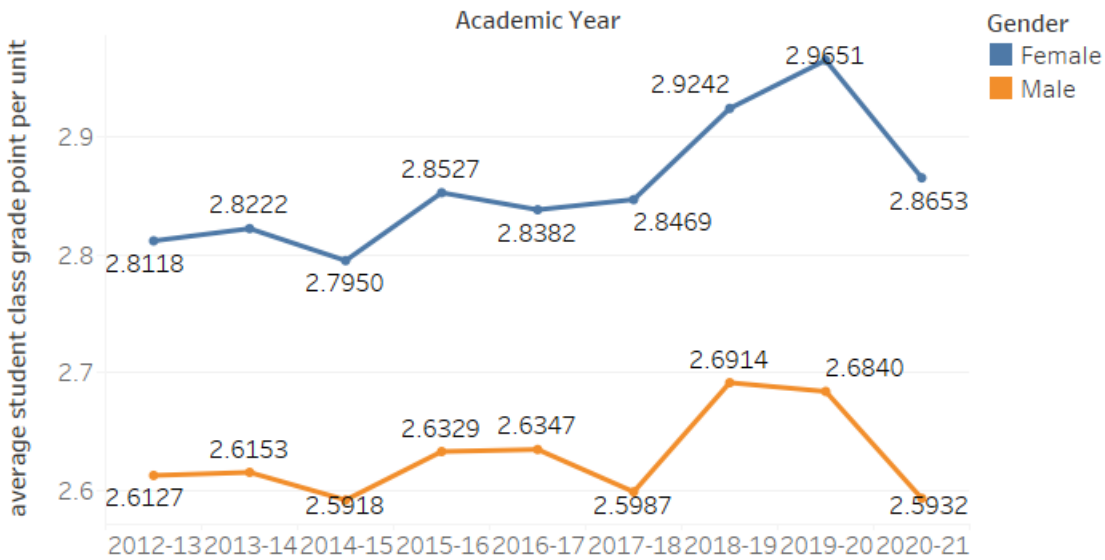
Gender\STEM Flag, Grade Points Per Unit Earned



Average student class grade point per unit for each Gender broken down by STEM Flag Label . Color shows details about STEM Flag Label . The view is filtered on STEM Flag Label and Gender. The STEM Flag Label filter keeps Not STEM and STEM. The Gender filter keeps Female and Male.

Above, we can see the average of the grade points per unit earned, filtered by STEM and gender. We can see that in both STEM and non-STEM majors, females have higher grade point per unit averages than men.

Grade Points Earned Per Unit Over Time by Gender



The trend of average student class grade point per unit for Academic Year. Color shows details about Gender. The marks are labeled by average student class grade point per unit . The data is filtered on DFW Rate (Valid), which keeps non-Null values only. The view is filtered on Gender, which keeps Female and Male.

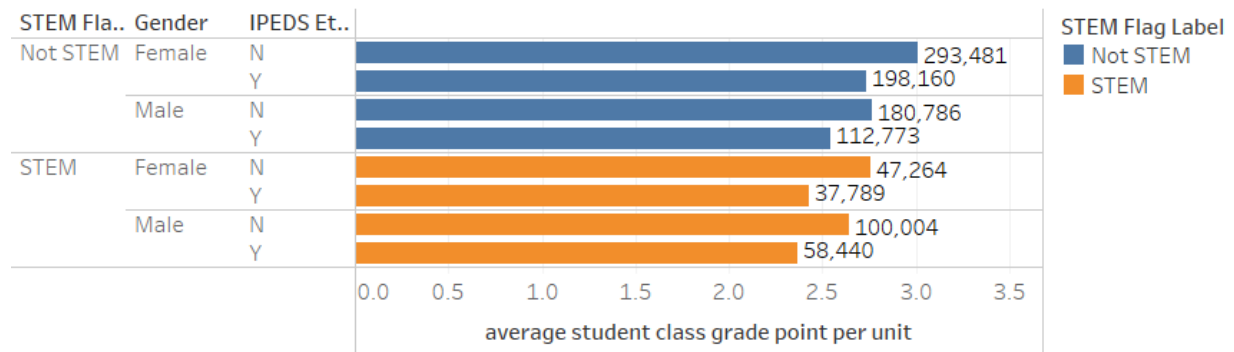
Above, we can see the grade point per unit earned over time filtered by gender. Similar to Figure 3.1, females have had higher grade points earned than males. We can also see the same fluctuation in the

2019-2020 academic year that we saw with the DFW rates over time. Grade Points per Unit Earned dropped during that time, likely because of the COVID pandemic. We can also see the fluctuation in the 2018-2019 school year that may be attributed to the campfire.

###Average Grade Points per Unit Earned Within Minority Populations

####Under Represented Minority Students

Average Grade Points Earned Per Unit filtered by STEM FLAG, Gender, and URM flag

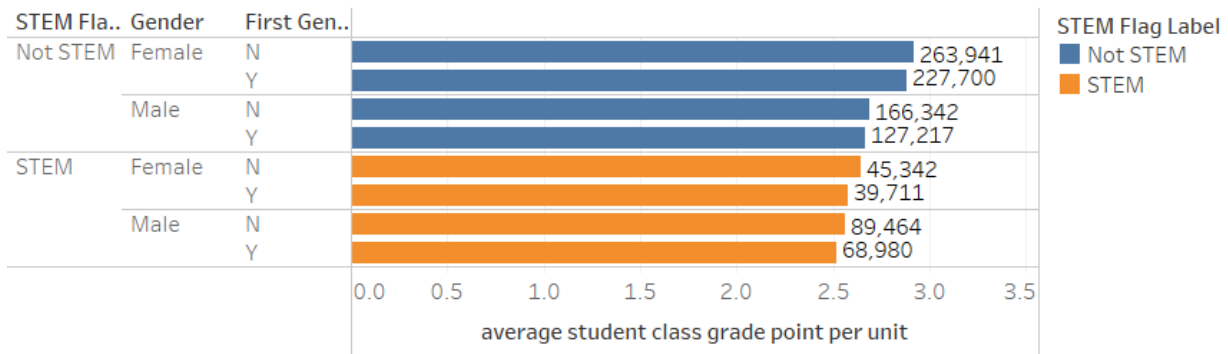


Average student class grade point per unit for each IPEDS Ethnicity URM Flag broken down by STEM Flag Label and Gender. Color shows details about STEM Flag Label. The marks are labeled by sum of Total Grade Pass Fail Withdrawal Count. The view is filtered on Gender and STEM Flag Label. The Gender filter keeps Female and Male. The STEM Flag Label filter excludes Null.

Above we can see the Average Grade Points Earned Per Unit filtered by STEM FLAG, Gender, and URM flag. We can see that the females are still out-performing the males in their respective gender/STEM/URM categories. Non-URM students are also still out performing the URM category students as well.

####First Generation Students

Average Grade Points Earned Per Unit filtered by STEM FLAG, Gender, and First Generation Flag



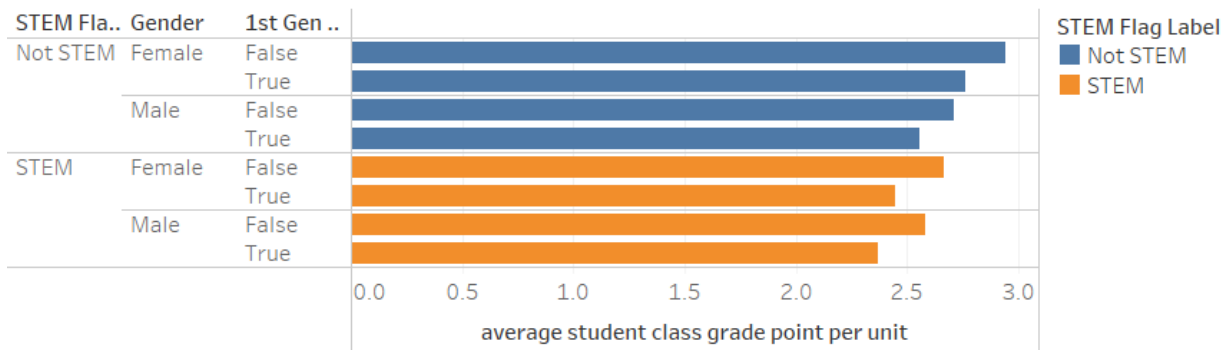
Average student class grade point per unit for each First Generation Flag broken down by STEM Flag Label and Gender. Color shows details about STEM Flag Label. The marks are labeled by sum of Total Grade Pass Fail Withdrawal Count. The view is filtered on Gender and STEM Flag Label. The Gender filter keeps Female and Male. The STEM Flag Label filter excludes Null.

Now we can look at the same graph, but instead of URM students we are looking at First Generation Students. Females are still getting better grade points earned per unit than males, however the gap between first gen and non-first gen in their respective STEM/not-STEM and gender categories is much smaller than the gap that can be seen along URM category students. This is a similar trend to that found within DFW rates.

This might suggest even more that being categorized as a URM student has a more negative correlation with success in school than being a first generation student.

The following Graph shows Grade Points per Unit Earned among students who are categorized as both URM and First Generation in comparison to those who are not.

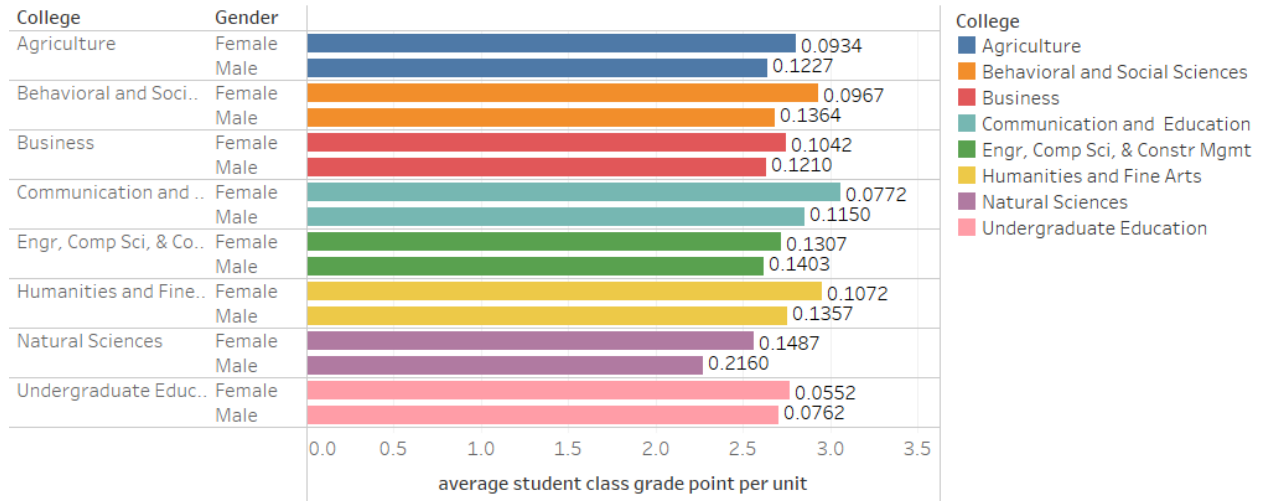
Average Grade Points Earned Per Unit, First Generation and URM students, and STEM Flag



Average student class grade point per unit for each 1st Gen and URM broken down by STEM Flag Label and Gender. Color shows details about STEM Flag Label. The view is filtered on Gender and STEM Flag Label. The Gender filter keeps Female and Male. The STEM Flag Label filter excludes Null.

###Average Grade Points Earned by College

Average Grade Points Earned Per Unit Per College Filtered by Gender



Average student class grade point per unit for each Gender broken down by College. Color shows details about College. The marks are labeled by DFW Rate (Valid). The view is filtered on Gender and DFW Rate

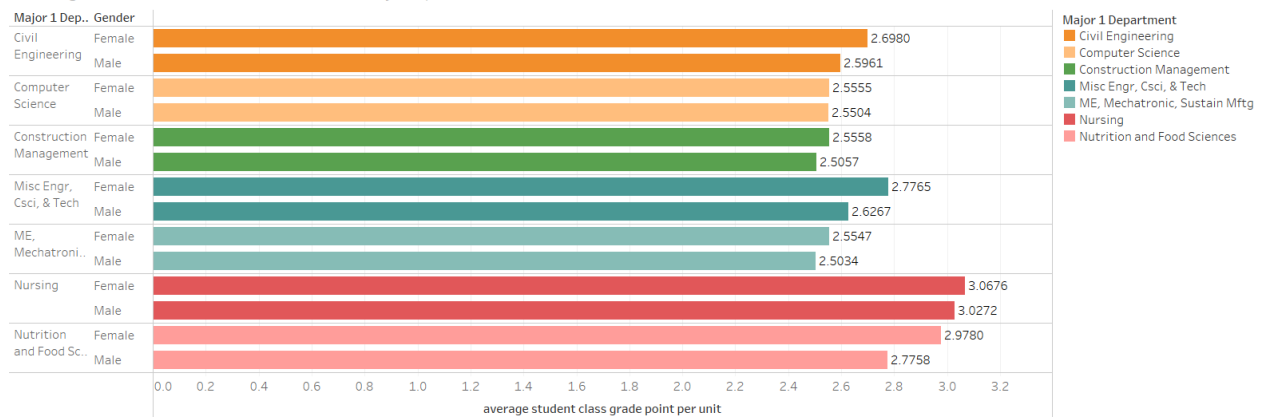
[Figure 6.1] (Valid). The Gender filter keeps Female and Male. The DFW Rate (Valid) filter includes everything.

In the figure above, we can see the average grade points earned for both males and females within their Colleges. There are no colleges in which the females are not receiving higher averages of Grade Points Earned.

Let's dive back into the Departments where we found that there was higher enrollment from either male or females in the College of Natural Science and The College of Engineering, Computer Science, and Construction Management.

College of Natural Sciences and College of Engineering, Computer Science, and Construction Management

Average Grade Points Per Unit Earned by Department and Gender



Average student class grade point per unit for each Gender broken down by Major 1 Department. Color shows details about Major 1 Department. The marks are labeled by average student class grade point per unit. The data is filtered on Major 1 College, which keeps Engr, Comp Sci, & Constr Mgmt and Natural Sciences. The view is filtered on Gender and Major 1 Department. The Gender filter keeps Female and Male. The Major 1 Department filter keeps 7 of 48 members.

[Figure 6.2]

We can see from this visualization above, that females are demonstrating higher average grade points per unit earned than men in every single department that was of interest for the DFW rates, even those that were highly male dominated.

##Conclusion

Further research would be needed to clarify these results can be attributed to gender, URM status, First Gen classification, or STEM Flag.

###Gender

Throughout the above exploration of DFW rates and Grade Points Per Unit Earned, the gap between males and females is constant and durable over time as well as throughout colleges and departments. Even in departments that were male dominated, with the exception of Computer Science, females had lower DFW rates and higher Grade Points Per Unit Earned than males.

Throughout STEM majors and Non-STEM majors, females continued to excel over males.

Within the departments that were predominantly male or predominantly female it is important to note that one student within the minority group of that department would have a larger effect on the DFW rate or Grade Points Per Unit earned. This makes the results more volatile, and additional research would need to be done to conclude whether or not the gap in male and female performance is statistically significant, or if it can be partly attributed to sample size.

###URM and First Generation Students

Similar to the gender, the gap between students who were categorized as URM, First Generation, or both was consistent over DFW Rates and Grade Points Per Unit Earned. Students who are not categorized as URM or First Generation are getting lower DFW rates and higher Grade Points per Unit Earned throughout STEM and non-STEM majors.

The gap between URM and non-URM students is larger than that of the gap between First Generation and non-First Generation Students, which would lead us to believe that being categorized as a URM student may have a larger correlation with student grades than being a First Generation Student.

###STEM and non-STEM

STEM majors are receiving higher DFW rates and lower Grade Points Per Unit Earned than non-STEM students throughout gender, URM and First Generation students. STEM Majors are known for being notoriously difficult and intense, which could be a reason that STEM majors are not doing as well in their classes.