

The Effect of Faculty and Student Gender on Student Success and Subject Persistence

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Abstract

This study explores the relationship between student and faculty gender, and how it can affect a student's success and course persistence. This study is mainly focused on females, as the percent of female students and faculty is far less than males in many college majors, subjects, and courses. To do so, we use student and faculty data from the University of Oregon and created a model which includes this gender relationship, ethnicity, course grades, and high school GPA in order to show the impact of faculty gender on student persistence in the subject. We have found that while faculty gender does impact student's average GPA, it does not significantly impact student subject persistence.

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Introduction

Though females have recently become the majority of degree earning students at universities around the world, gender gaps in courses, majors, and job fields are still a serious issue. In many subject such as economics and mathematics, women still make up less than one third of the major. Though women take roughly the same amount of introductory courses as men do, and receive higher grades in almost every major (Appendix Figure 1), their persistence rates are much lower. So why this stark difference in persistence in certain subjects for males and females? One explanation could be the gender of the professor in each subject. As the number of male professors outnumbers females in many fields, female students often do not have a female role model to look up to in a teacher. This could be affecting their grades in said class, or even discouraging them from continuing on in the major.

At the University of Oregon, women make up almost 54% of the faculty. However, subjects such as chemistry, econ, and mathematics still have less than 35% women faculty (Appendix Figure 2). A key point in our study will be seeing how this low percentage of female faculty affects students of both genders in order to see if faculty student gender relationships are a key point in student success and persistence in a course, subject, or major. As many subjects at the University of Oregon require introductory sequences in order to advance in the major, we will be able to study the students who do move on in the sequence versus those who do not, in order to see if faculty gender is a key point of whether or not a student advances in the major. Through this research we will be able to help the University of Oregon obtain a better grasp on

gender differences in their students in relation to academic achievement, faculty relationships, and subject persistence.

Literature Review

For our research, we are interested in seeing if there is a significant correlation between faculty gender, and student success, achievement, and continuation in the course subject. Many economists have already completed research detailing this relationship between faculty gender and student success, yet while extensive research has been done, most of the results have been contradictory, many finding that faculty does impact student success, and many finding no correlation.

One of the first papers to find no correlation between student and faculty data is *Do Teachers' Race, Gender, and Ethnicity Matter?* by Ehrenberg, Goldhaber, and Brewer (1994). This paper uses the National Educational Longitudinal Study of 1988, a national database of student data, in order to see how various teacher characteristics influence student success, measured by standardized tests and the methods of which teachers evaluate their students. This study grouped teachers and students alike by gender based on male and female, and ethnicity, based on white, Hispanic, or black. While they found slightly significant coefficients on the ethnicity of teachers when compared to student's test scores, gender was insignificant. Especially when looking at white female teachers vs. white male teachers, the difference in test scores for white students was virtually nonexistent. However, when looking at how teachers evaluate student success, this study did find that white female teachers did indeed give higher subjective evaluations to students varying in subject, specifically giving white female students higher scores in reading, math, and science when compared to scores given by white male

teachers. Though this paper did not find a difference in test scores of students, it still leaves the question of how teacher gender can subjectively affect student success.

On the other hand, in her paper, *Do Female Faculty Influence Female Students' Educational and Labor Market Attainments?* Donna Rothstein (1995) found a significant impact of gender on student success. This paper studies the high school class of 1972 in order to explore the relationship between female faculty and female student success in college and post undergrad. As of 1993, only 20% of college faculty were female, which leads us to question how that affects female students, as faculty often acts as mentors for students, leaving females without many role models to look up to in their college careers. Accounting for various student and college variables, Rothstein found that there was a positive, statistically significant impact of female faculty on female student success and the probability that females would attain an advanced degree. While this is interesting research, we would like to further these findings to explore the relationship between certain classes and majors, and not just percentage of female faculty in general at a college.

This exact gender and class relationship was studied in *The Impact of Student and Professor Gender on Grade Performance in the Managerial Finance Course* by Kathleen Henebry and Jeanette Diamond (1995), where they did indeed find quite a significant correlation between faculty gender and student success. This paper explores the relationship of professor student gender in a university course, specifically finance. This research was done through data at a Midwestern state university where 127 finance courses were taught by 17 different faculty members during the time period of the study.

Henebry and Diamond found that the withdrawal rate from this class was almost 2% less for female professors than male professors. We can also see that in general, both male and students perform better in classes with female professors, as there is a positive 3.5% difference in grades with female professors when compared to male. This is an important finding as this is one of the first papers to detail a clear, significant difference between grade averages given by male and female professors.

Another paper detailing the relationship between faculty gender and student success is *Faculty Gender in the College Classroom: Does it Matter for Achievement and Major Choice?* Written by Amanda Griffith (2014). Using data from selected liberal arts colleges in the northeast, Griffith found that while there was an increase in female grades when taught by a female instructor, that difference was quite insignificant, .07 grade points to be exact. However, this difference increases when the female taught course is in a primarily male dominated field. Though it becomes an economically significant difference, it is still unclear whether that difference is due to actual student success, or just nicer grading by the female instructors in those male dominated subjects.

In the paper *Sex and Science: How Professor Gender Perpetuates the Gender Gap*, Scott Carrell, Marianne Page, and James West (2010) researched the role of professor gender in STEM classes using data from the U.S Air Force Academy. This data was perfect due to the fact that in the academy, students are randomly assigned professors in their standardized courses, which eliminates bias due to pure preference of professor gender. Their research resulted in a couple notable findings, first, while males and females come into college with around the same abilities, men tend to perform much

better in introductory classes and exams in STEM subjects. However, when females are given a female instructor, this difference is completely mitigated. Second, they found that in other subjects such as humanities, faculty gender has no relationship with student success. This shows that is important to take into account the exact courses and majors of the students and faculty teaching them, instead of just researching university-wide data.

Another subject specific paper, *The Gender Gap in Undergraduate Economics Course Persistence and Degree Selection* written by Laura Ahlstrom (2017) explores the relationship solely between student gender and academic success and persistence, specifically concerning the gender gap in economics, a field in which less than one third of degree earners are females. Ahlstrom uses data from the University of Delaware to research the reasons why females enter this field far less than their male counterparts. Though this paper does not deal with faculty gender, it is just as important to understand the possible other reasons for gender differences in student success and course persistence. The results from this study found that grades are the strongest determinant of women's course persistence in economics. And since women's grades in the introductory microeconomics class are much lower than that of males, they tend to be much more put off towards continuing in and obtaining a degree in economics, even though their grades in subsequent classes would tend to be the same or better than that of men's. Women also tend to be much less confident than men in their abilities, specifically due to their lower perceived analytical skills, and due to perceived bias' in the field, leading to less women wanting to enter. These findings are important to note when considering student gender differences in specific subjects and persistence of major.

Though lots of research has been completed on the direct effect of faculty gender on student success through grades, we would like to explore faculty genders effect not only on grades of the class, but of subsequent classes in the sequence, and whether faculty gender affects the students' choice of instructor gender, as well as continuance in the major. This is more on the lines of what Eric P. Bettinger and Bridget Terry Long did their paper *Do Faculty Serve as Role Models? The Impact of Instructor Gender on Female Students*. Using data from nearly 54,000 students, Bettinger and Long used OLS to explore the relationship between female instructors and student success in subsequent courses and future course taking behavior. First, they compared outcomes of students who had female instructors versus male instructors in an introductory course for a subject. This was a significant estimate, however, it varied positively or negatively based on the course subject. When taught by a female, subjects such as biology and physics were less likely to retain female students whereas psychology, sociology, and journalism were more likely to retain female students. They also found that in subjects with significantly less female representation such as geology, math, and statistics, having a female instructor increased the likelihood of a female continuing on in the subject by 100%.

This paper is a great baseline for our research, as we would like to further explore the relationship of faculty student gender by subject and major, and future success in the University of Oregon. We would also like to explore other gender combinations of student faculty relationships, as this paper was focused purely on female-female interaction. This research will be interesting for the University of Oregon, especially when knowing that prior research has led to conflicting results and conclusions. We hope

that our research will help shed a light on both student-faculty interactions and gender differences within courses and majors not only within the University of Oregon, but be useful information for universities around the world.

Data

In order to explore this relationship of student faculty gender and student success, we will be using student and faculty data from the University of Oregon. We received two separate data sets, the first containing student personal and course information. This data set included a student race, gender, and age, as well as other demographic data, and each class they took and at what term, and the grade received in said class. It was a comprehensive data set including every grade for every student in every class they took from fall term 2000 through winter term 2018, amounting to over 3.4 million observations.

The second data set matched courses with the name of the faculty teaching it. However, this data did not include faculty gender, which we had to receive through an R package which assigned probability of gender based upon first name, as reported in the national census. We then assigned all faculty their most likely gender. However, this data set was not comprehensive. When combined with our first data set we were left with just over 0.9 million observations from fall 2008 through summer 2016.

Methodology

First, we cleaned up the data by dropping observations of people merely auditing a class, or if their professor did not enter a grade. We also dropped observations when there was a clear mistake in the student's high school GPA (if it was above 5). We also dropped data on students who do not have a binary gender, because we did not have enough observations of such students to get meaningful results. Finally we dropped data on students whose race/ethnicity was unknown. This left us with 3,321,785 observations, of which we had faculty information on 878,819.

Next, we identified the subjects for which we had the most observations. Picking an arbitrary threshold of 20,000 observations we were left with 14 departments: Anthropology(ANTH), Business(BA), Chemistry(CH), Economics(EC), English(ENG), History(HIST), Journalism(J), Mathematics(MATH), Music(MUS), Political Science(PS), Psychology(PHY), Sociology(SOC), Spanish(SPAN), and Writing(WR). In all of these departments, we found gender discrepancies in both student enrollment and student grades.

In order to examine the effects of faculty gender on students persistence within subjects, we found intro sequences in our previously identified departments for which we had at least 1,000 observations of men, and 1,000 observations of women who had passed the first class in the sequence, and for whom we had data on the gender of their faculty. The sequences we found were: CH221-CH222, EC201-EC202, MATH111-MATH112, MATH241-MATH242, MATH251-MATH252, PSY201-PSY202, and SPAN201-SPAN202. We used these sequences to look for any effects of student and faculty gender on student continuation rates in the sequence.

First we looked at what the gender discrepancies in continuation rate were, and then we used our model to regress continuation on student and faculty gender. In our model we set up dummy variables for what grade they got in the first course in the sequence against a baseline of A. We only included students who passed the first class, so the only possible grades were A, B, C, and P. We also split students into three categories, straight from high school, GED, and transfer. Additionally, we created dummy variables for faculty gender, international students, white students, non-resident students.

The GED category of students is very small. Oftentimes none of these students went through a sequence. Therefore, we omitted this variable when displaying our results in the “Results and Analysis” section, although when applicable, the model does control for it.

Empirical Model

Our model regressed likelihood of continuation on faculty gender, grade in the first class in the sequence, and student demographic information. For each sequence, we ran the regression once for men and once for women, and compared the results. The model is a simple OLS regression of the form:

$$Y_{\text{continue}} = \beta_1 + \beta_2(\text{female faculty}) + \beta_3(\text{B}) + \beta_4(\text{C}) + \beta_5(\text{P}) + \beta_6(\text{hsgpa}) + \beta_7(\text{international}) + \beta_8(\text{not White}) + \beta_9(\text{non resident}) + \beta_{10}(\text{transfer student}) + \beta_{11}(\text{GED student}) + \varepsilon$$

Y_{continue} = the percent chance that a student took the next class in the sequence

female faculty = 1 if the teacher is female, 0 otherwise

B = 1 if the student got a B in the first class in the sequence, 0 otherwise

C = 1 if the student got a C in the first class in the sequence, 0 otherwise

P = 1 if the student got a P in the first class in the sequence, 0 otherwise

hsgpa = the student's GPA from high school

International = 1 if the student is an international student, 0 otherwise

Not White = 1 if the student has a reported race/ethnicity other than white, 0 otherwise

Non resident = 1 if the student is not a resident of Oregon, and 0 if the student is

Transfer student = 1 if the student is a transfer student, 0 otherwise

GED = 1 if the student is a GED student, 0 otherwise

Results and Analysis

In our preliminary findings, we can see that women receive higher grades than men in almost every subject (Appendix Figure 1) and the average grades with respect to faculty-student relationships (Appendix Figure 2). We can also see that when taught by females, female student's grades are either affected either more positively, or less negatively than that of their male counterparts. In some subjects, such as chemistry, a female receives a higher-grade point of over .15 points when taught by a female professor. However, these are simple results, not correcting for other facts such as student demographics or course difficulty.

Next, we have split up our findings depending on subject in order to see the impact of faculty-student gender on course persistence and achievement.

Chemistry Courses:

Through running our model on the chemistry sequence of 221-222, we have found that in chemistry, men are more likely to continue with the sequence if they have a female teacher by 4.2%. Interestingly, women are more likely to progress if they have a female teacher. We also see that poor grades negatively affect men's and women's continuation rates similarly, and being an international student is a much bigger detriment for women than for men, as female international students are 20.7% less likely to proceed with the sequence than domestic students.

Chemistry 221 – Chemistry 222

VARIABLES	(MEN) Continuation rate	(WOMEN) Continuation rate
Female faculty	0.0421** (0.0173)	-0.000379 (0.0148)
Grade of B instead of A	-0.0524*** (0.0200)	-0.0625*** (0.0186)
Grade of C instead of A	-0.184*** (0.0209)	-0.119*** (0.0191)
Grade of P instead of A	-0.496*** (0.0416)	-0.484*** (0.0356)
HS GPA	0.000429 (0.0228)	-0.0127 (0.0223)
International	-0.121*** (0.0344)	-0.207*** (0.0379)
Ethnicity other than white	0.0224 (0.0173)	0.00786 (0.0145)
Non resident	0.000609 (0.0156)	0.0301** (0.0136)
Transfer student	-0.0122 (0.0266)	-0.0395 (0.0262)
Constant	0.932*** (0.0888)	0.982*** (0.0897)
Observations	2,320	2,840
R-squared	0.089	0.075

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Economics Courses:

In the economics 201-202 sequence, both men and women are more likely to continue if their EC201 teacher was female, however females have an added increase, with men by 2.8% and women by 3.9%. Men and women are affected similarly by bad grades, and being an international student again has a bigger impact on women than men. This time female international students are 21.6% more likely to continue than domestic students. Transfer students are significantly less likely to continue.

Economics 201 – Economics 202

VARIABLES	(MEN) Continuatin rate	(WOMEN) Continuatin rate
Female faculty	0.0279 (0.0169)	0.0394* (0.0222)
Grade of B instead of A	0.0168 (0.0174)	-0.00485 (0.0247)
Grade of C instead of A	-0.00732 (0.0185)	-0.0407 (0.0265)
Grade of P instead of A	-0.223*** (0.0385)	-0.232*** (0.0346)
HS GPA	-0.0208 (0.0204)	-0.0604** (0.0292)
International	0.115*** (0.0232)	0.216*** (0.0313)
Ethnicity other than white	0.00596 (0.0172)	-0.0292 (0.0217)

Non resident	-0.0107 (0.0148)	0.0196 (0.0197)
Transfer student	-0.172*** (0.0222)	-0.102*** (0.0308)
Constant	0.906*** (0.0772)	0.969*** (0.114)
Observations	3,068	2,330
R-squared	0.049	0.068

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Mathematics Courses:

In the Math 111-112 sequence, Women are largely unaffected by faculty gender, but men are less likely to continue if they have a female teacher by 4.6%. Women are ever so slightly more discouraged by poor grades, although this is definitely in the margin of error. Again, internationality has a much bigger effect on women. This time international women are 32% less likely to continue than domestic women.

Interestingly in the Math 241-242 sequence, women are less likely to continue if there teacher is female by 6.1%. Women of color are more likely to continue than white women, an effect not seen in the men.

In the Math 251-252 sequence, faculty gender does not affect continuation much, but the effect of poor grades is high, and slightly more pronounced in men. Again, the

effect of being an international student is higher in women; this time being a positive 19.3% increase in course persistence.

Math 111 – Math 112

VARIABLES	(MEN) Continuation rate	(WOMEN) Continuatio n rate
Female faculty	-0.0459*** (0.0164)	0.00403 (0.0177)
Grade of B instead of A	0.00123 (0.0182)	-0.0247 (0.0192)
Grade of C instead of A	-0.0214 (0.0196)	-0.0395* (0.0212)
Grade of P instead of A	-0.191*** (0.0272)	-0.214*** (0.0324)
HS GPA	0.0478** (0.0234)	0.0549** (0.0266)
International	-0.0968*** (0.0291)	-0.320*** (0.0362)
Ethnicity other than white	0.0565*** (0.0174)	0.0672*** (0.0177)
Non resident	-0.0392*** (0.0149)	0.0157 (0.0159)
Transfer student	-0.0347 (0.0349)	-0.0693* (0.0384)
Constant	0.248*** (0.0861)	0.291*** (0.102)
Observations	4,536	4,130
R-squared	0.022	0.031

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Math 241 – Math 242

VARIABLES	(MEN) Continuation rate	(WOMEN) Continuation rate
Female faculty	-0.0295 (0.0194)	-0.0607** (0.0296)
Grade of B instead of A	0.00926 (0.0180)	-0.0161 (0.0261)
Grade of C instead of A	-0.0571*** (0.0178)	-0.0845*** (0.0266)
Grade of P instead of A	-0.129*** (0.0269)	-0.253*** (0.0446)
HS GPA	0.0275 (0.0192)	-0.0734** (0.0348)
International	-0.0383 (0.0235)	-0.00260 (0.0330)
Ethnicity other than white	0.00248 (0.0164)	0.0401* (0.0240)
Non resident	0.0157 (0.0134)	0.00223 (0.0218)
Transfer student	-0.0175 (0.0211)	-0.00174 (0.0381)
Constant	0.822*** (0.0727)	1.154*** (0.137)
Observations	2,615	1,364
R-squared	0.022	0.040

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Math 251 – Math 252

VARIABLES	(MEN) Continuation rate	(WOMEN) Continuatio n rate
Female faculty	-0.0247 (0.0286)	-0.0283 (0.0363)
Grade of B instead of A	-0.0932*** (0.0263)	-0.0828** (0.0336)
Grade of C instead of A	-0.198*** (0.0271)	-0.158*** (0.0363)
Grade of P instead of A	-0.346*** (0.0596)	-0.306*** (0.0655)
HS GPA	-0.0693** (0.0323)	0.0712 (0.0456)
International	0.146*** (0.0362)	0.193*** (0.0455)
Ethnicity other than white	-0.0150 (0.0276)	0.0346 (0.0317)
Non resident	-0.00635 (0.0248)	-0.0284 (0.0298)
Transfer student	-0.0188 (0.0372)	-0.0261 (0.0517)
Constant	1.100*** (0.123)	0.428** (0.181)
Observations	1,542	1,264
R-squared	0.074	0.070

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Psychology Courses:

In the psychology 201-202 sequence, women are 5.8% less likely to continue if they had a female teacher, whereas men are 9.5% less likely. Grades play a much less significant role in this sequence than in others, and the effect of being an international or transfer student is much higher for women. 20.2% increase for being international, 21.7% decrease for being a transfer.

Psychology 201 – Psychology 202

VARIABLES	(MEN) Continuation rate	(WOMEN) Continuation rate
Female faculty	-0.0952*** (0.0344)	-0.0584** (0.0243)
Grade of B instead of A	-0.00132 (0.0286)	-0.00405 (0.0207)
Grade of C instead of A	-0.0174 (0.0321)	-0.0367 (0.0241)
Grade of P instead of A	-0.176*** (0.0473)	-0.229*** (0.0382)
HS GPA	-0.0855** (0.0339)	-0.0914*** (0.0274)
International	0.0540 (0.0634)	0.202*** (0.0547)
Ethnicity other than	0.0255	-0.0103

white	(0.0255)	(0.0192)
Non resident	-0.0445* (0.0230)	0.00259 (0.0173)
Transfer student	-0.0951** (0.0376)	-0.217*** (0.0313)
Constant	0.837*** (0.128)	0.933*** (0.106)
Observations	2,025	3,543
R-squared	0.018	0.031

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Spanish Courses

Faculty gender plays an insignificant role in sequence continuation, as do grades. This is the sequence for which our variables explain the variance in continuation the least, with R² of 0.007 and 0.012.

Spanish 201 – Spanish 202

VARIABLES	(MEN) Continuation rate	(WOMEN) Continuation rate
Female faculty	-0.00157 (0.0174)	-0.00911 (0.0126)
Grade of B instead of A	0.00119 (0.0205)	0.0140 (0.0141)
Grade of C instead of A	-0.0219 (0.0271)	-0.00762 (0.0218)

Grade of P instead of A	-0.0703* (0.0398)	-0.135*** (0.0366)
HS GPA	-0.0458* (0.0257)	-0.0372* (0.0202)
International	0.0138 (0.0803)	0.0445 (0.0780)
Ethnicity other than White	-0.0315 (0.0226)	-0.0332** (0.0159)
Non resident	-0.0101 (0.0180)	-0.0142 (0.0134)
Transfer student	-0.00518 (0.0295)	-0.0177 (0.0226)
Constant	1.071*** (0.0974)	1.061*** (0.0780)
Observations	1,276	2,092
R-squared	0.007	0.012

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Conclusion

While in our preliminary findings it is clear that females receive higher grades on average when taught by a female professor. In every single identified subject except for writing, females receive an increased grade anywhere from .01 to over .2 grade points when compared to men. This is a significant finding, as a .2 grade point difference is about the difference between an A- and an A.

From our regressions and analysis however, we can see that faculty gender does not substantively impact persistence rates as measured by sequence continuation. Economics courses and the math 211-212 sequence were the only two courses that saw an increase in continuation rate for females when taught by a female professor, economics being the greatest increase, with women being 3.9% more likely to take EC202 if they took EC201 from a woman.

Though we did not find a significant discrepancy in course persistence by gender, our research did find that other variables such as grades do play a part in continuation in sequences. We found that men and women are similarly affected by poor grades. Getting a B or C in the first sequence rather than an A is one of the bigger reasons a student might not continue in the sequence, though the magnitude of this effect differs for each gender by course subject.

Transfer and international students are also more greatly affected when looking at course persistence. Female international students had a wide range of continuation rates

by course, ranging from being 32% less likely, to 21% more likely to continue on in the sequence than female domestic students. Female transfer students also see the same impact. These findings suggest that student type plays a much larger role in subject persistence than faculty gender, and though in some cases females see an increase in likeliness to continue on in the sequence, in most courses and subjects, the number is insignificant.

Further analysis could be done to this study in order to see female faculty's impact on female student's grades, with a lengthened model with added variables. This would be helpful in seeing female faculty's true impact on student grades. It would also be helpful to perform further analysis on transfer and international students, as women in both see a much higher magnitude of likeliness of course persistence.

Appendix:

Figure 1: Gender breakdown of our identified course subjects

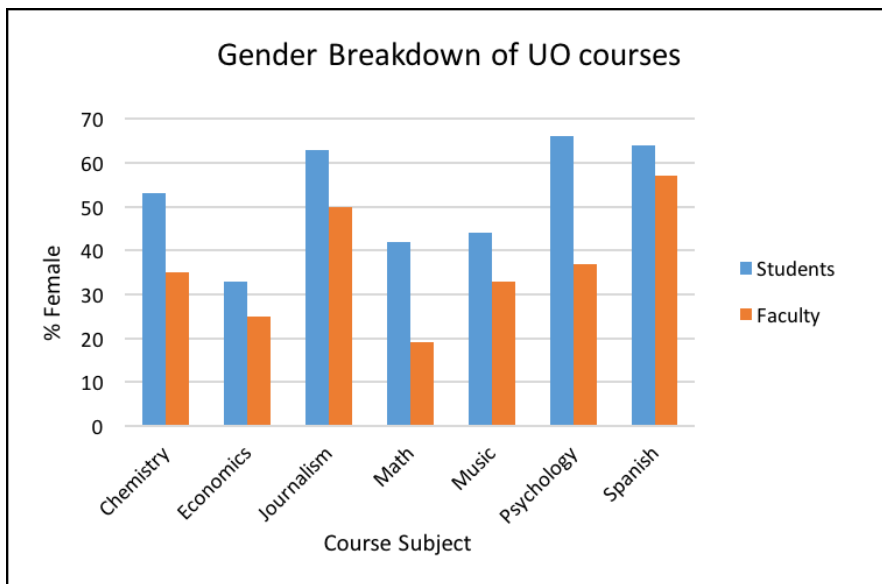


Figure 2: Average GPA of our identified course subjects

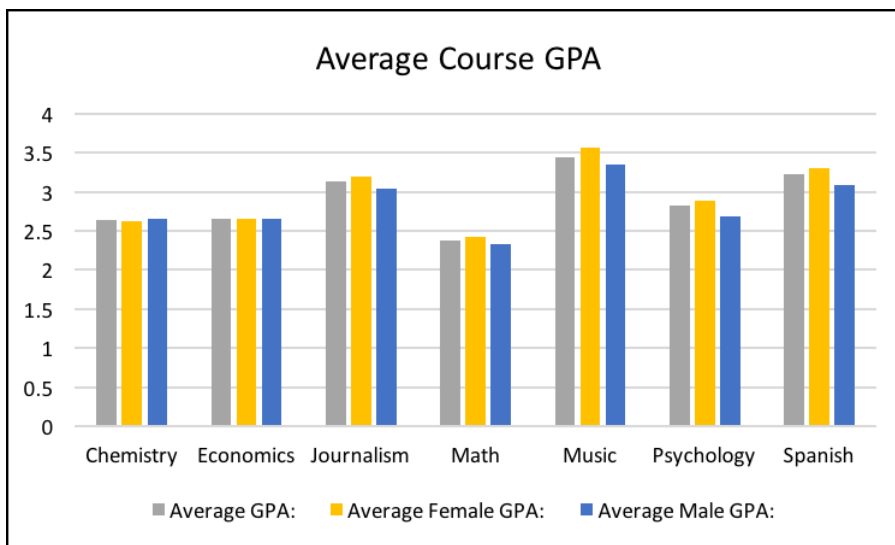


Figure 3: Average GPA with respect to teacher-student gender relationships, where MM= males teaching males. MF = males teaching females. FM = females teaching males FF = females teaching females.

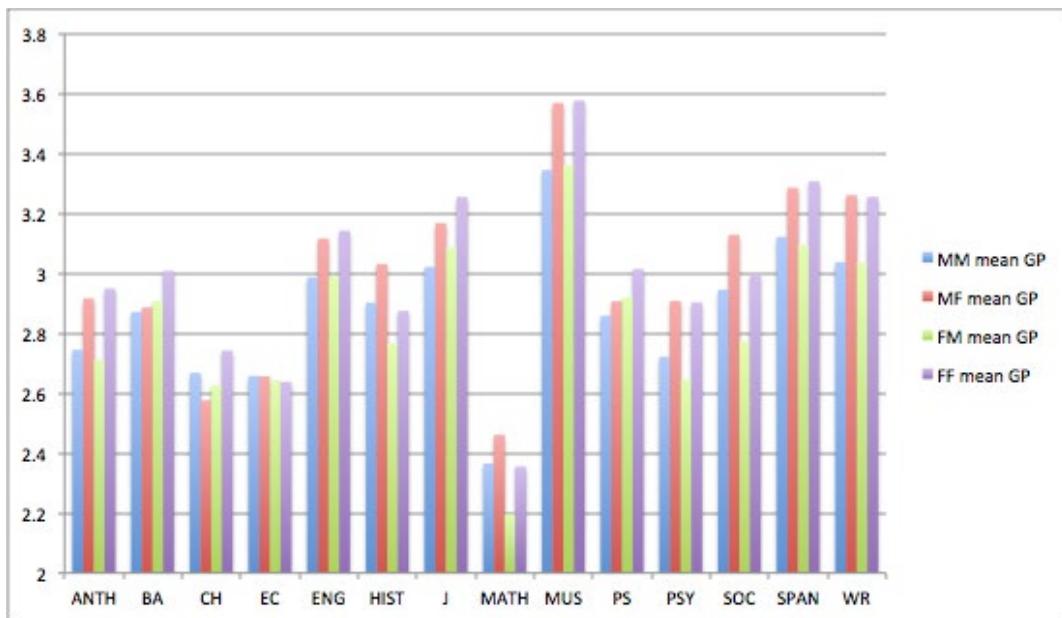
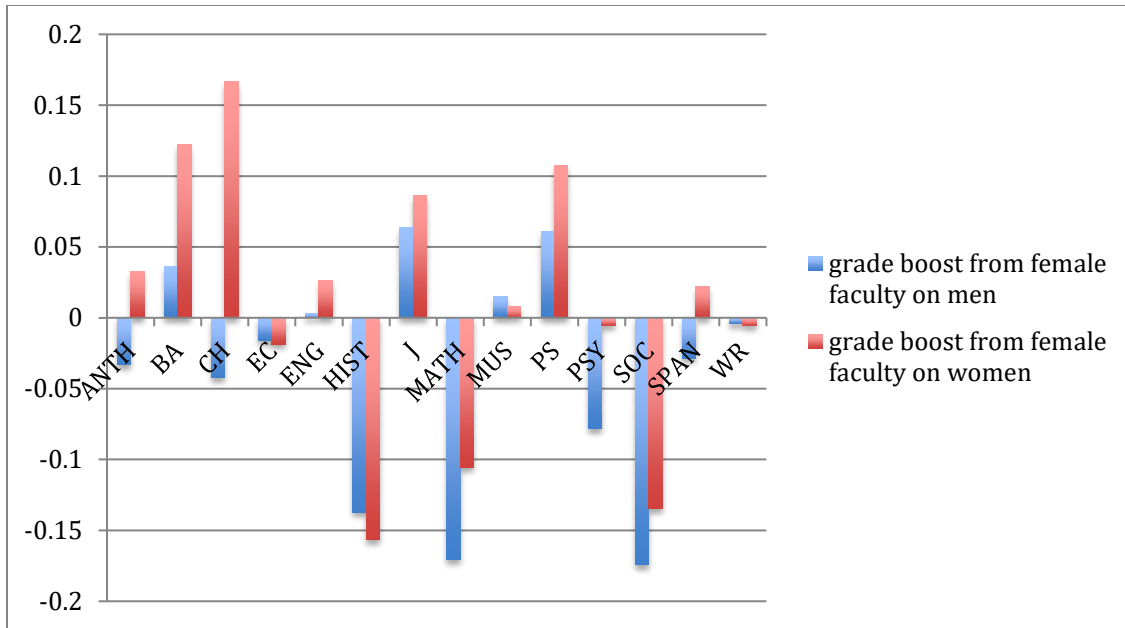


Figure 4: Grade boost from being taught by women



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