The Effect of Instructor Race and Gender on Student Persistence in STEM Fields

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The objective of this study is to determine if minority and female students are more likely to persist in a science, technology, engineering, and math (STEM) major when they enroll in classes taught by instructors of their own race or gender. Using data from public four-year universities in the state of Ohio, I analyze first semester STEM courses to see if the race or gender of the instructor effects persistence of initial STEM majors in a STEM field after the first semester and first year. Results indicate that black students are more likely to persist in a STEM major if they have a STEM course taught by a black instructor. Similar to previous findings, female students are less likely to persist when more of their STEM courses are taught by female instructors.

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JEL Classification codes: I2, J1

Introduction

Historically, women and racial minorities have been underrepresented in science and engineering occupations. In an effort to increase the number of women and minorities in these occupations, many recent policies have focused on increasing the number of female and minority students who enter college in science, technology, engineering, or math (STEM) fields. However, the NSF's Science and Engineering Indicators report (2008) finds that students who begin college as STEM majors have a lower probability of receiving a degree in their initial field than students in other majors. Of even greater concern is that women and historically disadvantaged racial minorities who initially intend to major in a STEM field are the least likely to persist toward a degree in one of these fields.

It is hypothesized that students experience better educational outcomes when they are able to interact and associate with faculty who are of their own race or gender. Multiple studies examine the association between female faculty and academic outcomes of female students in STEM majors (Rothstein, 1995; Canes & Rosen, 1995; Robst, Keil, & Russo, 1998), yet these studies do not account for selection bias that might be introduced when students self select courses. Hoffman and Oreopoulos (2009) focus on first semester courses, which are chosen independent of instructor race, and find that an own-gender instructor in a math or science course decreases female grade performance and the number of same subject courses taken in later years. Carrel et al (2010) rely on random assignment of both students and faculty to courses to show that on average female students perform better in a course taught by a female instructor but experience no increase of performance in subsequent courses and no effect on graduating in a STEM field. They do however find that high ability female students, defined by SAT scores, who have an introductory STEM course taught by a female instructor perform better in the introductory and subsequent courses and are more likely to receive a degree in a STEM field. Bettinger and Long (2007) address the selection issue by instrumenting for having a course taught by a female instructor with a measure of the fraction of courses within a department taught by female instructors. They find that female faculty have a positive effect on female students taking additional courses in mathematics and geology, but a negative effect in the fields of biology and physics.

While many studies have examined the effect of own-gender instructors, little research exists on the effect of own-race instructors on student outcomes at the college level. Rask and Bailey (2002) find that minority students who take more courses in a field from a professor of the same race are more likely to major in that field. This study only seeks to analyze the correlation and not the causal effect of having a course taught by a same-race instructor. There have been several studies which have looked at own-race instructors at the K-12 setting, and find positive effects on students who have their classes taught by own-race teachers (Ehrenberg & Brewer, 1995; Ehrenberg, Goldhaber, & Brewer, 1995; Dee, 2004; Klopfenstein, 2005, Dee, 2005). While there is documented evidence for a positive effect of teacher-student racial matching in elementary and secondary school, the relationship that exists between professor and student may be quite different at the college level. There is a need for research on the effect of having a same-race teacher for college students.

The primary objective of this study is to estimate the effect of having own-race instructors on persistence in STEM fields using within institution variation of the number of black faculty assigned to teach introductory courses. A secondary objective is to examine the effects of own-gender instructors on persistence of initial STEM majors.

The outcome of interest in the current study is persistence in a STEM field major, with persistence being defined as entering college with the intent of majoring in a STEM field and remaining in a STEM field major in subsequent semesters. The focus is placed on the intermediate measurement of intended major in order to identify when students begin to transition from STEM to non-STEM fields while in college. Many students change their major during their first years of college (40 percent after the first year and 74 percent after the second year). As findings from previous research indicate that faculty have the strongest influence on students within the first years of their college experience (Canes & Rosen 1995; Solnick, 1995), this study focuses on the student-faculty interaction occurring during the first semester of the freshmen year.

I use a linear probability model to estimate the effect of STEM instructor's race on student persistence in STEM fields. The key explanatory variable is the number of STEM courses in which a student enrolls in the first semester that are taught by black instructors. I use data from the Ohio Board of Regents, which includes course enrollment data for first time freshmen who enrolled between 1998 and 2002 in all public 4-year institutions in the state of Ohio. One of the empirical challenges of identifying casual effects of instructors is that students may differentially select into courses based on the race or gender of the instructor. For example, the data used in this study indicate that courses taught by a black instructor have a 2.4 to 10.4 percent higher fraction of black students enrolled in the course.

To address this selection issue, I instrument for whether a STEM course is taught by a black instructor with the fraction of STEM courses taught by black instructors at a given institution during a given semester. The fraction of STEM courses taught by black instructors within an institution varies due to several factors such as recent hires, course assignments, sabbaticals, and faculty leaving the institution. I also include a measure for the total number of black faculty in STEM fields within each institution to capture factors that may change within an institution over time. I use a similar instrumental variable to estimate the causal effects of female instructors on persistence.

My IV estimates indicate that having a black instructor increases the likelihood that black students persist in a STEM field. However, In contrast to past studies using elementary and secondary school student samples (Dee, 2004), I find that for college students, black instructors have no effect on persistence of white students in STEM fields. These results illustrate the positive effect that own-race instructors can have on academic outcomes early on in college for underrepresented minorities. In addition, I find that female instructors do not have a positive effect on the likelihood that female students persist in a STEM field.

III. Data

The data for this study comes from the Ohio Board of Regents, which collects data from all public universities within the State of Ohio. The data consist of first-time freshmen who enrolled in one of the 13 public 4-year universities in the state of Ohio between 1998 and 2002. Three sources of student-level data are included in the present analysis: (1) information the school receives when the student first enrolls, including gender, race, age, standardized test score (ACT or SAT) and state of residence; (2) information the school records each term, such as term grade point average and intended major field of study, and (3) the courses in which each student enrolled for each term up to six years after initial enrollment. In addition course records identify the instructor of each course. I then merge in administrative faculty files containing information on each faculty member, including race, gender, tenure status, rank, and highest degree earned. This allows me to match each student with the instructor of each course in which they enrolled.

One of the difficulties of examining the effect of minority instructors on academic outcomes is that many data sets have a small number of observations of either the number of minority students or minority faculty. The Ohio data used in this study includes information on 14,448 black students and 1,613 black faculty, a sample size that makes it possible to estimate the effects of having a black instructor on academic outcomes for black college students. Another advantage of using data from Ohio is that the demographic characteristics of students who attend public 4-year universities in the state are similar to nationally representative samples.[1]

The five cohorts of first-time freshmen included in the data utilized in this analysis include over 155,000 students, of whom 22.1 percent initially intended to major in a STEM field. Throughout this paper, I aggregate subfields into a general STEM or non-STEM classification. Table 1 examines initial major choice and shows that female students initially constitute a lower percentage of STEM majors than non-STEM majors. Additionally, ACT scores are 2.5 points higher (≈90 SAT points) among STEM majors.[2] Significant differences arise when examining the fraction of students from a particular subgroup who initially declare a STEM major. Among men in the sample, 31.8 percent initially declare a STEM major compared to only 14.3 percent of female students. In terms of initial racial differences; 22.3 percent of white students initially declare a STEM field major compared to 20 percent of black students.

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[1] For a more detailed argument of external validity see Bettinger (2007)

[2] The ACT is a college entrance exam similar to the SAT. A 21.7 on the ACT is approximately equivalent to a 1000 and a 24.2 is equivalent to a 1090 on the SAT.

There are significant gender and racial differences in faculty characteristics within STEM fields. As shown in Table 2, the same proportion of black faculty in STEM fields have a Ph.D. as white faculty, but they are less likely to be full professor. Female faculty are less likely to have a Ph.D., be a full or associate professor, and be full-time employed. These differences show the importance of controlling for observable characteristics of instructors when estimating the effect of instructor race and gender on student outcomes.

If the ultimate policy goal is to increase the number of female and minority students who major in a STEM field, then outcomes of interest should include indicators that are correlated with receiving a degree in a STEM field. Previous studies have examined grade performance and probability of enrolling in additional courses in a particular field as indicators for earning a degree (Hoffman & Oreopoulos, 2009; Carrell et al., 2009; Bettinger & Long, 2005). These outcomes may not provide the best measures of intent to earn a degree in a STEM field since enrolling in additional STEM courses may be the result of a general education requirement needing to be fulfilled and not necessarily due to interest in that field or intent to graduate in it. Whether the individual intends to major in a STEM field major is a better indicator that can be used to show progress toward the goal of receiving a degree in a STEM field. Therefore, the outcome which is of most interest in this study is whether a student who initially intends to major in a STEM field continues in a STEM field as his or her intended major in subsequent terms in which he or she enrolls.

IV. Patterns of Persistence

In this study, persistence is defined as continuing on in the field of the initial major during subsequent semesters that the student is enrolled in classes. The data for this measure are constructed from administrative records that contain the student's intended major for each term the student is enrolled. The focus of this analysis is on STEM fields in general; thus changing majors within STEM fields is counted as persisting in a STEM field (i.e. a student who initially declares a major in chemistry and then changes to a biology major is considered as persisting in a STEM field). The same is true for students who transfer within non-STEM field majors.

Lower persistence rates exist among those students who initially enter STEM fields compared with those who initially enter non-STEM fields. Table 3 shows the cumulative distribution of persisting in initial major, changing majors, and dropping out of school. Among initial STEM majors, 91.6 percent remain STEM majors by the second semester of their freshman year. However, only 71.8 percent of initial STEM majors remain in a STEM field by the beginning semester of their sophomore year. Persistence rates for non-STEM majors are significantly higher, with 95.8 percent persisting in a non-STEM field after the first semester and 83.4 percent after the first year[3]. Also, a larger fraction of students in non-STEM majors drop out of college compared with students in STEM majors. Among initial STEM majors, those individuals who either change majors or drop out of school, 14 percent do so after the first semester, 47 percent do so within in the first year of school, and 75 percent within the first two years.

In addition to differences in persistence rates across fields of study, there are significant differences in persistence rates between gender and racial groups within STEM field majors. The results in the top panel of Figure 1 indicate that, even after controlling for institution and cohort, white students are more likely to persist in STEM fields than black students. However,

[3] The persistence rates between STEM and non-STEM majors is significantly different at the 1% level

controlling for a measure of prior achievement by including ACT test scores, the white-black persistence gaps decreases by almost one-half. This provides suggestive evidence that prior preparation is an important factor in explaining the racial differences of persistence in STEM fields. The bottom panel shows that males are more likely to persist in STEM fields than female students. However, ACT test scores do not explain the difference in persistence rates between males and females as the male-female persistence gap is virtually unchanged when controlling for test scores.

While there are racial and gender differences in persistence in STEM fields, there also exist such differences in non-STEM fields. As shown in Figure 2, there is a racial gap in 3-year persistence rates in both STEM and non-STEM fields. This measure of persistence counts individuals who change to non-STEM majors and dropouts as not persisting, yet individuals who dropout and individuals who change majors may be very different. To examine the decision of persisting in STEM majors versus changing majors, I condition on not dropping out of school. Once conditioning on not dropping out, the persistence gaps remains among STEM fields but black are marginally more likely to persist in non-STEM fields. This indicates that the unconditioned persistence gap among non-STEM majors is being driven by students who drop out. Figure 3 shows that men are more likely to persist in STEM fields, but less likely to persist in non-STEM fields.

V. Methods

The objective of this study is to test whether students who have their STEM courses taught by an instructor with similar racial or gender characteristics are more likely to persist in a STEM field major. To test this hypothesis, I focus on the first semester courses of students who initially declare a STEM major. The basic econometric model is represented with the following equation:

$$
\begin{aligned}
Persistence_{ijk} = {} & \beta_1(Black)_{ijk} + \beta_2(Black\ STEM\ instructor)_{ijk} + \\
& \beta_3(Black\ STEM\ instructor * Black)_{ijk} + \\
& \beta_4(Number\ of\ STEM\ courses)_{ijk} + \beta_5(Number\ of\ Non-STEM\ courses)_{ijk} + \\
& X_{ijk} + \lambda_{ijk} + \theta_i + \delta_j + \delta_k + u_{ijt}
\end{aligned}
$$

where $Persistence_{ijk}$ is a binary outcome equal to one if student *i* at school *j* in cohort *k* is a STEM major in the second semester given that student i's initial major was in a STEM field. The key variable of interest is black STEM instructor, which is a binary measure for having at least one black instructor in a STEM course (89% of students who have at least one black STEM instructor have only one). The term black STEM instructor gives the effect of a black instructor on white students, and the interaction of black STEM instructor and black, which yields the effect of a black STEM instructor on black students. The vector X_i controls for student characteristics such as race, gender, ACT test score[4], and state of residence. Also included in the equation are controls for observable characteristics of instructors such as rank, tenure status, full-time, and graduate assistant (λ). To account for structural differences between majors within STEM fields, θ is a set of dummy variables for the initial major of student i. There may also be specific programs implemented by individual universities that may affect a student's decision to remain in a STEM field major; thus I also include institutional fixed effects (δ_j), and cohort fixed effects (δ_k) to account for differences over time. I also use this same model to estimate the own gender effect of instructors on persistence.

[4] A dummy variable is included to account for the 16% of the sample who have missing ACT scores.

I start by assuming that first semester courses are chosen independent of the characteristics of the instructors of the course. Based on this assumption, I use a linear probability model to estimate the correlation between the number of STEM courses that are taught by black instructors and the outcome of persisting in a STEM field. However, there are some possible reasons why the assumption that students randomly sort into classes in their first semester may not be a valid assumption. For example, although students sign up for classes before coming to campus, they can access information about potential instructors online or there may be opportunities to switch classes during the first week of school.

The selection into courses may occur at two different levels. First, students may decide to take a course within a field of study, and then enroll in a course which is taught by an instructor of similar characteristics, or what I refer to as between-course selection. The second type of selection occurs when students decide on a course, and then enroll in a section of the course based on faculty race or gender (within-course selection). Following the method of Hoffman and Oreopoulos (2009), I test both type of selection by examining the relationship between the race of the instructor and the racial composition of the students in the course and show results in Table 5. Within field selection shows that once controlling for faculty characteristics, institution and cohort fixed effects, and field fixed effects, STEM courses taught by a black instructor have a 5.7 percentage point increase in the fraction of black students enrolled in the course. With an average class size of 32.86, this increase represents, on average, 1.87 more black students when a course is taught by a black instructor. Within-course selection shows even less selection, once including course fixed effects, a black instructor is correlated with a 2.8 percentage point increase in the fraction of black students enrolled in the course. This translates to about .92 of a student on average. Though modest in magnitude, this does provide suggestive evidence that black students do select into courses taught by black instructors.

Similar to the analysis examining selection into courses based on race of instructor, I examine the gender of the instructor influences the gender composition of the class (see Table 6). Between-course selection shows that having a female instructor in a STEM course increases the fraction of female students by 3.7 percentage points (1.2 more female students). Within-course selection shows that having a female instructor is not correlated with the fraction of female students who enroll in the course, indicating that selection may be less of an issue when examining the effect of own-gender instructor on persistence.

To address possible selection bias issues, I use the fraction of STEM courses taught by black instructors at an institution to instrument for the number of STEM courses taught by black instructors. Since institutional and cohort fixed effects are included in the model, the variation of the instrument comes from within institution changes over time in the number of courses taught by black faculty and the total number of courses offered. This variation can be driven by recent hires, course assignments, sabbaticals, job loss, or other within institution factors. I also control for the total number of black STEM instructors at each institution in the first stage equation to proxy for time-varying institutional factors that might be correlated with the type of instructors assigned to introductory courses and a student's decision to persist in a STEM field.

This instrument is similar to that used by Bettinger and Long (2005), but can be seen as an improvement because it aggregates fields to classify them as STEM versus non-STEM. Bettinger and Long conduct their analysis on more refined measures of field of study (i.e. physics, chemistry, biology, etc.) and use proportion of courses taught by female faculty to instrument for having a female instructor. While this controls for selection within a field, there may be selection across closely related fields of study based on faculty characteristics. For example, the choices of students may not just be between sections of the same chemistry course, but between different courses within STEM fields. Thus, aggregating to a higher level better accounts for the type of selection that occurs.

VI. Results

Effect of Racial Matching

The baseline model examines the relationship between the number of black instructors in STEM courses and persistence of students in a STEM field after the first semester and after the first year. OLS makes the assumption that factors related to a student enrolling in a class taught by a black instructor are not correlated with persistence. Results in Table 7 indicate that under OLS assumptions, black students are equally as likely to persist as non-black students after the first semester. Additionally, the number of black STEM instructors has a positive influence on persistence of non-black students, as the coefficient on Black STEM Instructor indicates a 2.8 percentage point increase in persistence. The interaction term between Black STEM Instructors and Black yields the effect of the number of STEM courses taught by black faculty on the persistence of black students. After the first semester, there is not a statistical relationship between the number of black instructors and persistence on black STEM majors. Looking at persistence after the first year of school, OLS results indicate that black students are 4.5 percentage points less likely to persist after one year. However, a black student who has at least one STEM course taught by a black instructor is 8.1 percentage points more likely to persist, which closes the black-white persistence gap. Other results from the baseline model indicate that higher ACT scores are correlated with increased rates of persistence. Also, holding constant the number of non-STEM courses, each additional STEM course in which a student enrolls is associated with a 1.9 and 5.5 percentage point increase in persistence after the first semester and first year respectively.

As discussed, self selection of students into courses may introduce a bias in the OLS estimations. To account for this possible bias, I instrument for the number of black STEM instructors with the fraction of STEM courses that are taught by black faculty at the institution. The lower panel of Table 7 shows the first stage estimation results for the number of black STEM instructors. Since the baseline equation includes both the number of black STEM instructors and the number of black instructors interacted with black, I use the instrument and the instrument interacted with black (student race) to create the first stage estimations. In both cases the instruments are highly correlated with the number of black instructors in STEM courses and have large F statistics. The second stage results show that there continues to be no statistical effect on persistence after the first semester. However, examining transitions that occur by the end of the first year; it appears black students are significantly more likely to persist when their initial STEM courses are taught by black instructors.

I change the baseline model to verify the robustness of the results. First, Instead of using a binary measure of having at least one black STEM instructor, I include a count measure of the number of black STEM instructors. Second, I redefine persistence to be conditional on not dropping out of school, thus I am modeling the decision to persist in a STEM major or change to a non-STEM major for those who are still enrolled in school. Under both of these specifications the results remain qualitatively and quantitatively similar.

The general finding is that black instructors do not have a significant impact on black students' persistence in a STEM field after the first semester. It does seem to be the case that having a black instructor has a significant impact on persistence of black students after the first year. The magnitude of the effect is hard to pin down. OLS results would suggest the effect is between five to eight percentage points. IV results would suggest that the real effect, once accounting for selection bias, is much larger. Maybe equally important is that black instructors do not have a negative impact on non-black students. The effect was ranged from two to three percentage points under OLS, but was insignificant with instrumental variables. There is evidence to suggest that not having an own –race teacher has negative impacts in the K-12 setting (Dee, 2007), yet it is evident that this is not the case at the college level.

Effect of Gender Matching

The baseline model of the effect of having at least one female STEM instructors on persistence of initial STEM majors is shown in Table 8. The OLS model shows that female students are 4.1 percentage points less likely to persist in a STEM field than male students after the first semester. Having a female instructor in a STEM course has a small negative effect on the persistence of male students and no effect on the persistence of female students. However, when examining persistence after the first year, female students are 7.4 percentage points less likely to persist and each additional female instructor lowers the persistence of male students by 1.8 percentage point after the first year. Female students who have at least one course taught by a female instructor are 1.1 percentage points more likely to persist after the first semester, but not statistical relationship exists after the first year. These results are fairly robust under other specifications which examine the number of STEM courses taught by a female instructor and conditioning on not dropping out.

In a similar study, Carrel et al (2010) find that on average there are no effects on academic outcomes when female students enroll in STEM courses taught by a female faculty. However, when they look at a subsample of students who are high ability, they find significant and positive effects of high ability females who have female instructors. They use the 75th percentile of the SAT math section (score of 700) as the cutoff for high ability. While the data in this study does not include a detailed breakdown of the ACT exam, I can set arbitrary benchmarks to separate the sample. Using an ACT score at 30 or above[5], I find that there no longer exists a significant negative relationship between own-gender instructors and persistence of female STEM majors (See Table 9). Using the 75th percentile of the distribution of scores (ACT score of 25) or other cutoffs below 30 continue to show a negative relationship between female instructors and persistence of female students[6]. While this does not show the same result as Carrel et al (2010), it is suggestive that the negative effect of own-gender instructors does not exist among high ability students.

The general result that female students are less likely to persist when they have a female instructor in an introductory STEM corresponds with findings in previous studies. Hoffman & Oreopoulos (2009) find that female students who have female instructors in math and science courses get lower grades in those courses. There is evidence to suggest that female students are more sensitive to grades, and are less likely to take additional courses than male students when they receive poorer grades (Rask & Tiefenthaler, 2008). Therefore, if female students receive lower grades in a STEM course when taught by a female instructor, then this could explain why female students are less likely to persist in STEM fields. Subsequently, multiple studies find that

[5] Results are similar when using ACT scores above 30 as the cutoff.
[6] Results are available upon request

female students enroll in significantly fewer classes in STEM fields when initial courses are taught be female faculty (Hoffman & Oreopoulos, 2008; Bettinger & Long, 2005).

Conclusions

The current study seeks to explain why minority and female students are less likely to persist in STEM fields. The black-white persistence gap begins to emerge after the first semester, and continues to grow after each semester. After 3 years, about 30 percent of initial STEM majors who are black are still in a STEM related field, compared to almost half of white students. Prior preparation, as measured by ACT scores, explains about half of the black-white persistence gap for minority STEM majors. This indicates that there is much to do in both preparing underrepresented minorities prior to enrolling in college as well as during the first few years in their college experience to be able to succeed in STEM related majors. There are also distinct patterns of persistence between male and female STEM majors. The gender persistence gap is smaller in magnitude than the black-white persistence gap, but emerges even after the first semester and continues to increase after the sixth semester (40 percent persistence for women versus 53 percent for men). However, controlling for prior preparation does not significantly degrease the gender. This suggests that more could be done within the college setting to improve persistence of women in STEM majors.

The main objective of this study was to test the hypothesis that students who have STEM courses taught by an instructor of their own race or gender are more likely to persist in a STEM major. The empirical evidence provided in this study suggests that black students who enroll in STEM courses taught by black instructors are more likely to persist in a STEM field after the first year. Furthermore, this study also suggests that female students are less likely to persist in a STEM field when courses in these fields are taught by female instructors.

Findings from this study would suggest that increasing the number of black faculty teaching introductory STEM courses would have a positive influence on improving persistence of black students. But the limitation of the study is that it does not identify the mechanism driving the result. If black instructors serve as mentors to black students, then maybe schools could do more to facilitate and foster mentor relationships between students and faculty. If the presence of black instructors in the classroom serve as role models or help improve student's view of self efficacy, then just having black faculty in the department could have the same effect. What is really needed is future research designed to understand the mechanism, such that policy implications can be provided to increase the representation of minority students persisting toward a degree in a STEM field.

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Figure 1.
Racial and Gender Persistence Gap of Initial STEM Majors by Semester

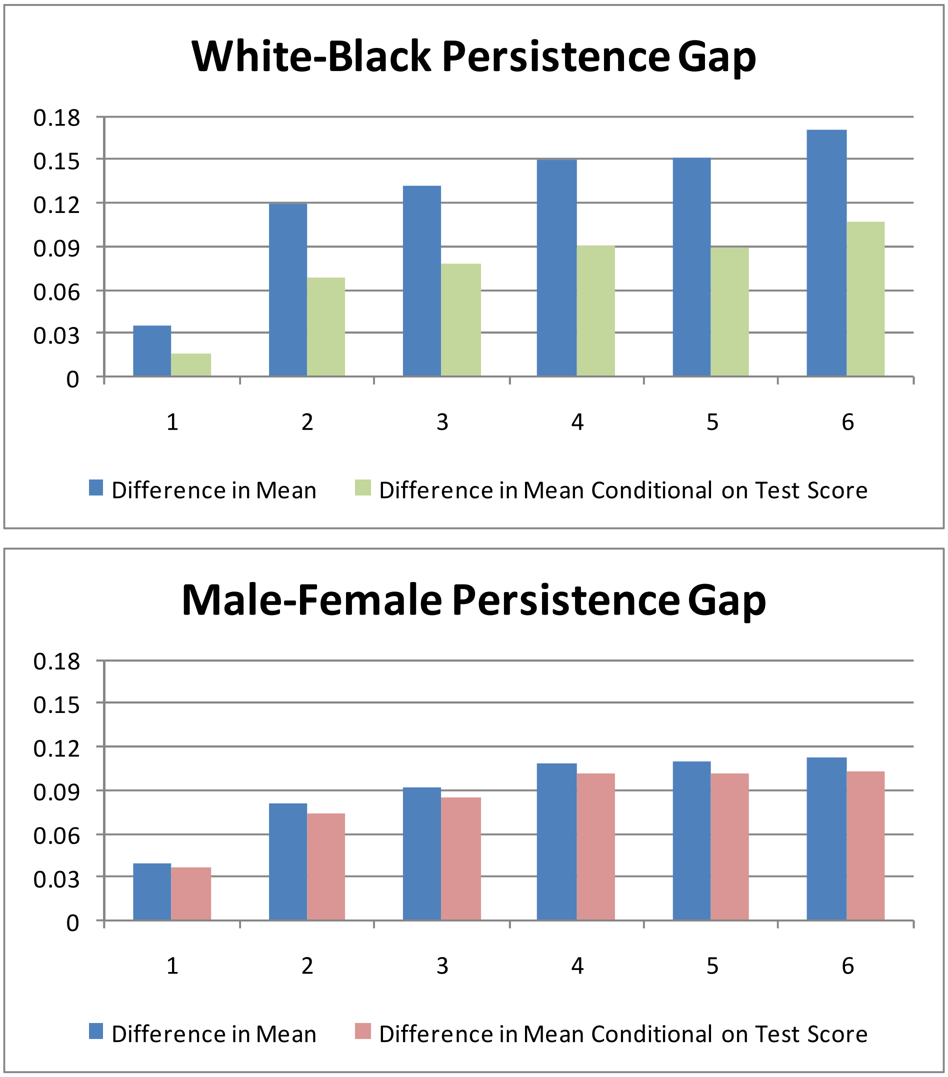

Figure 2.
Three Year Persistence Rates by Race

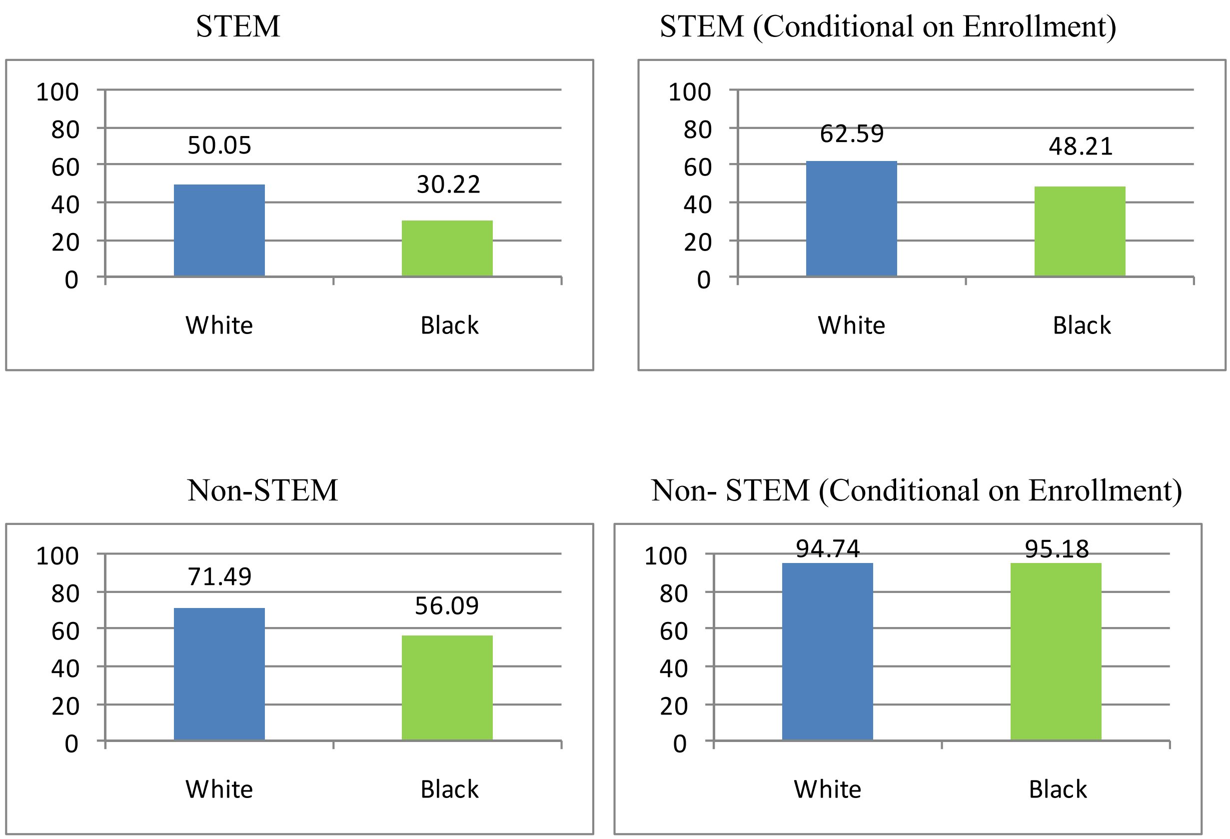

Figure 3.
Three Year Persistence Rates by Gender

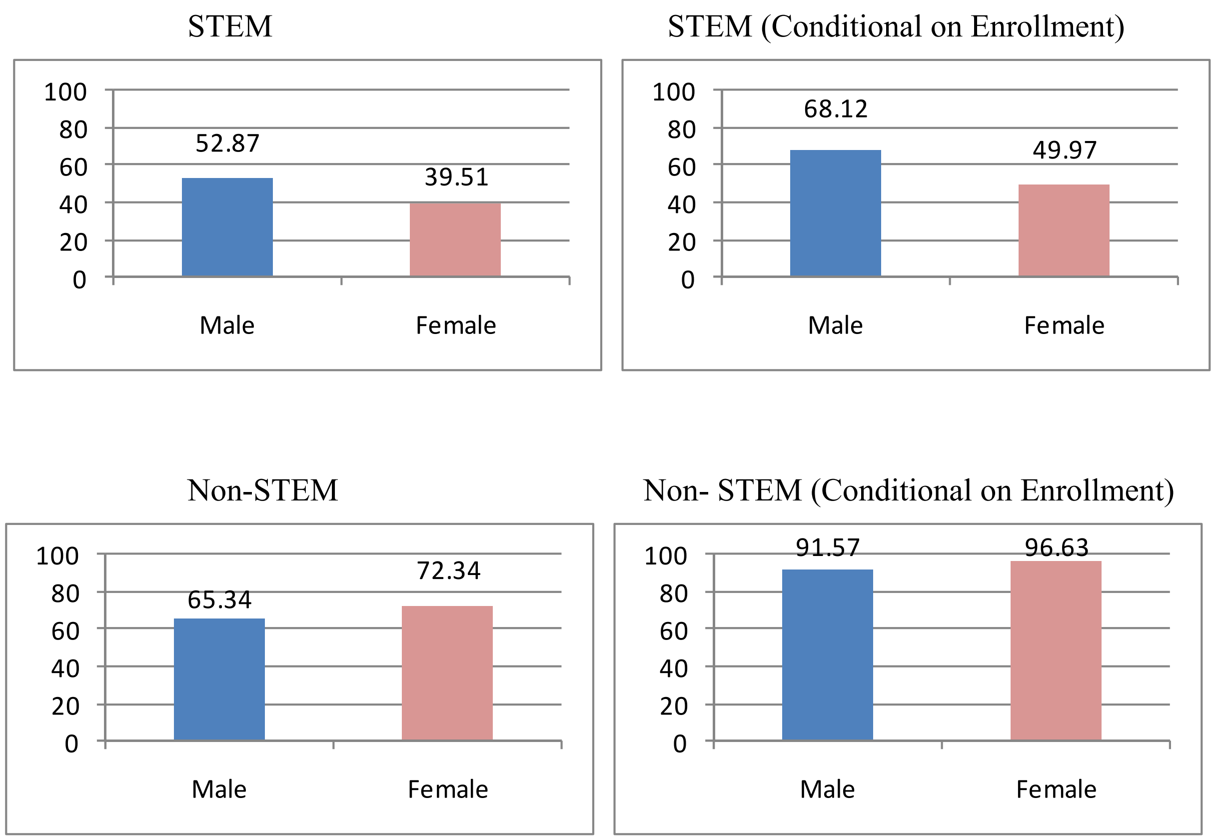

Table 1. Summary Statistics

		STEM	Non-STEM	
Variable	Mean	Mean	Mean	p-value
female	0.538	0.344	0.593	0.000
white	0.828	0.824	0.829	0.035
black	0.093	0.083	0.096	0.000
asian	0.022	0.038	0.018	0.000
other	0.057	0.055	0.057	0.066
ACT score	22.3	24.2	21.7	0.000
	[4.284]	[4.252]	[4.137]	
Engineering	0.088			
Life/Physical Science	0.083			
Technology/Math	0.050			
Business	0.149			
Communication	0.050			
Education	0.098			
Humanities	0.195			
Social Science	0.096			
Vocational	0.086			
Unknown	0.105			
N	156,056	34,687	121,369	

Table 2. Racial and Gender Differences of Faculty with STEM Fields

		White	Black			Male	Female	
Variable		Mean	Mean			Mean	Mean	
Highest Degree								
	Ph.D.	0.340	0.340			0.441	0.241	***
	Masters	0.333	0.407	***		0.295	0.382	***
	Other degree	0.327	0.253	***		0.264	0.376	***
Rank								
	Professor	0.123	0.067	***		0.185	0.044	***
	Associate	0.115	0.149	***		0.148	0.086	***
	Assistant	0.125	0.159	***		0.131	0.131	
	Other rank	0.637	0.626			0.536	0.739	***
Apointment								
	Full-time	0.205	0.271	***		0.240	0.175	***
	Part-time	0.297	0.291			0.266	0.321	***
	Grad assistant	0.272	0.203	***		0.218	0.324	***
Observations		28,358	1,784			17,632	14,227	
Note: Asterisks represent significant difference in means, *** 1%, ** 5%, and *10%								

Table 3. Cumulative Distribution of Persistence

Initial Non-STEM Majors (N=121,369)			
	Remain in Non-STEM	Change to STEM	Dropout
1st Semester	0.958	0.011	0.032
2nd Semester	0.834	0.028	0.142
3rd Semester	0.802	0.032	0.166
4th Semester	0.738	0.040	0.222
5th Semester	0.727	0.040	0.233
6th Semester	0.688	0.040	0.272
Initial STEM Majors (N=34,687)			
	Remain in STEM	Change to Non-STEM	Dropout
1st Semester	0.916	0.065	0.018
2nd Semester	0.718	0.174	0.108
3rd Semester	0.654	0.217	0.129
4th Semester	0.551	0.272	0.177
5th Semester	0.530	0.287	0.183
6th Semester	0.484	0.298	0.218

Table 4. Cumulative Distribution of Persistence by Race and Gender

White			
	Remain in STEM	Change to Non-STEM	Dropout
1st Semester	0.911	0.064	0.016
2nd Semester	0.723	0.172	0.095
3rd Semester	0.661	0.214	0.116
4th Semester	0.562	0.270	0.159
5th Semester	0.542	0.283	0.166
6th Semester	0.497	0.296	0.198
Black			
	Remain in STEM	Change to Non-STEM	Dropout
1st Semester	0.875	0.089	0.036
2nd Semester	0.574	0.211	0.214
3rd Semester	0.505	0.266	0.229
4th Semester	0.380	0.307	0.314
5th Semester	0.359	0.328	0.313
6th Semester	0.302	0.326	0.372
Male			
	Remain in STEM	Change to Non-STEM	Dropout
1st Semester	0.931	0.051	0.018
2nd Semester	0.751	0.139	0.110
3rd Semester	0.694	0.173	0.133
4th Semester	0.597	0.220	0.182
5th Semester	0.578	0.235	0.187
6th Semester	0.530	0.247	0.223
Female			
	Remain in STEM	Change to Non-STEM	Dropout
1st Semester	0.888	0.093	0.018
2nd Semester	0.654	0.243	0.104
3rd Semester	0.578	0.302	0.121
4th Semester	0.462	0.372	0.166
5th Semester	0.439	0.387	0.174
6th Semester	0.396	0.395	0.209

Table 5. Selection into Courses: Outcome is Fraction of Students Who are Black

	Non-STEM Course					STEM Course				
Black Instructor	0.190***	0.187***	0.105***	0.104***	0.024***	0.214***	0.201***	0.059***	0.057***	0.028***
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.005]	[0.005]	[0.005]	[0.004]	[0.004]
Constant	0.105***	0.092***	0.089***	0.078***	0.253***	0.098***	0.078***	0.078***	0.029***	0.094**
	[0.001]	[0.001]	[0.002]	[0.003]	[0.083]	[0.001]	[0.001]	[0.002]	[0.003]	[0.038]
Observations	63370	63370	63370	63370	63370	25332	25332	25332	25332	25332
R-squared	0.08	0.1	0.43	0.44	0.76	0.06	0.09	0.42	0.44	0.73
faculty characteristics		x	x	x	x		x	x	x	x
Institution FE			x	x	x			x	x	x
Cohort FE			x	x	x			x	x	x
Field FE				x					x	
Course FE					x					x

Standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6. Selection into Courses by Gender: Outcome is the Fraction of Students Who are Female

			Non-STEM Course					STEM Course		
Female Instructor	0.064***	0.068***	0.068***	0.066***	0.012***	0.060***	0.056***	0.053***	0.037***	0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]
Constant	0.530***	0.544***	0.514***	0.531***	0.658***	0.435***	0.438***	0.359***	0.097***	0.549***
	[0.001]	[0.002]	[0.004]	[0.005]	[0.133]	[0.002]	[0.003]	[0.007]	[0.007]	[0.056]
Observations	57608	57608	57608	57608	57608	20259	20259	20259	20259	20259
R-squared	0.03	0.03	0.06	0.08	0.64	0.02	0.03	0.07	0.31	0.78
faculty characteristics		x	x	x	x		x	x	x	x
Institution FE			x	x	x			x	x	x
Cohort FE			x	x	x			x	x	x
Field FE				x					x	
Course FE					x					x

Standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7. Regression Results: Outcome is Persist in STEM Field Major
At Least 1 Black Faculty

	After First Semester			After First Year	
	OLS	IV		OLS	IV
Black	-0.002	-0.007		-0.048***	-0.087***
	[0.006]	[0.008]		[0.010]	[0.013]
Black STEM Instructor	-0.011	-0.042		-0.004	0.156
	[0.008]	[0.084]		[0.012]	[0.136]
Black STEM Instructor * Black	-0.011	0.05		0.109**	0.540***
	[0.019]	[0.069]		[0.030]	[0.111]
ACT	0.004***	0.004***		0.012***	0.012***
	[0.000]	[0.000]		[0.001]	[0.001]
Female	-0.036***	-0.036***		-0.078***	-0.078***
	[0.003]	[0.003]		[0.005]	[0.005]
Number of Non-STEM Courses	-0.002	-0.001		-0.014***	-0.017***
	[0.003]	[0.003]		[0.005]	[0.006]
Number of STEM Courses	0.017***	0.017***		0.046***	0.045***
	[0.003]	[0.003]		[0.005]	[0.005]
Constant	0.857***	0.860***		0.518***	0.513***
	[0.013]	[0.015]		[0.020]	[0.023]
R-squared	0.03	0.03		0.06	0.04
First Stage Estimation					
Fraction of Courses Taught by Black Faculty		0.863			0.863
		[0.143]			[0.143]
F-Stat		12.08			12.08
Fraction of Courses Taught by Black Faculty*Black		0.99			0.99
		[0.024]			[0.024]
F-Stat		81.48			81.48
Observations	34,687	34,687		34,687	34,687
Standard errors in brackets					
* significant at 10%; ** significant at 5%; *** significant at 1%					

Table 8. Regression Results: Outcome is Persist inn STEM Field Major
At Least 1 Female Faculty

	After First Semester			After First Year	
	OLS	IV		OLS	IV
Female	-0.041***	0.06		-0.074***	0.022
	[0.004]	[0.052]		[0.007]	[0.082]
Female STEM Instructor	-0.012***	-0.039		-0.018***	-0.103
	[0.004]	[0.052]		[0.007]	[0.082]
Female STEM Instructor * Female	0.011*	-0.211*		-0.006	-0.211
	[0.006]	[0.115]		[0.010]	[0.181]
ACT Score	0.004***	0.004***		0.012***	0.012***
	[0.000]	[0.001]		[0.001]	[0.001]
black	-0.004	-0.001		-0.039***	-0.036***
	[0.006]	[0.006]		[0.009]	[0.010]
asian	0.027***	0.028***		0.066***	0.066***
	[0.008]	[0.008]		[0.012]	[0.013]
other	-0.002	-0.002		-0.003	-0.004
	[0.007]	[0.007]		[0.011]	[0.011]
Number of Non-STEM Courses	-0.002	-0.003		-0.014***	-0.015***
	[0.003]	[0.003]		[0.005]	[0.005]
Number of STEM Courses	0.018***	0.023***		0.047***	0.055***
	[0.003]	[0.005]		[0.005]	[0.007]
Constant	0.858***	0.836***		0.516***	0.499***
	[0.013]	[0.018]		[0.020]	[0.028]
R-squared	0.03			0.06	0.03
First Stage Estimation					
Fraction of Courses Taught by Female Faculty		0.286			0.286
		[0.088]			[0.088]
F-Stat		6.54			6.54
Fraction of Courses Taught by Female Faculty*Female		0.388			0.388
		[0.056]			[0.056]
F-Stat		13.92			13.92
Observations	34,373	34,373		34,373	34,373
Standard errors in brackets					
* significant at 10%; ** significant at 5%; *** significant at 1%					

Table 9 Regression Results: Outcome is Persist in STEM Field Major
(At Least 1 Female Faculty, ACT Score ≥ 30)

	After First Semester		After First Year	
	OLS	IV	OLS	IV
Female	-0.016*	0.003	-0.078**	-0.076
	[0.009]	[0.031]	[0.018]	[0.062]
Female STEM Instructor	-0.014	-0.067	-0.006	0.157
	[0.010]	[0.079]	[0.019]	[0.158]
Female STEM Instructor * Female	-0.004	-0.045	0.022	-0.005
	[0.015]	[0.079]	[0.029]	[0.157]
ACT Score	0.001	0.001	0.011**	0.012**
	[0.002]	[0.003]	[0.005]	[0.005]
black	-0.006	-0.008	-0.027	-0.038
	[0.034]	[0.034]	[0.068]	[0.070]
asian	0.022	0.019	0.023	0.029
	[0.015]	[0.016]	[0.030]	[0.031]
other	-0.002	-0.006	-0.004	-0.002
	[0.017]	[0.018]	[0.033]	[0.035]
Number of Non-STEM Courses	-0.006	-0.005	-0.021	-0.024*
	[0.007]	[0.007]	[0.014]	[0.015]
Number of STEM Courses	0.017**	0.018**	0.042***	0.040***
	[0.007]	[0.007]	[0.014]	[0.014]
Constant	0.930***	0.929***	0.565***	0.537***
	[0.079]	[0.083]	[0.157]	[0.165]
R-squared	0.03	0.01	0.04	0.01
First Stage Estimation				
Fraction of Courses Taught by Female Faculty		2.362		2.362
		[0.396]		[0.396]
F-Stat		11.94		11.94
Fraction of Courses Taught by Female Faculty*Female		1.635		1.635
		[0.287]		[0.287]
F-Stat		11.38		11.38
Observations	3,104	3,104	3,104	3,104

Standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%