

Instructor's Race and Gender and Freshman Student Perceptions

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Abstract

Much has been written about the need for role models to increase retention of women and minorities in engineering. One hypothesis has been that an instructor of the same race or gender will serve as encouragement for women or minority students to continue in engineering. An experiment was conducted to quantify the effect of an instructor's race and gender on the perceptions of freshman engineering students. At the beginning of their first semester, students were asked to evaluate a series of statements (strongly agree to strongly disagree) concerning their perceptions of Virginia Tech's engineering program and its commitment to equal opportunity for men, women, and minorities. A total of 371 students, all taking the same introduction to engineering course, participated in the survey. Three instructors participated, with a black male teaching 119 students in four sections, a white male teaching 162 students in five sections, and a white female teaching 90 students in three sections. The results indicate that, in general, the race or gender of the instructor had little effect on the social perceptions of first semester freshman engineering students at Virginia Tech.

Background

Like most technical institutions the College of Engineering at Virginia Tech is significantly under represented in women and minority students. In 1997, women comprised 16% and African-Americans 4.2% of the college's undergraduate student body¹. Again, like most technical institutions, the college wants to recruit and retain the highest quality students and believes that this is best accomplished by selecting from the largest and widest pool possible. The need for women and minority instructors to act as role models and mentors has often been put forth as a desirable and effective method of increasing retention, and as a way to provide a climate and culture beneficial to all populations.

In the fall of 1999 a total of 1280 first semester freshman engineering students were enrolled in Introduction to Engineering (EF 1015) of whom 237 were women and 55 African-American. There were 40 sections with an average class size of 32 students. Class composition was random with each class typically containing a few women and one or two African-Americans.

¹ Patricia B. Hyer, Emet L. LaBoone, and Eugenia L. Mottley, "Women and Minorities at Virginia Tech," (Blacksburg, VA: Virginia Tech, 1998).

Study

The purpose of this work is to capture student's perceptions of Virginia Tech's social climate during those first few, memorable and impressionable, days of their engineering careers. These days set the tone for the entire first semester during which curriculum changing decisions are most often made.

In the third week of their first semester, 371 freshman engineering class students, in 12 sections, were asked to rate the statements in Table I on a scale of 1 to 4 where 1 indicated strongly agree and 4 indicated strongly disagree. Of the twelve sections, three were taught by a white female (WF), four by a black male (BM), and five by a white male (WM). Of the 371 total students, 90 were taught by the WF, 119, by the BM, and 162 by the WM.

Table 1

Statements Rated by Freshman Engineering Students

Statement	
1	Men are welcome in Virginia Tech's engineering program.
2	Women have an advantage in Virginia Tech's engineering program.
3	The social climate in Virginia Tech's college of engineering is pro-minority.
4	Minorities are at a disadvantage in Virginia Tech's engineering program.
5	The social climate in Virginia Tech's college of engineering is anti-female.
6	I am unhappy with my decision to attend Virginia Tech.
7	Women are welcome in Virginia Tech's engineering program.
8	Minorities have an advantage in Virginia Tech's engineering program.
9	The social climate in Virginia Tech's college of engineering is pro-male.
10	I am happy with my decision to enter the engineering program.
11	Men are at a disadvantage in Virginia Tech's engineering program.
12	Minorities are welcome in Virginia Tech's engineering program.
13	The social climate in Virginia Tech's college of engineering is pro-female.
14	The social climate in Virginia Tech's college of engineering is anti-minority.
15	Men have an advantage in Virginia Tech's engineering program.
16	The social climate in Virginia Tech's college of engineering is anti-male.
17	Women are at a disadvantage in Virginia Tech's engineering program.
18	I am happy that I chose to attend college.

Results

The mean response for all instructors, for the black male's students, for the white male's students, and for the white female's students are shown in Table II below. Again, a response of "1" indicates strongly agree and a response of "4" strongly disagree, and a mean of "2.5" implying neutral.

Table II

Mean Student Responses to Statements in Table I
1 = Strongly Agree; 4 = Strongly Disagree

Statement	Overall (BM+WM+WF)/3	BM (n=119)	WM (n=162)	WF (n=90)
1	1.223	1.218	1.228	1.222
2	2.914	2.866	2.988	2.888
3	2.621	2.496	2.679	2.689
4	3.268	3.261	3.199	3.344
5	3.325	3.370	3.261	3.344
6	3.549	3.672	3.453	3.522
7	1.471	1.403	1.543	1.467
8	2.916	2.882	2.932	2.933
9	2.609	2.630	2.611	2.584
10	1.615	1.555	1.667	1.622
11	3.283	3.261	3.311	3.278
12	1.589	1.613	1.642	1.511
13	2.914	2.866	2.932	2.944
14	3.342	3.387	3.261	3.378
15	2.945	2.950	2.963	2.922
16	3.362	3.370	3.373	3.344
17	3.086	3.136	3.043	3.078
18	1.196	1.254	1.185	1.148

In general, students were satisfied with their decision to attend college and study engineering (statements 6, 10, and 18). Men were perceived to be welcome with a slight pro-male atmosphere and no significant advantage (statements 1, 9, 11, 15 and 16). Women were perceived to be slightly less welcomed than men, with neutral responses to the atmosphere and advantages (statements 2, 5, 7, 13, and 17). Minorities were felt to be about as welcome as women, with a slight pro-minority atmosphere and a generally neutral attitude regarding advantages.

The average student perceptions were very strong (within 0.5 of the extreme) with respect to both men and women being welcome in the engineering program at Virginia Tech (statements 1 and 7). Students also indicated that they were very satisfied to be attending college and Virginia Tech (statements 6 and 18).

Analysis

A two-tailed, pooled t-test was used to determine if there was a significant difference in the mean student responses between those instructed by:

1. black male versus the white male
2. black male versus the white female
3. white male versus the white female

The null hypothesis is that the average difference equals zero, and the research hypothesis is that the average difference is significantly different from zero. P-values (ranging from 0 to 1) are presented in Table III below. A p-value is the probability of rejecting the null

hypothesis when it is in fact true. Therefore, the smaller the p-value, the more likely it is that a significant difference in the student's responses exists.

Table III

Difference of Mean Responses
p-value

Statement	BM-WM	BM-WF	WM-WF
1	0.858	0.953	0.915
2	0.095 ^a	0.804	0.216
3	0.022 ^b	0.036 ^b	0.907
4	0.382	0.320	0.058 ^a
5	0.120	0.745	0.290
6	0.017 ^b	0.132	0.523
7	0.050 ^b	0.397	0.312
8	0.470	0.519	0.982
9	0.828	0.656	0.783
10	0.206	0.484	0.662
11	0.489	0.831	0.649
12	0.693	0.205	0.072 ^a
13	0.385	0.383	0.876
14	0.074 ^a	0.907	0.119
15	0.860	0.750	0.625
16	0.963	0.728	0.668
17	0.204	0.504	0.621
18	0.314	0.177	0.519

Note: "a" implies significant at the 0.10 level and "b" is significant at the 0.05 level.

Of the 54 comparisons made (see Table III), four had a significance between 5% and 10 % and four had a significance less than or equal to 5%. When looking at the differences between the BM and WM instructors, three were 5% significant and two 10% significant. Between the WM and WF two statements were 10% significant. Between the WF and BM one statement was 5% significant.

The differing perceptions for statement 3 showed the greatest difference among the three instructors. While students generally agreed that the social climate within the College of Engineering was pro-minority (overall mean = 2.62) there was a significantly greater perception of this by the BM's students versus the WM's students (p-value = 0.022) and the WF's students (p-value = 0.036). Interestingly, there was virtually no difference in the response to this statement when comparing the WM's students to the WF's students (p-value = 0.907).

Statements 3 and 14 relate to the student's perceptions of the College of Engineering social climate towards minorities. When presented in the positive sense (statement 3) the BM's students response differed significantly than both the WM's and WF's students with the BM's students perceiving the college to be more pro-minority. When presented in the

negative sense (statement 14) there was a significant difference only between the BM and WM's students.

Statistically, the most significant finding was differing responses of the BM's students to the WM's students for statement 6 (p-value = 0.017). With the WM's students being significantly more satisfied with their decision to attend Virginia Tech.

In statement 7 the BM's students felt significantly stronger than the WM's (p-value = 0.050) that women were welcome in Virginia Tech's engineering program. For this same statement, there was no significant difference in perception of the female instructor's students versus either of the male instructors.

Conclusion

Generally, first semester freshman engineering students in their third week of class had similar social perceptions of Virginia Tech and its college of engineering regardless of the race or gender of their instructor. The differences, where they existed, were mostly between the black male's and white male's students with five of the eight statements that were significant to the 10% level between those two groups. Of the eight comparisons with 10% or better significant differences: five related to minorities, two to women, one to satisfaction with college, and none to men.

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