Climate for Graduate Students in Science and Engineering Departments

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Abstract
Departmental climate and academic/social integration are key factors influencing the retention and advancement of female graduate students [1]. Yet little is known about graduate student perceptions relative to department climate or their social and academic experiences in science and engineering graduate programs. Recent studies on graduate education highlight the need for more research in this area [2-4]. Administered at a large Pacific Northwest research university, the Science and Engineering Graduate Student Experience Survey explores graduate student perceptions about faculty relationships, departmental climate and the relevance of work/life issues in decision-making. Responses totaled 574 graduate students from 18 science and engineering departments. The survey data was disaggregated by gender, science/engineering departments, and program level (Masters vs. Ph.D.). Results suggest that there are significant differences between male and female graduate students, graduate students in science and engineering departments, as well as different gender issues in science departments than in engineering departments. Logistic regression was used to test the association of climate and integration factors with graduate degree progress. Multinomial logit regression estimates the effects of climate and integration measures on career commitment. Both regression analyses find that certain aspects of climate and integration are significantly associated with graduate student advancement and retention.

I. Introduction

Graduate enrollments in science, technology, engineering and mathematics (STEM) reached a record high of 455,400 students in the fall of 2002. According to the National Science Foundation, the number of women graduate students in STEM has increased every year for the last twenty years and more than 40% of STEM graduate students are women [5]. As science and engineering graduate programs become more diverse, it is imperative that we know more about gender differences in perceptions about the climate for graduate students in STEM academic departments. Negative perceptions about departmental climate during graduate school can hinder the development of relationships with faculty and peers that are critical to graduate students' social and academic integration into academic departments. Prior research suggests that perceptions about department climate, integration experiences and concerns about work/life balance may coalesce in significantly different ways for male and female STEM graduate students[3, 4, 6-10].

This research study sought to explore the extent to which department climate, integration experiences and concerns about work/life balance are related to gender differences in degree progress and commitment to STEM professional careers. The institution at which the study took place was one of the initial institutions to receive a National Science Foundation ADVANCE Institutional Transformation Award to advance female faculty careers in STEM. At the time of the study, the ADVANCE program was in its third year of programming to transform the climate for female faculty and graduate students. For purposes of this paper, the analysis and discussion is limited to departmental climate and its relationship to degree progress and career commitment. Integration experiences and concerns about work/life balance are explored in more depth in a forthcoming article by the authors. Given the emphasis on departmental climate, the research questions addressed in this paper include: Are there gender differences in graduate student perceptions about climate in STEM departments? How are perceptions about climate related to degree progress? and Does departmental climate influence graduate student commitment to STEM professional careers?

II. Climate, Degree Progress and Career Commitment

First coined by Hall & Sandler in the early 1980's to describe the classroom experiences of undergraduate women, the construct of a chilly climate has been extended to include experiences outside the classroom, graduate student experiences and the academic workplace for female faculty and administrators[11-13]. A chilly climate is defined by the isolation, subtle discrimination and persistent micro-inequities experienced by women and underrepresented groups in academic settings. Hall and Sandler identified behaviors that overlook, ignore, discount or single out women, and reflect preconceived ideas about the ability of women to succeed in academic settings[13].

Numerous reports and research studies have shown that the paucity of women in STEM coupled with the culture of science can create a climate that surpasses chilly to be frigid for women in those disciplines[6, 14-18]. The climate in science departments continues to be based upon masculine ideals, such as competitiveness and a belief in the objectivity of the scientist [19-22]. In a study of biology and chemistry departments, Ferreira [19] found that men and women differed in their perception of certain aspects of climate, including whether gender was a barrier to a successful career in science, and whether women have to prove themselves more than men. Although the men and women in Ferreira's study also had similar perceptions of the culture of science, most of the data in general pointed to science as a masculinized and inflexible career.

Department climate in terms of STEM graduate education is characterized by departmental differences in the orientation and support provided to students, faculty expectations of and relationships with graduate students, and the quality of student peer relationships[3, 6, 7, 23, 24]. Graduate education is decentralized and occurs under the auspices of academic disciplines and departments. Graduate students are admitted by and spend most of their time in the context of an academic department. Department climate varies in the same manner that informal norms and expectations about student admissions, degree requirements and student performance varies from one academic department to another. One of the seminal works on doctoral degree progress concluded that department climate influences degree progress and that student commitment to earning the degree shifts constantly in response to experiences in the department [25].

Of late, research has focused on both documenting differences in departmental climate for female faculty and graduate students, and discerning how those differences influence the recruitment, retention and advancement of women in STEM. Barber hypothesized that the climate for women in STEM at the doctoral level leads them to change their minds about careers in STEM[21]. In other words, there is something that happens during the doctoral course of training that lessens women's commitment to a career in STEM. Lovitts [3]hypothesized that high attrition rates for women and underrepresented groups can be attributed to flaws in departmental climate which prohibit their social and academic integration into the department's formal and informal community. Nerad & Miller [26] found that a chilly department climate was a salient factor in student decision-making about leaving doctoral programs after advancement to candidacy.

While many hypotheses about the relationship between climate, career commitment and degree progress have been offered, few studies have attempted to measure the extent of the relationship between these three constructs.

III. Methodology

A. Sample

The Science and Engineering Graduate Student Experience Survey was developed at the University of Washington (UW) and builds upon an Undergraduate Student Experience Survey which was originally designed at the UW. The Undergraduate Survey was expanded by the Women in Engineering Program Advocates Network and administered to 29 institutions[27]. The web-based Graduate Survey explores the extent to which graduate students feel comfortable and supported in their department. It asks questions about classroom experiences, laboratory experiences, department climate, professional development, relationships with faculty and mentors, academic program status and work/family balance. Additionally there is a question about career aspirations, and multiple demographic questions including marital status, children, and financial resources. The survey is composed of sixty-two questions, the majority of which use a five point Likert scale ("1" =not at all, "5" =very much) to assess student experiences.

Graduate students enrolled in 19 UW science and engineering departments in March 2004 were included in the sample. All students who were female and who were members of under-represented ethnic groups were selected for inclusion in the sample. Additionally, the number of Asian American men and White American men were each made equal to the number of White American women in the sample, using a random sampling technique. The number of international men was made equal to the number of international women in the sample. This strategy under-represented White and Asian men while over-representing women and under-represented groups compared to the population of graduate students in Science and Engineering programs. There were a total of 1224 participants selected for the survey. Of those, 574 returned usable surveys, resulting in a response rate of 47%.

B. Variables

The two dependent variables utilized for the regression analyses in this paper are measures of career commitment and degree progress. Degree progress is measured by five separate questions that indicate whether someone has completed specific stages in the doctoral degree progress. The stages are: classes and coursework, comprehensive or qualifying exams, master's degree earned, advancement to candidacy, and approval of dissertation. If a student said that a specific stage was not required for their program, they were not included in that specific analysis. Students who said they had completed a stage were coded as "1" and those who indicated they have not completed a stage yet were coded at "0". Career commitment is measured by the question "To what extent has your academic experience in your department reaffirmed your career choice?" Responses to this question ranged on a five point scale from "not at all" to "very much". Higher values indicate greater career commitment.

Since many of the substantive sections of the survey, such as professional development and laboratory experiences, use multiple questions to obtain a well-rounded picture of climate, factor analysis was performed to combine multiple indicators of climate into single indices. Only factors with eigenvalues above 1.0 were chosen to use in the analysis. Eigenvalues above one indicate good internal consistency of the variables of which the factor is composed. A description of the variables which comprise each factor is in Table 1.

Table 1. Description of Factor Analysis Variables of Climate.

Factor	**Questions of which factor is comprised**
Gender Discrimination	Extent you have been judged on the basis of gender?
	Extent you feel singled out in class to speak on behalf of your gender?
	Since entering your department, have you experienced discrimination on the basis of gender?
	Since entering your department, have you experienced sexual harassment?
	Since entering your department, have you experienced violence in the workplace?
Race Discrimination	Extent you have been judged on the basis of race/ethnicity?
	Extent you feel singled out in class to speak on behalf of your race/ethnicity?
	Since entering your department, have you experienced discrimination on the basis of race/ethnicity?
Taken Seriously	Extent you feel your suggestions or comments in the classroom are taken seriously by faculty members?
	Extent you feel your suggestions or comments in the classroom are taken seriously by peers?
Pace/Workload/Isolation	Do you feel overwhelmed by the pace and workload in your program?
	Since entering your department, have you experienced isolation?
Laboratory Climate	How well are lab experiments explained prior to your participation in them?
	Extent other team members view you as a leader when working in small groups in the lab?
	How productive do you feel when working in a group lab setting?
	Extent your suggestions or comments are taken seriously by the

Factor	Questions of which factor is comprised
	lab group leader?
	How comfortable are you in approaching the lab group leader for assistance in a laboratory setting?
Laboratory Barriers	Extent access to lab equipment is a barrier to personal research goals?
	Extent you feel ignored by others in the lab or given trivial assignments?
Degree of Competition	Have finances adversely affected your pursuit of a graduate degree?
	Extent graduate students in your department compete for funding?
	Extent graduate students in your department compete for grades?
	Extent graduate students in your department compete for awards and recognition?
Relationship with Advisor	Extent you are treated with respect by your advisor?
	Extent your advisor places more value on research than teaching and advising?
	Extent your advisor is available to you?
	Extent your faculty advisor also serves as a mentor?
Professors are Mentors/Care	Extent professors in your department serve as formal or informal mentors to you?
	Extent professors in your department care whether or not graduate students succeed?

IV. Analysis

A series of T-tests are performed to determine whether women and men are significantly different on a number of graduate life variables. T-tests are also conducted to determine gender differences within science departments and within engineering departments. Finally, the differences between science graduate students and engineering graduate students is analyzed with additional T-tests. These results are reported in Tables 4-6. In cases where the variances of the variables was not assumed to be equal, and thus violated an assumption of T-test analysis, the Levene test as used to determine the proper statistical significance of the relationship.

Regression analysis was performed on two different dependent variables, using different methodologies. Logistic regression was used to test possible factors related to degree progress. Logistic regression was used because degree progress is a binary outcome variable and it would bias ordinary least squares regression estimates of the slope.

Multinomial logit regression was used to estimate the effect of climate measures on career commitment. Multinomial logit regression is typically used for nominal categorical variables. While an ordered logit regression might be more appropriate given the implicit ordering of Likert-type variables, the results of a multinomial logit regression are easier to understand, and the coefficients are not biased as they would be in ordinary least squares. In fact, using multinomial logit for ordered variables reduces the efficiency of the model, making it a conservative estimate of effects [28]. Using multinomial logit regression also avoids the parallel regression assumption of ordered logit.

The reader must be cautioned that the findings for the t-test analysis and both regression analyses are correlational, not causal. It is impossible to determine causation in cross-sectional data, and so future research should use longitudinal data to more accurately determine causation of graduate student outcomes such as retention and progress. In discussion of the results, we take care to refer to relationships between variables but not to suggest that one variable is the cause of another.

A. Descriptives

Reported in Table 2 are some descriptive statistics for the sample. Table 3 reports the means and standard deviations for the variables used in the analyses.

Table 2. Sample Statistics[1]. UW Graduate Climate Survey 2004

		Number	**Percentage**
Gender	Female	295	51.4
	Male	256	44.6
	Unknown	23	4.0
Ethnicity	African American	9	1.6
	Asian Indian	30	5.3
	Asian	78	13.8
	Pacific Islander	2	.4
	Hispanic	18	3.2
	Native American/ Alaska Native	4	.7
	Other	10	1.8
	Caucasian	418	73.3
Citizenship	U.S. Citizen	447	77.9
	Permanent Resident	19	3.3
	International	95	16.6
Degree Level	Professional Master's	62	11.3
	Research Master's	82	14.9
	Doctoral	405	73.8

[1] All percentages do not add up to 100% because not all respondents answered the questions

Table 3. Descriptive Statistics for Variables in Analyses. UW Graduate Climate Survey 2004

Variable	N	Minimum	Maximum	Mean	Std. Dev.
Dependent Variables					
Career Commitment	545	1	5.00	3.43	1.07
Classes/Coursework Completed	430	0	1.00	0.62	0.49
Qualifying Exams Completed	411	0	1.00	0.60	0.49
Master's Degree Earned	268	0	1.00	0.66	0.48
Advancement to Candidacy	401	0	1.00	0.35	0.48
Approval of Dissertation Proposal	383	0	1.00	0.24	0.43
Independent Variables					
Gender Discrimination	549	-2.14	8.82	0.00	1.01
Race Discrimination	549	-3.00	6.13	0.00	1.01
Taken Seriously	534	-3.15	2.08	0.01	1.00
Pace/Workload/Isolation	498	-2.45	3.24	0.02	1.01
Laboratory Climate	237	-3.00	2.06	-0.05	1.00
Laboratory Barriers	237	-2.00	3.18	-0.01	0.99
Degree of Competition	498	-2.12	2.82	0.01	1.01
Relationship with Advisor	522	-3.25	1.95	-0.01	1.01
Professors are Mentors/Care	522	-2.92	1.98	0.01	0.99

B. Bivariate Relationships

Tables 4–6 show the results of the t-test analysis. T-values which are negative indicate that the mean for males is higher than the mean for females. Positive T-values indicate higher means for females than males. For example in table 4, the T value for gender discrimination is 8.00 which indicates that on average, females reported more experiences with gender discrimination than males.

In general, females indicated greater experience with gender discrimination and a more negative view of the pace/workload/isolation in their department (Table 4).

Within Science and Engineering departments, there are divergent gender differences on a few factors and similarities between the departments on gender issues. Pace/Workload/Isolation and gender discrimination are issues for females in both types of departments. In Engineering departments, males report a greater sense of competition, and better relationships with their advisors than women report (Table 5).

Correspondingly, there are differences between Science and Engineering departments. Science students are more likely to report that gender discrimination is more of a problem than engineering graduate students report. Engineering graduate students report greater competition in their department than science students report (Table 6).

Table 4. Overall Gender Differences for Graduate Students in Science and Engineering

Variables	Status	N	Mean	Std. Dev.	T-value	p-value
Gender discrimination	Female Male	283 247	.28 -.34	1.21 .50	8.00	.000
Pace/Workload/Isolation	Female Male	254 227	.21 -.18	.97 1.02	4.24	.000

Table 5. Gender Differences Disaggregated by Science and Engineering Departments

Variables	Status	N	Mean	Std. Dev.	T-value	p-value
Science Departments						
Gender Discrimination	Female Male	160 97	0.45 -0.35	1.44 0.30	6.77	.000
Pace/Workload/Isolation	Female Male	144 86	0.24 -0.11	0.95 1.14	2.44	.016
Engineering Departments						
Gender Discrimination	Female Male	123 149	0.07 -0.34	0.76 0.60	4.85	.000
Pace/Workload/Isolation	Female Male	110 140	0.16 -0.22	1.00 0.94	3.06	.002
Degree of Competition	Female Male	110 140	-0.01 0.28	1.03 1.05	-2.19	.029
Relationship with advisor	Female Male	118 142	-0.14 0.12	1.08 0.94	-2.13	.034

Table 6. Differences between Science and Engineering Graduate Students.

Variables	Status	N	Mean	Std. Dev.	T-value	p-value
Gender Discrimination	Science Engineering	263 285	0.16 -0.14	1.22 0.73	3.44	.001
Degree of Competition	Science Engineering	235 262	-0.12 0.13	0.94 1.06	-2.75	.006

C. Regression Analyses

1. Multinomial Logit Regression of Career Commitment

The dependent variable for this multinomial logit analysis is based on a question from the survey that asks, “To what extent has your academic experience in your department reaffirmed your career choice?” Responses were grouped into 3 categories; category 1 includes those who answered ‘not at all’ or ‘very little’, category 2 includes only those who answered ‘somewhat’, and category 3 includes those who answered ‘moderately’ or ‘very much’. The categories can be described as low commitment, medium commitment and high commitment. Category 3 is the reference category, and all results are reported relative to those indicating high commitment.

The two factors relating to laboratory climate were left out because almost 40% of students indicated lab work was not at all a part of their training or did not answer the question. Including these variables restricts the number of cases in the analysis and biases the estimates.

Three variables significantly affected membership in the low commitment category relative to high commitment (Table 7). A negative perception of pace/workload/isolation is associated with increased likelihood of low commitment relative to high commitment. For every additional unit increase in pace/workload/isolation, the odds of being in the low commitment category increase by 89% relative to the high commitment category. Having professors in the department who serve as mentors and who care about student success, is associated with decreases in the likelihood of being in the low commitment category. Specifically, an increase in the perception that one's department has professors who act as mentors and care about graduate student success is associated with a 64% decrease in the likelihood of indicating low career commitment. Additionally, the better a student's relationship is with their advisor, the lower the likelihood of being in the low career commitment category relative to high career commitment.

Two factors differentiate the medium career commitment category from the high career commitment category. Students are less likely to have medium levels of career commitment relative to high commitment if they have mentoring type relationships with professors who care about their graduate students, and feel that they have good relationships with their advisor.

Thus, overall, it seems that having good relationships with faculty in one's department is highly beneficial to a graduate student's sense of career commitment. This finding was consistent for both the low and medium career commitment categories. Too quick of a pace, a sense of isolation and an overwhelming workload all function to decrease a student's overall career commitment.

Table 7. Multinomial Logit Regression of Career Commitment on Climate Variables, UW Grad Climate Survey 2004

		B	s.e.	sig.		exp(B)
Low	Intercept	-1.36	0.18	0.000	***	
Commitment	Gender Discrimination	0.10	0.14	0.498		1.10
	Race Discrimination	-0.17	0.17	0.303		0.84
	Taken Seriously	-0.04	0.17	0.807		0.96
	Pace/Workload/Isolation	0.64	0.18	0.000	***	1.89
	Degree of Competition	0.00	0.17	0.988		1.00
	Relationship with Advisor	-0.38	0.16	0.019	*	0.68
	Professors are Mentors/Care	-1.02	0.17	0.000	***	0.36
Medium	Intercept	-0.48	0.12	0.000	***	
Commitment	Gender Discrimination	-0.20	0.15	0.176		0.82
	Race Discrimination	-0.17	0.14	0.222		0.85
	Taken Seriously	-0.02	0.13	0.878		0.98
	Pace/Workload/Isolation	0.19	0.14	0.179		1.20
	Degree of Competition	0.22	0.13	0.098		1.24
	Relationship with Advisor	-0.41	0.13	0.001	**	0.66

		B	s.e.	sig.		exp(B)
	Professors are Mentors/Care	-0.47	0.14	0.001	***	0.62
N=403						

2. Logistic Regression of Degree Progress

Degree progress is conceptualized as a process of completing hurdles during graduate education. Others have measured degree progress in terms of degrees granted or retention, but this perspective denies the continual transitional nature of graduate education. We suggest that factors affecting the completion of coursework are different than those affecting the achievement of candidacy. This type of analysis is important because it helps educators to understand what factors might be related to completion of different levels of degree progress. In this way, educators can more effectively help graduate students to complete their academic programs.

For this reason, five logistic regressions are used to determine whether aspects of climate affect completion of different stages of ones graduate career. Each level of degree progress is regressed on multiple climate measures. If a student completed a level they are given a '1', if they have not completed a level yet, they are given a '0'. Those students who indicated that a certain progress indicator was not required in the program were excluded from that particular analysis. The five levels examined are: classes and coursework, comprehensive or qualifying exam, master's degree earned, advancement to candidacy, and approval of dissertation proposal. No regression analysis is performed on those who have written or defended their dissertation because only 1.2% of those who answered the question have done so and thus there is too little variation to do an analysis. The results are reported in Table 8.

Gender and time in program are included in the regression model. Gender has been shown to be significantly related to degree progress in other studies and its inclusion serves as a control for this phenomenon[4, 25, 26, 29]. Logically, time in program is expected to be correlated with completion of the degree stages. It is included to ensure that any observed effects are not due to time in program.

As expected, time in program is significantly related to all five degree stages. Competition is significant in the early stages of degree progress, but is not significant after completion of qualifying exams.

There is one climate variable negatively related to the completion of classes and coursework. Increases in the degree of competition in ones department are related to a 33% decrease in the odds of completing classes and coursework.

Four climate variables are significantly related to completing comprehensive or qualifying exams. Increases in the perception of the competition are associated with a 40% decrease in the odds of completing comprehensive or qualifying exams. That is, greater competition is associated with not completing exams. A negative relationship also exists between pace/workload/isolation and completion of qualifying exams. The greater someone's perception of the pace/workload/isolation the less likely they are to complete their exams.

However, the better a student's relationship is with their advisor, the more likely they are to complete their comprehensive or qualifying exams. In fact, as a student's relationship with their advisor improves, students are 61% more likely to complete exams. The experience of gender discrimination is also positively related to completing qualifying exams. The greater the experiences of gender discrimination, the more likely graduate students are to complete their exams, controlling for all other variables in the model. This relationship is not causal, but correlational and suggests that perhaps those who have completed their exams have consequently experienced more gender discrimination.

Only one variable has a statistically significant effect on the odds of earning a master's degree. Students who indicate that the pace of their program is very quick and the workload is very heavy etc. are less likely to complete the master's degree. That pace/workload/isolation is significant at this stage may indicate one of the main reasons students leave doctoral programs both before and just after the completion of the master's degree.

Two variables, both demographic, have a statistically significant relationship to the odds of advancement to candidacy. As mentioned earlier, time in the program is related to completion of every degree progress stage, including advancement to candidacy. But interestingly, advancement to candidacy is the only stage at which gender is significantly related to completion of said stage. Being female decreases the odds of advancement to candidacy by 55%.

One climate variable increases the odds of having a dissertation proposal approved. The experience of gender discrimination is associated with increased odds of having the dissertation proposal approved. As the experience of gender discrimination becomes greater, the odds of gaining approval for the dissertation proposal increase by 58%. Again, this finding may be the result of the fact that people who make it to this degree stage are more likely to have had more experiences with gender discrimination, rather than the idea that the experience of gender discrimination actually aids in completion of doctoral degree stages.

Table 8. Logistic Regression of Degree Progress Stages, UW Grad Climate Survey 2004

Dependent Variable	Independent Variable	B	s.e.	sig.		exp(B)
Classes and Coursework	Year in Program	1.24	0.16	0.000	***	3.46
	Female	-0.09	0.33	0.786		0.91
N=308	Gender Discrimination	0.20	0.18	0.262		1.22
	Race Discrimination	0.01	0.17	0.951		1.01
	Taken Seriously	0.01	0.18	0.948		1.01
	Pace/Workload/Isolation	-0.18	0.18	0.300		0.83
	Degree of Competition	-0.40	0.18	0.026	*	0.67
	Relationship with Advisor	0.15	0.17	0.384		1.16
	Professors are Mentors/Care	-0.23	0.17	0.170		0.80
	Constant	-3.09	0.48	0.000	***	0.05
Comprehensive or	Year in Program	1.42	0.17	0.000	***	4.14

Dependent Variable	Independent Variable	B	s.e.	sig.		exp(B)
Qualifying Exams	Female	-0.65	0.36	0.071		0.52
N=296	Gender Discrimination	0.49	0.20	0.014	*	1.63
	Race Discrimination	-0.11	0.18	0.523		0.89
	Taken Seriously	0.03	0.19	0.883		1.03
	Pace/Workload/Isolation	-0.48	0.20	0.017	*	0.62
	Degree of Competition	-0.52	0.19	0.008	**	0.60
	Relationship with Advisor	0.48	0.19	0.010	**	1.61
	Professors are Mentors/Care	-0.22	0.18	0.238		0.80
	Constant	-3.58	0.54	0.000	***	0.03
Master's Degree Earned	Year in Program	1.46	0.26	0.000	***	4.32
	Female	0.87	0.48	0.071		2.38
N=193	Gender Discrimination	-0.19	0.24	0.422		0.82
	Race Discrimination	-0.11	0.28	0.704		0.90
	Taken Seriously	-0.36	0.23	0.120		0.70
	Pace/Workload/Isolation	-0.88	0.26	0.001	***	0.41
	Degree of Competition	0.05	0.23	0.807		1.06
	Relationship with Advisor	0.04	0.22	0.859		1.04
	Professors are Mentors/Care	-0.13	0.21	0.550		0.88
	Constant	-3.64	0.73	0.000	***	0.03
Advancement to Candidacy	Year in Program	1.19	0.14	0.000	***	3.30
	Female	-0.80	0.39	0.038	*	0.45
N=288	Gender Discrimination	0.32	0.17	0.061		1.38
	Race Discrimination	-0.15	0.18	0.395		0.86
	Taken Seriously	0.08	0.19	0.666		1.09
	Pace/Workload/Isolation	-0.19	0.20	0.351		0.83
	Degree of Competition	-0.18	0.20	0.357		0.83
	Relationship with Advisor	0.01	0.18	0.967		1.01
	Professors are Mentors/Care	-0.16	0.19	0.389		0.85
	Constant	-4.75	0.58	0.000	***	0.01
Approval of Dissertation Proposal	Year in Program	1.22	0.16	0.000	***	3.38
	Female	-0.45	0.44	0.313		0.64
N=276	Gender Discrimination	0.46	0.21	0.025	*	1.58
	Race Discrimination	-0.47	0.25	0.060		0.63
	Taken Seriously	-0.32	0.24	0.180		0.73
	Pace/Workload/Isolation	-0.41	0.24	0.089		0.66

Dependent Variable	Independent Variable	B	s.e.	sig.		exp(B)
	Degree of Competition	-0.35	0.23	0.125		0.70
	Relationship with Advisor	0.02	0.22	0.913		1.02
	Professors are Mentors/Care	-0.18	0.22	0.414		0.84
	Constant	-5.82	0.73	0.000	***	0.00

V. Discussion

There are pervasive gender differences both overall and within science and engineering departments. Men and women experience the pace and workload and community differently than one another. Women are more likely than men to feel isolated, that the pace is quicker, and the workload is greater. Also, gender discrimination is still alive and well in STEM departments. Women report greater experiences with gender discrimination than men report. These gender differences suggest that the climate in STEM graduate departments continues to be chilly for women.

Not only did this study find evidence of gender differences in the perception of climate, but it also revealed that some of those same climate issues significantly affected a graduate student's career commitment and degree progress. The factor that represented pace/workload/isolation issues was significantly related to increased odds of low career commitment relative to those who indicated high career commitment. This suggests that graduate students with low career commitment might benefit from a departmental environment that is more interactive and facilitating.

Perhaps most interestingly, the degree of competition that is perceived in a department is highly related to early levels of degree progress. At all levels prior to completion of a master's degree, competition is negatively related to the completion of a stage of the doctoral process. This persistent finding suggests that collaboration rather than competition in early years of graduate education would increase the numbers of graduate students who make it to later doctoral milestones. Given that the work world relies fairly heavily on work-teams and collaboration, introducing such an emphasis early in doctoral programs would surely help students to better acclimate to their positions after graduation.

VI. Study Limitations and Future Research

While the findings here contribute to what is known about climate, degree progress and career commitment, the study has a few limitations. The generalizability to other settings is limited due to sampling from one institution. The small number of underrepresented students in the sample is also problematic. Administration of the survey at other institutions, especially those with more underrepresented students in the population, would increase the generalizability of findings and expand what is known about how department climate is related to degree progress and career commitment for different populations.

The reader must be cautioned again that these results are correlational in nature, not causal. Because the survey has only been administered once, the data are cross-sectional. Using this survey on an annual basis would provide rich, longitudinal information which could be used to help determine causation of degree progress and career commitment. Qualitative research might also be helpful in understanding the decision process for graduate students in Science and Engineering programs.

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