Funding Source and Satisfaction with Graduate Program:
A Preliminary Analysis of the ACS Graduate Student Survey
J. Stockard, July 4, 2018

This short report examines the relationship between chemistry graduate students' funding and their satisfaction with graduate school and confidence regarding their future careers. Specifically, it examines data from the ACS survey of graduate students to test the hypothesis that students whose primary source of funding is fellowships would have less favorable outcomes than other students. The ACS survey asked respondents to indicate the percentage of financial support received from a variety of sources. The most common were teaching assistantships (37% on average), research assistantships (36%) and fellowships and scholarships (19%). This brief report examines the relationship between funding type, satisfaction with the graduate experience, and socio-demographic variables. Over 90 percent of the total group of respondents were PhD students. Thus, to eliminate level of program as a factor, the results reported here focus only on PhD students.

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Univariate Results

Table 1 gives descriptive statistics for the variables that were examined.[1] Three socio-demographic variables were included: gender, race-ethnicity, and first-generation status. Slightly more than half (52%) of the respondents were men, almost nine-tenths (87%) were of non-Hispanic white ethnicity, and about the same number (86%) had at least one parent who had attended college.

A composite measure of satisfaction with the graduate experience and confidence in the future was based on six variables: rated satisfaction with their research group, quality of the student's relationship with the advisor (the scale used in the analysis of gender differences in aspirations), likelihood of completing the degree, likelihood of staying in the chemical sciences for a career, confidence in negotiating the job market, and confidence in building a successful career. Although there was substantial variability, on average, respondents were relatively satisfied with their research group and confident they would finish their degree and stay in chemistry after graduating. Average values were slightly lower in reports of support received from their advisors and in ratings of confidence regarding navigating the job market and building a successful career. Because responses to these six variables were strongly correlated with each other they were combined into an additive scale (Cronbach's alpha = .72). Because the measures had different ranges, standardized scores were used in scale construction, resulting in a mean scale score of zero. Positive scale scores indicate more positive experiences and greater confidence regarding a successful chemistry career.

As noted above, funding was measured as the percent of resources obtained from each source: TAs, RAs, and fellowships and scholarships.[2] Immediately following the question regarding funding sources

[1] Because of time constraints no attempt was made in this analysis to impute missing values. This should be a step included in future work.

[2] I also tried analyses when the measure of funding was collapsed into dummy variables, one in which having any funding from a source was given a value of one and another in which having at least half of funding from a given source was given a value of one. Because of time constraints, comparative analyses were only done with the

respondents were asked to indicate the extent to which they agreed or disagreed with this statement, "The funding for my graduate studies is adequate to meet the cost of living where I live." Higher scores on the measure indicate greater agreement that the funding was adequate, and results indicate, on average, slight agreement that funding was adequate (mean of 3.7 on a 5 point scale).

Bivariate Results

Table 2 shows the correlations between the measures of satisfaction and confidence, funding, and socio-demographics. Results indicate that satisfaction and confidence was significantly greater for those who had lower proportions of TA funding, who felt their funding was adequate, men, racial-ethnic minorities, and first generation college students.

The three measures of funding were negatively correlated, reflecting the tendency of students to rely on one source more than another. Men were significantly less likely to have funding from TAs or fellowships or scholarships, but significantly more likely to have funding from RAs. Men were also more often first generation college students. Non-Hispanic whites were significantly more likely to have RA funding and to report that their funding was adequate, but less likely to have fellowship funding. Gender was not associated with perceptions of the adequacy of funding.

Multivariate analyses

Table 3 summarizes the results of regressing the composite measure of experiences and confidence on funding source, perceived adequacy of the funding and the socio-demographic variables. Four models are included: three that include each funding source separately and a third that includes all three funding sources together. Unstandardized regression coefficients (b's), which can be compared across models, are included as well as standardized regression coefficients (betas), which can be compared within a model and with the correlation coefficients in the first column of Table 2. The zero-order correlations in Table 2 indicate the total relationship between satisfaction/confidence and each independent variable, and the standardized coefficients indicate the direct, or net, relationship once other variables in the model are controlled.

The results from all four models are essentially the same, and most results from the regressions parallel the bivariate results. Satisfaction/confidence was significantly higher for those who believed their funding was adequate, males, racial-ethnic minorities, and first generation students. There was however a decline in the relationship between satisfaction/confidence and support from a TA in the multivariate models. This decline indicates that some of the relationship of TA support and lower satisfaction/confidence can be explained by the association of these variables with gender and perceived adequacy of funding. When gender and perceived adequacy are controlled, differences by TA support disappear.

In additional analyses I explored the relationship of minority status and gender to the satisfaction and confidence scale. Results indicate that the relationships were independent of each other. In other words, the differences between men and women were the same magnitude within majority and

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receipt of fellowship/scholarship funds. Those analyses resulted in identical results with the continuous measure (% of funding as used in this analysis) and the two dichotomous measures. Future analyses could examine these and other alternative methods of operationalizing funding.

minority race-ethnic groups and the differences between the race-ethnic groups were the same within each gender.

Discussion

This, admittedly very brief, examination of the ACS data did not provide evidence that graduate students who depended heavily on fellowships for their financial support had more negative graduate experiences or expectations for the future. There are, however, many ways in which the analysis could be improved. As discussed briefly in note 2, alternative measures could be used to examine funding sources. In addition to the alternatives discussed in that note one could also compare students with very high reliance on fellowships and little or no reliance on an RA post with other students (i.e. a measure that combined RA funding and fellowship funding). Other control variables should also be examined, with special attention to some that might be repressing possible associations between funding and outcomes, such as support from peers and the institution in general. The measure of outcomes could also be refined, as for instance examining different elements of the graduate school experience and different aspects of expectations of future careers.

The findings regarding the socio-demographic variables are also interesting and deserve further exploration. Particularly striking is the finding that men were more often supported by RAs than by TAs and Fellowships and had significantly better perceptions of their graduate experience and more confidence in future career success. Future work could focus on examining elements that are involved in these interrelationships. [3] Also striking was the more positive views of racial-ethnic minorities and first generation students, and it could be informative to examine why these associations appear.

Finally, it is important to remember that graduate student experiences occur within institutional contexts. It will be important to examine the ways in which these contexts, and especially variables related to departments and universities, are related to student experience and the relationship between student financial support and outcomes.

[3] One could hypothesize that the RA experience could provide experience, knowledge, and associations that enhance men's aspirations and confidence and helps contribute to the gender differences in aspirations discussed in another analysis.

Table 1

Univariate Statistics Variables in Analysis

Socio-Demographic Variables	Mean	Range	High Value Indicates
Gender	0.52	0, 1	Male
Race-Ethnicity	0.87	0, 1	Non-Hisp. Wh.
First-Generation	0.86	0, 1	GE 1 parent with some college
Graduate Experiences and Confidence			
Satisfied with Research Group	4.12	1-5	More satisfied
Advisor Supportive	3.57	1-5	More supportive
Confident in degree completion	0.77		Definitely will complete
Confident will stay in chemistry	4.11	1-5	More confident
Confident can navigate job market	3.10	1-5	More confident
Confident can build successful career	3.39	1-5	More confident
Satisfied/Confidence Scale	0.00	-2.6 to 1.3	More satisfied and confident
Funding			
Percent from TA's	37.01	0 - 100	Greater support
Percent from RA's	35.72	0 - 100	Greater support
Percent from Fellow/Scholarship	19.37	0 - 100	Greater support
Funding Adequacy	3.66	1 - 5	Fully adequate

N ranged from 2360 to 2442.

Table 2

Correlations Among Variables in the Models

	Sat/Conf.	TA	RA	Fellow/Sc	Adequate	Male	Non-Min
Sat/Confident Scale	1						
TA Funding	-0.05*	1					
RA funding	0.03	-.46***	1				
Fellow/Scholarship	0.02	-.43***	-0.40***	1			
Funding Adequate	.08***	-.09***	.09***	.14***	1		
Male	0.14***	-0.05*	0.12***	-0.07***	0	1	
Non-Hispanic White	-0.05**	0.02	0.06**	-0.07**	.11***	0.02	1
2nd Generation	-0.08***	-0.01	-0.02	0.03	0.02	-0.04*	0.01

Table 3

Regressions of Satisfaction/Confidence on Funding Source, Adequacy, and Socio-Demographic Variables

	Model 1		Model 2		Model 3		Model 4	
Ind. Variable	b	beta	b	beta	b	beta	b	beta
% TA*10^4	-6.02	-0.03	-----	-----	-----	-----	-9.97	-0.05
% RA*10^4	-----	-----	1.56	0.01	-----	-----	-4.81	-0.02
% Fell.*10^4	-----	-----	-----	-----	2.35	0.01	-4.46	-0.02
Funding Adeq.	.05***	0.09	.05***	0.10	.05***	0.10	.05***	0.10
Male	.19***	0.14	.19***	0.15	.19***	0.15	.19***	0.15
Non-Hisp. Wh.	-.11**	-0.05	-.11**	-0.06	-.11**	-0.05	-.11**	-0.05
2nd Gen +	-.13***	-0.07	-.13***	-0.07	-.13***	-0.07	-.13***	-0.07
Constant	-0.06		-0.09		-0.09		-0.25	
R squared	.04***		.04***		.04***		.04***	

Note: b values are unstandardized coefficients, betas are the standardized coefficients. * = p<.05; **=p<.01, ***=p<.001