Predictability of Students' Plans to Participate in Undergraduate Research

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Overview

This poster presentation illustrates the value of surveying first-year students' plans to participate in undergraduate research with a faculty member. The sample for this study includes the survey responses of over 43,000 students who participated in the National Survey of Student Engagement (NSSE) as a first-year student between 2004 and 2008; responses were matched with the same student who completed the survey three or four years later as a senior. The purpose of this study is two-fold: a) to examine if planning to participate in undergraduate research as a first-year student increases the likelihood of participation and b) identify other factors (like major field) that may influence the rate of completion among students. This poster presentation is important to AIR members because it provides a broad comparison of completion rates of undergraduate research and models the value of surveying first-year students regarding their future behavior.

Undergraduate Research

According to the Council for Undergraduate Research (2011) over 600 institutions have developed programs which have two main components: 1) undergraduate students creating new knowledge and 2) collaboration with faculty members. Yet, in a large national sample of senior students, only 20% of the students participated in undergraduate research (NSSE, 2012). Researchers have examined the relationship between an undergraduate research experience's rigor and the skills gained by students, like crafting research questions, analyzing test results, and explaining experimental findings (Bauer & Bennett 2008; Buckley, Korkmaz, & Kuh, 2008; Hu, Scheuch, Schwartz, Gayles, & Li, 2008). Overarching gains from participating in undergraduate research include increases in confidence, critical thinking, problem and communication skills (Seymour, Hunter, Laursen, & DeAntoni, 2004).

Research Questions Guiding this Study

Q1: For seniors, is there a significant difference in participation in a research experience between those, who as first-years, planned to participate in research compared to those who did not?

Q2: Do the completion rates of seniors who, in their first year, planned to participate in undergraduate research significantly differ by major?

Q3: Accounting for gender, first-generation status, and transfer status, are planning for and major choice related to the odds of students participating in undergraduate research by the senior year?

Sample

The sample for this study includes the paired survey responses of 43,554 students who participated in NSSE. These students completed the survey as first-year students between the spring of 2004 and the spring of 2008 and again as a senior three or four years after their initial participation in the survey. The sample represents students from 702 institutions; however, it is over-represented by students who attended masters-level institutions (41%) and respondents who identified as women (70%). A wide breadth of major fields of study is represented within the sample with the highest representation in the Arts and Humanities (15 %) and the lowest representation in the Physical Sciences (4%). About 1 in 3 students (34%) planned to participate in research as first year students.

Q1. Plans to Participate

Table 2

Two-Way Table for First-Year Plans to Complete Undergraduate Research v. Completion of Undergraduate Research as a Senior

	Completed Undergraduate Research		
First-Year Plans	Yes	No	Total
Planned to Participate	6,179	8,662	14,841
Did Not Plan to Participate	5,745	22,764	28,509
Total	11,924	31,426	43,350

Estimated Expected Frequencies	Yes	No
Planned	4,082.22	10,758.78
Did Not	7,841.78	20,667.22

Pearson Statistic (χ^2)	Yes	No
Planned	1,076.99	408.64
Did Not	560.65	212.73
	Total	2,259.01

Likelihood-Ratio Statistic (G^2)		
Planned	2561.30	-1877.72
Did Not	-1787.48	2199.72
	Total	2,191.64

When comparing the completion numbers between students who planned and did not plan to participated in undergraduate research, both the Pearson Statistic (χ^2) statistic and the Likelihood Ratio Statistic (G^2) by far exceed the threshold (χ^2=3.84) indicating that we can reject the null hypothesis (plans and completion are independent).

Q2. Comparing the Completion Rates by Major

Partitioned Table for First-Year Students who Planed to Complete Undergraduate Research v. Senior Completion by Major

		Completed UR			Estimated		χ^2		Standardized Residuals	
Major		Yes	No	Total	Yes	No	Yes	No	Yes	No
Arts and Humanities		641	1,216	1,857	835.20	1,021.80	45.15	36.91	-16.37	16.37
Physical Science		563	257	820	368.80	451.20	102.26	83.58	16.37	-16.37
	Total	1,204	1,473	2,677				267.91		
Arts and Humanities		641	1,216	1,857	692.68	1,164.32	3.86	2.29	-4.33	4.33
Engineering		390	517	907	338.32	568.68	7.89	4.70	4.33	-4.33
	Total	1,031	1,733	2,764				18.74		
Arts and Humanities		641	1,216	1,857	856.21	1,000.79	54.09	46.28	-13.55	13.55
Biological Sciences		1,248	992	2,240	1,032.79	1,207.21	44.84	38.36	13.55	-13.55
	Total	1,889	2,208	4,097				183.57		

The data were partitioned to learn if the rate of completion among those who planned to participate in an undergraduate research was independent of major. Students who majored in Art and the Humanities were compared to three different majors: Physical Sciences (χ^2 = 267.91), Engineering (χ^2 = 18.74), and Biological Sciences (χ^2 = 183.57). For each of the comparisons, the Pearson statistic exceeds the threshold for two degrees of freedom (χ^2=3.84) indicating that completion is not independent of major.

For each set of the partitioned majors, the standardized residuals (|16.37|, |4.33|, |13.55|) were also above three standardizations, indicating that there is a relationship between major and the completion of undergraduate research for students who planned to participate as first-year students. In each of the cases, the students who majored in Arts and Humanities were over predicted to complete undergraduate research.

Q3. Accounting for Student Demographics, Plans

Logistic Regression of Students Participating in Undergraduate Research Accounting for Plans, Gender, Transfer Status, Major, and an Interaction between Major and Planning

				Likelihood Ratio 95% Confidence Limits		
Parameter	β	$e^{(\beta)}$	SE			*p*
Intercept	-1.53	0.22	0.04	-1.61	-1.45	0.00
Student Background Characteristics						
Plan	0.91	2.49	0.06	0.79	1.03	0.00
Male	0.01	1.01	0.03	-0.04	0.06	0.65
Transfer	-0.39	0.68	0.08	-0.55	-0.24	0.00
First Generation	-0.13	0.88	0.04	-0.21	-0.06	0.00
Major*						
Biological Sciences	0.93	2.53	0.06	0.81	1.05	0.00
Business	-0.63	0.53	0.07	-0.76	-0.51	0.00
Education	-0.41	0.66	0.07	-0.55	-0.28	0.00
Engineering	0.32	1.37	0.08	0.16	0.47	0.00
Physical Science	0.89	2.44	0.08	0.73	1.05	0.00
Other & Professional	-0.15	0.86	0.07	-0.29	-0.02	0.03
Social Sciences	0.42	1.52	0.05	0.31	0.52	0.00
Non Spanning Double Major	0.27	1.32	0.06	0.16	0.39	0.00
Spanning Double Major	0.48	1.61	0.05	0.37	0.58	0.00
Major Interaction with Planning**						
Biological Sciences X Plan	-0.07	0.93	0.09	-0.24	0.11	0.46
Business X Plan	-0.12	0.89	0.11	-0.33	0.09	0.27
Education X Plan	0.04	1.04	0.12	-0.20	0.28	0.73
Engineering X Plan	0.03	1.03	0.11	-0.20	0.25	0.83
Physical Science X Plan	0.53	1.70	0.12	0.30	0.77	0.00
Other & Professional X Plan	-0.31	0.73	0.12	-0.54	-0.08	0.01
Social Sciences X Plan	-0.20	0.82	0.08	-0.36	-0.04	0.02
Non Spanning Double Major X Plan	0.15	1.16	0.09	-0.04	0.33	0.12
Spanning Double Major X Plan	-0.02	0.98	0.08	-0.19	0.14	0.78

*Note: *Arts and humanities are the reference group, ** Students who did not plan to participate in undergraduate research and majored in the arts and the humanities are the reference group.*

Conclusions

When accounting for student background characteristics and academic major, the increased odds between planning and completion were tempered. The odds of students who planned to participate in undergraduate research were almost one and half times more likely (θ = 2.49) to do so compared to students who did not plan to participate. Similar increases in odds were found for students who declared a Physical Science major (θ = 2.44) and Biological Science major (θ = 2.53) compared to Arts and Humanities majors; whereas Engineering, Social Science, and double majors saw moderate increase in the odds of completion (1.32 < θ < 1.61) compared to this reference group. Arts and Humanities majors were over five times as likely to complete compared to students who had Professional majors (θ = 6.54).

Of the nine parameters that represented an interaction between student major and plans to participate in undergraduate research, only three were significant and had confidence intervals that did not span zero.

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