

**An Analysis of Space Allocation in STEM and SBS Departments at the University of Virginia
NSF Annual Report, U.Va. CHARGE, Project Year 2, June 1, 2014,**

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Executive Summary

This analysis of space allocation in Science, Technology, Engineering, Mathematics (STEM) and Social and Behavioral Sciences (SBS) departments was completed during the academic year 2013-2014. Square footage and occupancy data were collected from various sources, including the Office of Geospatial Engineering, the College of Arts and Sciences Director of Space Planning and Management, departmental websites, as well as new data collection within several buildings that was conducted by the UVA CHARGE Internal Evaluation Team. This data collection was limited to tenured and tenure track faculty in the following targeted departments within the College of Arts and Sciences: Anthropology, Astronomy, Biology, Chemistry, Economics, Environmental Sciences, Mathematics, Physics, Politics, Psychology, Sociology, and Statistics. All departments within the School of Engineering and Applied Science were included. Further, each faculty member in these departments was invited to participate in a questionnaire regarding their perceptions of physical space at the University of Virginia as part of the Social Science Supplement, an initiative of the UVA CHARGE Program. As a result, in addition to the analysis of space allocation in STEM and SBS departments, we also report faculty perceptions and recommendations regarding changes to work or public spaces at UVA that they believe would improve their productivity as researchers.

Summary of Findings

1. UVA does not currently collect or monitor space allocation data for faculty.
2. When comparing male and female faculty members, there is no significant difference in square foot allocation, but there is a significant difference in the number of spaces allocated ($p=0.01$) with male faculty receiving more individual offices and research space.
3. Three variables act to significantly predict the total square footage allocated to faculty:
 - a. Total grant dollars won, Arts and Sciences STEM discipline, and Engineering STEM discipline.
 - b. When compared with faculty members in Social and Behavioral Sciences fields, faculty in Arts and Sciences STEM disciplines are allocated an additional 1,136 square feet of space.
 - c. Similarly, faculty members in Engineering STEM disciplines are allocated an additional 543 square feet of space when compared to Arts and Sciences STEM disciplines.
4. Overall, the results indicate that spaces are allocated equitably when controlling for gender, race, years of service, total grant dollars, discipline, and tenure status.
5. 42% of responding faculty recommended creating spaces to foster formal and informal relationships among faculty within and between departments, such as creating informal lounges or lunch spaces within every department to encourage collegiality, increasing the number of lounges and cafes that remain open during student breaks, as well as developing a faculty-only cafeteria or restaurant on campus.
6. A fewer percentage of faculty recommended creating spaces that would also increase their formal interactions with their peers. These suggestions included the creation of physical research centers, where faculty and staff would have a centralized location, moving all faculty onto campus, and

ensuring that all faculty within one department are located within one building. In addition to being within one building, faculty would also appreciate the ability to move easily among various laboratories, department offices, and their own offices, as some older buildings on campus lack this feature.

7. 26% of STEM and SBE faculty requested their spaces be updated, including ways to control the temperature, both heating and cooling and increasing the amount of natural light within office spaces, larger spaces, new furniture, and private offices. Additionally, the noise level of construction and general acoustics of offices were a common complaint. Thus, faculty reported a desire for acoustically insulated spaces to be able to have private conversations with students and other faculty members, as well as have quiet spaces available to focus on their work.
8. 6% of faculty participants mentioned parking as a major hindrance to their productivity. These individuals requested limiting student parking availability, limiting automobile traffic on campus, and improving the accessibility of public transportation among classroom and research spaces.

Analysis: Space Allocation

As there is no central repository for space allocation at UVA, data collection that occurred as part of this report were compiled from various sources. The Office of Geospatial Engineering provided square footage data, as well as partial data regarding the occupants of spaces within the several natural science and engineering fields, including Biology, Chemistry, Physics, Environmental Science, and many departments within the School of Engineering and Applied Science. Their survey of spaces included instructional, individual research, research centers, and shared department spaces such as conference rooms and storage areas. For the purposes of this study, we included only spaces designated as individual research or research centers that are located on campus at the University of Virginia. The Mountain Lake Biological Station and Anheuser-Busch Coastal Research Center were not included in this analysis, as these spaces are shared by numerous faculty members across several departments at UVA, as well as utilized by faculty members at other institutions. After selecting spaces designated as individual research and research centers, we reviewed the spaces that were assigned to tenured/tenure track (TTT) faculty. For spaces located within the College Arts and Sciences, the Director of Space Planning and Management provided some additional data. Information regarding remaining spaces within natural science departments of the College of Arts and Sciences were collected by a team of researchers, who interviewed department administrators and walked through spaces recording occupancy. Whenever possible, staff members, such as laboratory managers, postdoctoral research associates, and graduate research assistants were assigned to a TTT faculty member. Spaces that were shared among multiple TTT faculty were equally divided, with a portion of the square footage of the space assigned to all those faculty who share them. All occupancy data collected as part of this research were reported to the Office of Geospatial Engineering and the Director of Planning and Space Management such that these offices could update their records.

A list of Tenured/Tenure-Track/Non-Tenure Track (TTT/NTT) faculty members was generated by the Office of the Provost, and compared to data collected for the purposes of this study. This faculty list also included faculty gender, race, tenure status, and years of service to the university. Table 1 provides basic demographic information of the faculty. While every effort was made to include every space allocated to every faculty member, we were unable to assign spaces to 92 of 569 faculty members

in the targeted departments (N= 477). Finally, we also collected data regarding the total amount of external grant dollars awarded to individual faculty between 2008 and 2013 (N=311). This information was provided by the Associate Dean for Research. Table 2 provides descriptive statistics for the total grant dollars awarded to faculty.

Table 1: Basic demographic information the faculty sample

Characteristic	Frequency	Percent
Gender		
Male	432	80.6
Female	104	19.4
Race		
White	434	83.9
Black or African American	15	2.9
Asian	47	9.1
Hispanic of any origin	12	2.3
Two or more races	9	1.7
Department		
Anthropology	21	3.9
Astronomy	18	3.3
Biology	43	8.0
Chemistry	32	5.9
Economics	29	5.4
Environmental Science	34	6.3
Mathematics	32	5.9
Physics	34	6.3
Politics	38	7.0
Psychology	41	7.6
Sociology	20	3.7
Statistics	8	1.5
Biomedical Engineering	11	2.0
Chemical Engineering	11	2.0
Computer Science	33	6.1
Electrical and Computer Engineering	27	5.0
Engineering and Society	24	4.4
Materials Science	20	3.7
Mechanical and Aerospace Engineering	27	5.0
Systems and Information Engineering	34	6.3
Rank		
Assistant Professor	73	13.5
Associate Professor	126	23.3
Professor	193	35.7
Instructor	7	1.3
Lecturer	36	6.7
Research Assistant Professor	26	4.8
Chaired Professor	51	9.4
Professor Emeritus	13	2.4

Other	15	2.8
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Table 2: Descriptive statistics for the Total Grant Dollars Awarded to Research Active Faculty 2008-2013 (N=311).

	Minimum	Maximum	Mean	Std. Deviation
Total Grant \$	\$1,000	\$23,987,727	\$1,325,089	\$2,499,050

We compared the total square footage and the number of spaces assigned to individual faculty members by gender, race, and tenure status. Table 3 provides the results of these analyses. When comparing male and female faculty members, there is no significant difference in square foot allocation, but there is a significant difference in the number of spaces allocated ($p=0.01$). Men are allocated a greater number of discrete spaces (e.g., individual offices for staff, lab space) than women faculty. Faculty did not differ by race in terms of the square footage of space or the number of spaces allocated. Tenured/tenure track faculty differ significantly from non-tenure-track faculty both in terms of square footage and number of spaces allocated ($p < 0.05$).

Finally, we conducted two OLS regression analyses to investigate the relationship between the independent variables of gender, race, total grant dollars awarded, discipline, tenure status, and the dependent variables of a) total square footage; and b) total number of spaces allocated. Table 4 presents the results of the predictors of total square footage. This model is statistically significant ($F= 9.45$, $p < 0.001$). Three variables act to significantly predict the total square footage allocated to faculty: total grant dollars won, Arts and Sciences STEM discipline, and Engineering STEM discipline. When compared with faculty members in Social and Behavioral Sciences fields, faculty in Arts and Sciences STEM disciplines are allocated an additional 1,136 square feet of space. Similarly, faculty members in Engineering STEM disciplines are allocated an additional 543 square feet of space when compared to Arts and Sciences STEM disciplines. When comparing the standardized β coefficients, the total grant funding awarded to faculty members explains the greatest amount of variance in the total square footage of space allocated to faculty members. This model explains 22.1% of the variance in square footage of space allocation to STEM and SBS faculty at the University of Virginia. Table 5 presents the results of the OLS regression model investigating the predictors of total number of spaces allocated to faculty members. This model is statistically significant ($F=6.303$, $p < 0.001$). When holding all other independent variables constant, the total grant dollars won by faculty members is the only significant predictor ($p < 0.001$). This model explains 15.1% of the variance in number of spaces allocated to faculty in STEM and SBE fields.

Table 3: Space allocation by gender, race/ethnicity, and tenure eligibility

	Men (N=362)		Women (N=82)		<i>t</i>	<i>df</i>	Sig
	Mean	Std Dev	Mean	Std Dev			
Total square footage	993.9	1713.8	808.6	1218.4	0.9	442	NS
Total number of spaces	3.7	5.3	3.2	4.4	2.8	308	0.01
	White (N=356)		Person of color (N=69)		<i>t</i>	<i>df</i>	Sig
	Mean	Std Dev	Mean	Std Dev			
Total square footage	1015.8	1749.8	786.3	1108.0	1.1	423	NS
Total number of spaces	3.8	5.4	3.0	4.0	1.0	423	NS
	Tenure/TT (N=376)		Non-TT (N=54)		<i>t</i>	<i>df</i>	Sig
	Mean	Std Dev	Mean	Std Dev			
Total square footage	1034.2	1736.6	567.8	807.4	3.3	428	0.05
Total number of spaces	3.9	5.4	2.1	2.5	3.9	428	0.00

Table 4: Predictors of total square footage of space allocated (N=269)

	Unstand B	Stand B	<i>t</i>	Sig	Collinearity diagnostics	
					Tolerance	VIF
Gender	257.35	0.05	0.88		0.93	1.08
Total grant funding	0.00	0.44	8.04	***	0.95	1.05
Length of service in years	16.23	0.09	1.58		0.86	1.16
Race (1=White; 0=POC)	102.79	0.02	0.34		0.91	1.10
Arts & Sciences STEM discipline	1136.49	0.27	3.84	***	0.58	1.72
Engineering discipline (Referent: Arts & Sciences SBE discipline)	542.73	0.14	1.96	*	0.58	1.73
Tenure/tenure-track status	-284.71	-0.03	-0.43		0.47	2.12
Non-tenure-track status	-1226.53	-0.04	-0.65		0.85	1.18
Research faculty status (Referent: Emeritus status)	-812.64	-0.07	-0.87		0.50	2.01
F	9.45	***				
Adjusted R ²	0.221					

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 5: Predictors of total numbers of spaces allocated (N=269)

	Unstand B	Stand B	<i>t</i>	Sig	Collinearity diagnostics	
					Tolerance	VIF
Gender	0.70	0.04	0.75		0.93	1.08
Total grant funding	0.00	0.40	6.94	***	0.95	1.05
Length of service in years	0.04	0.07	1.19		0.86	1.16
Race (1=White; 0=POC)	0.26	0.02	0.27		0.91	1.10
Arts & Sciences STEM discipline	1.79	0.14	1.90		0.58	1.72
Engineering discipline (Referent: Arts & Sciences SBE discipline)	-0.03	0.00	-0.03		0.58	1.73
Tenure/tenure-track status	-1.01	-0.04	-0.48		0.47	2.12
Non-tenure-track status	-4.11	-0.04	-0.69		0.85	1.18
Research faculty status (Referent: Emeritus status)	-3.31	-0.09	-1.11		0.50	2.01
F	6.303	***				
Adjusted R ²	0.151					

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Analysis: Space Recommendations

In addition to the analysis completed regarding total square footage and number of spaces assigned to faculty in STEM and SBS departments at the University of Virginia, we also collected data regarding what changes faculty would like to see in their space allocation in order to be more productive. All faculty in STEM and SBS departments were invited to participate in this survey (N=569). Of the invited faculty, 250 (43.9%) participated, and 183 of these individuals provided a response to an open ended question regarding physical space. This question asked faculty what changes they would like to see to the physical space at the University of Virginia in order to improve their productivity as researchers.

Responses were categorized and open-coded. We then condensed these coded categories into themes. These themes centered on facilitating interpersonal interaction, creating workspace outside traditional faculty offices, updating current facilities, and broader suggestions for campus convenience. The highest percentage of responses (42%) was related to creating spaces to foster formal and informal relationships among faculty within and between departments. These comments included creating informal lounges or lunch spaces within every department to encourage collegiality, increasing the number of lounges and cafes that remain open during student breaks, as well as developing a faculty-only cafeteria or restaurant on campus. Several faculty members also expressed a general desire to create spaces that would foster informal interactions with other members of their department. Other faculty reported a desire to create spaces that they could utilize to increase their interactions with graduate students, research and administrative staff, and undergraduate students. Faculty suggested moving their primary offices to a location closer to their laboratories to facilitate a greater level of interaction. Additionally, faculty members reported a desire to create spaces that would also increase their formal interactions with their peers. These suggestions included the creation of physical research centers, where faculty and staff would have a centralized location, moving all faculty onto campus, and ensuring that all faculty within one department are located within one building. In addition to being within one building, faculty would also appreciate the ability to move easily among various laboratories, department offices, and their own offices, as some older buildings on campus lack this feature.

STEM and SBE faculty reported several ways in which their current office spaces could be updated to improve their productivity. This category represented 26% of suggestions made by faculty members. Within this category, many participants requested ways to control the temperature, both heating and cooling and increasing the amount of natural light within office spaces. Several faculty also requested larger spaces, new furniture, and private offices. Additionally, the noise level of construction and general acoustics of offices were a common complaint. Thus, faculty reported a desire for acoustically insulated spaces to be able to have private conversations with students and other faculty members, as well as have quiet spaces available to focus on their work. Finally, faculty requested new furniture, printers within their offices, and additional spaces for their graduate research and teaching assistants to complete their work.

Updating current spaces was reported by 15% of faculty participants. Faculty reported the desire to have more seminar spaces available, specifically with moveable chairs that could hold up to 35 individuals. Updates to classroom spaces included the desire for enhanced technology, as well as improving the general quality of these spaces by allowing more flexibility in classroom lay-out. Several faculty also reported a desire for updated laboratory spaces and reported several issues with power supplies for their scientific equipment. Three faculty requested gender-specific spaces, such as a nursing

mother's room and increasing the number of female restrooms within the School of Engineering and Applied Science.

Parking and convenient travel around campus was a concern for 6% of faculty participants. Of these individuals, many faculty members mentioned that parking is a major hindrance to their productivity. These individuals requested limiting student parking availability, limiting automobile traffic on campus, and improving the accessibility of public transportation among classroom and research spaces. Finally, 10% of faculty participants expressed a desire for more available workspaces outside of their personal office or laboratory. Many faculty members reported the need for more tables and chairs in both outdoor and indoor public spaces, as well as more available shade for outdoor spaces. Several faculty participants also requested faculty-specific study carrels in Alderman Library.

In summary, while faculty members in STEM and SBS fields at the University of Virginia were able to identify several areas of concern for space allocation, the results of our analyses indicated that spaces are allocated equitably when controlling for gender, race, years of service, total grant dollars, discipline, and tenure status. Many faculty reported the need to improve spaces for both formal and informal collaboration with their peers and research groups. These types of spaces were not included in this report, however future research would benefit from including a measure of informal collaboration spaces with departments. It is possible that increasing the amount of informal collaborative spaces, such as cafes and lunchrooms, would allow faculty to become more productive researchers and increase their grant dollars brought to the University, thereby influencing their space allocation.