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Work in Progress: A Data-Gathering Effort on STEM Faculty Startup Packages for Assessing Equity in Recruitment

Dr. Leigh S. McCue, George Mason University

Leigh McCue is an Associate Professor and Chair of George Mason University's Department of Mechanical Engineering.

Dr. Girum Urgessa, P.E., George Mason University

Dr. Girum Urgessa is an Associate Professor of Civil Engineering in the Sid and Reva Dewberry Department of Civil, Environmental, and Infrastructure Engineering (CEIE) at George Mason University (GMU). He received his MS (2002) and PhD (2006) from the Uni

Tehama Lopez Bunyasi, George Mason University
Patrick Willette Healey, George Mason University
Patricia Wonch Hill, University of Nebraska, Lincoln

Dr. Hill is an applied sociologist, evaluator, and researcher whose primary scholarship is in gender, STEM and broadening participation in K-22 education and in professorate.

Dr. Jaime Lester, George Mason University

Jaime Lester (she, her, hers) is the Associate Dean of Faculty Affairs and Strategic Initiatives in the College of Humanities and Social Sciences and a Professor of the Higher Education Program. Her research examines organizational change and leadership in higher education with a focus on faculty affairs and development. Her work focuses on leadership to promote local and institutional change to create equitable workplaces in colleges and universities. Her more recent research on learning analytics and pedagogy promotes new data-driven evidence to promote changes in pedagogy, instructional practice, and leadership decision-making.

Jaime puts her research into practice as an academic administrator supporting faculty and college-level change. As an administrator, she is responsible for supporting faculty governance and developing new faculty career development and workload programs and policy. Jaime also leads all diversity, equity, and inclusion (DEI) efforts for the college. She is a member of the Philadelphia 2022 HER Leadership Institute.

Jaime's work is widely published in peer-reviewed journal articles and other academic publications and funded by federal agencies and private foundations. Her books on educational technologies, equitable workplace practices, and organizational change are widely used in higher education practice. She has received numerous awards for her research and teaching. Jaime regularly consults with colleagues and universities on faculty workload, pedagogical innovations, leadership, and organizational change.

Milagros Rivera, George Mason University

Work-in-progress: A data gathering effort on STEM faculty startup packages for assessing equity in recruitment

Leigh McCue, Girum Urgessa, Tehama Lopez-Bunyasi, Patrick Healey, Patricia Wonch Hill, Jaime Lester, and Milagros Rivera-Sánchez

Abstract
Supported under an NSF ADVANCE Catalyst grant, a multi-disciplinary team of researchers are conducting a comprehensive data gathering effort to assess equity in recruitment, hiring, renewal, promotion, and tenure activities at George Mason University for tenure-track, tenured, and term (contingent) faculty with attention to intersectional analyses. In this work-in-progress submission, we describe a data gathering effort to assess equity in startup packages for STEM faculty by sharing our process for identifying academic discipline faculty to be included in the analysis, data acquisition instrument, stakeholder engagement with the classified staff, administrative faculty, and Deans with access to the data, and preliminary findings.

Introduction

George Mason University participates in the Collaborative on Academic Careers in Higher Education (COACHE) survey, and on most recent implementation, included custom questions that sought to probe faculty perceptions as to if departments and colleges/schools within the University actively work to recruit and retain faculty members from historically excluded groups. Statistically significant differences were found between how faculty in STEM disciplines from historically marginalized groups answered versus majority faculty in STEM, with majority faculty indicating a more positive perception of departmental efforts toward recruitment and college/school efforts toward both recruitment and retention of faculty from historically excluded groups. Recognizing the key role startup support plays in recruitment and retention, the research team has initiated a detailed assessment of startup offers to STEM faculty at Mason. Startup support is a key component to faculty success, with a recognized range of models for this form of support [1].

White women, women of color, and men of color are underrepresented minorities (URM) in many STEM fields, particularly at the faculty level. A vast amount of research has shown that there are systemic barriers and disparities to URM faculty in hiring, promotion and tenure, service, teaching, research and salaries [2]–[4]. One area that is understudied is whether there are inequalities in start-up packages for new faculty hires. Startup packages are generally understood to be financial and material resources provided upon hire that support faculty research, teaching, service and professional development [5]. They are often but not always time-limited [1]. Packages might include funds to purchase equipment, graduate student support, lab space, benefits packages, leaves or course buy-outs, or dedicated funds to support professional development (e.g. travel to academic conferences). Gathering this type of data across STEM units at a large R1 university is quite complex, because each academic unit or college may have independent norms for startup offers. Start-up packages may also vary widely by academic discipline depending on whether the STEM discipline and research needs lab space or specialized equipment.

Recognizing the key role startup support plays in recruitment and retention, the research team has initiated a detailed assessment of startup offers to STEM faculty at Mason. First, though the body of literature is modest in the context of academia, research suggests a relationship between startup

packages/support and efficacious recruitment, robust retention, and higher job satisfaction [6]. Second, there is a positive relationship between the number of different types of benefits in a start-up package and the recipient's perception of the degree to which it contributed to their professional development. This relationship is mediated--both sequentially and in parallel--by satisfaction with the package and perception of whether the university honored the package [6]. In a study at a public University in the Southeastern United States published in 2019, it was found that women report lower levels of satisfaction and lower perception that the university honored their packages than men [7]. Similarly, among early-career clinician-researchers, a positive association was found between access to adequate research equipment, which start-up packages can provide, and professional success [8]. By the same token, University of California San Diego reported in 2023 statistically significant gender disparities in lab space in favor of men at its Scripps Institution of Oceanography. These differences could not be explained by other characteristics of the employees, their research, or the spaces; with the possible exception of race, which they were not able to measure [9].

Finally, there is an ethical motivation to investigate, as disparities between such packages (which are often valued at hundreds of thousands of dollars or more) along lines of marginalization after controlling for other factors would constitute a material injustice in need of correction. Sege, Nykiel-Bub, and Selk found that among early-career biomedical researchers, men received higher-value start-up packages than women across the board. The difference was statistically significant among PhDs, basic science researchers (as opposed to clinical), and employees of institutions in the top quartile of funding from the National Institutes of Health. The differences could not be explained by degree, experience, or institutional characteristics [10].

Our data acquisition instrument sought to capture salary and summer salary offers, laboratory space, equipment access and funds for equipment acquisition, travel, or other hardware, and graduate research assistantships. Furthermore, recognizing the differing impact of COVID-19 on faculty caregivers [11], we sought to capture data related to use of faculty-handbook guaranteed pre-tenure leave and/or COVID-19 related tenure clock extensions. Ultimately, when viewing this data in combination with other data sets, such as faculty satisfaction surveys, climate surveys, salary studies, etc., we aspire to develop a holistic perspective on faculty hiring, retention, and promotion at George Mason University.

Who Are 'STEM' Faculty?

In order to assess equity in STEM startup packages, an initial effort was conducted to identify who, specifically, would be designated as STEM faculty at Mason. This effort was perhaps less intuitive than one might expect. The National Science Foundation (NSF), for example, does not have a defined list of disciplines it considers to be STEM, though one can intuit such a list based upon eligibility for the Graduate Research Fellowship Program (GRFP), which is included in Appendix A for ease of reference [12]. We cross-referenced the NSF GRFP list to the Department of Homeland Security (DHS) list of disciplines for which F-1 visa students can receive the STEM Optional Practical Training (OPT) extension of their visa. The DHS denoted these disciplines (summarized in Appendix B) using the Department of Education's Classification of Instructional Program (CIP codes) [13], [14]. With this common basis for definitions, we established the list of departments for whom we designate their faculty as "STEM" faculty in Table 1. We considered a

more granular look by individual faculty member, but determined this approach to be impractical for the size of the University and current limitations of institutional human resources software.

School/College	Department	CIP Code
College of Humanities & Social Sciences	Criminology, Law & Society Program	43.01
	Economics	45.06
	Psychology	42.01
College of Engineering & Computing	Bioengineering (BENG)	14.05
	Civil Engineering & Infrastructure	14.08
	Computer Science	11.01
	Cyber Security Engineering	43.03
	Data Analytics Engineering	11.08
	Electrical & Computer Engineering	14.10
	Information Sciences & Technology	11.01
	Mechanical Engineering	14.19
	Statistics	27.05
	Systems Engineering & Op Research	14.27
College of Health & Human Services	Dept of Rehabilitation Science	51.23
	Global & Community Health	51.22
College of Science	Atmospheric, Oceanic & Earth Sci	40.06
	Biology	26.01
	Biomedical Program	26.01
	Chemistry	40.05
	Ctr Spatial Info Science & System	45.07
	Computational and Data Sciences	30.08
	Ctr for Collision Safety & Analysis	40.08
	Ctr for Ocean-Land-Atmosphere Stud	40.06
	Ctr Infectious Disease Rsch (CIDR)	26.01
	Ctr Proteomics & Mol Med (CAPMM)	26.01
	Environmental Science & Policy	03.01
	Geography & Geoinformation Sciences	45.07
	Mathematical Sciences	27.01
	Neuroscience	26.15
	Physics & Astronomy	40.08
	SSB-School of Systems Biology	26.11
College of Visual & Perf Arts	Computer Games Design	10.03
Smithsonian-Mason School of Conservation	Mason Front Royal Education Center	03.01

Table 1: Classification of departments containing “STEM” faculty.

Data Acquisition Instrument

To assess equity of initial offer packages, we sought to identify key components of a typical faculty member's startup package, utilizing language that was sufficiently broad as to capture components of offers generated in the different Colleges within the University. For example, a 'typical' offer letter for a faculty member in the College of Humanities and Social Sciences is structured differently from a 'typical' offer letter for a faculty member in the College of Engineering and Computing. Early versions of the instrument sought to sort various types of financial support a faculty member may receive (travel, computer, etc.). To avoid confusion, recognizing different units describe fiscal supports in different ways, it was concluded that a more straightforward path would simply be to ask for a total estimated value of all non-personnel financial support provided to the new hire. Following this logic, we sought to identify high-level, relatively universal components to faculty startup packages that may critically influence a faculty member's recruitment and pathway to success (e.g., salary, laboratory space/equipment as warranted by research field, graduate student and/or post-doctoral researcher support, and teaching load).

Additionally, the University offers pre-tenure leave, as guaranteed in the faculty handbook, and offered COVID-19 related tenure clock extensions; thus, we also wanted to assess the equity in use of these guaranteed supports. Because the same staff and administrative personnel would have access to that information, it was concluded that incorporation of questions related to leave use would be of value to include in this instrument. Lastly, we sought to develop an instrument that would capture these key pieces of information in a user-friendly manner, recognizing this to be a time-intensive request of College-level human resources, as well as fiscal and facilities personnel. Rather than requiring use of software systems that these various providers of data may or may not have prior experience with, we developed a simple Excel spreadsheet format for data entry. Because our ultimate intent is to assess equity across race, gender, and intersectional identities, demographic data is captured in the assessment instrument. Our measures of race/ethnicity and gender are limited by how Mason gathers data about faculty demographics at the institution. We do not have access to data on specific race/ethnic categories, and the race/ethnic categories used are not inclusive of some ethnicities (e.g. middle eastern). Also, due to small numbers in some race/ethnic groups, we have to aggregate BIPOC faculty into groups based on whether they belong to historically underrepresented minority groups in STEM. Similarly, our data is limited to the gender binary and a third category that is used for anyone who indicates they do not identity on that binary. Faculty in the last group are such a small group that we do not have statistical power to look for meaningful differences from other gender groups.

With these considerations in mind, the IRB-approved instrument is provided in Figure 1. For ease of data entry and consistency of inputs, numerous items were defined based on pull down lists, as summarized in Figure 2. The color coding in the IRB-approved instrument shown in Figure 1 is for ease of Excel data entry for the user. Admittedly color-coding is not a best practice for printed content or color-blind users. Each category in Figure 2 is an independent pull down-list. That is to say, it should not be read horizontally, rather, intersectional identities are captured by selections from amongst the first four categories, e.g. a tenure-track, Assistant Professor, who is male and Asian, or a tenured, Professor who is female and Black/African American. At Mason the rank of Instructor is utilized for faculty who do not hold a terminal degree. The Professor of Practice rank is utilized for faculty "with or without a terminal degree, who possess the expertise, achievements, and experience to provide professional instruction in a manner that brings relevance and distinction

to the local academic unit and the University" [15]. The Instructor and Professor of Practice ranks are term rather than tenure-track appointments. Academic unit is not solicited explicitly on the assessment instrument. This is due to the workflow used for data gathering. Specifically, academic units are asked to complete this instrument for faculty in their unit. The study team knows the relevant unit based upon who submits the assessment instrument. For example, the College of Science has been asked to complete this for their faculty. Therefore, their responses will only reflect the faculty from that College. The study team have deliberately not asked for greater refinement than College/School level data so as to avoid de-anonymizing data via sample size. This instrument was socialized with the relevant College-level staff and administrative faculty prior to finalization, as described in the next section.

General Instructions: Please complete a column for each term and tenure-track faculty hired within the past 5 years. While we request anonymized data, we recommend you maintain a key correlating faculty members to specific columns should there be follow on questions. Items shaded in tan are drawn from pull down lists. Items shaded in green request text entry. Gray boxes are placeholders. Please provide any required clarifying notes in the "Additional Notes" field below.	
General Faculty Information:	**Faculty 1**
Appointment type	
Rank type	
Gender	
Race	
Date of initial hire (MM/DD/YY)	
Salary, Startup Funding, Teaching Load:	**Faculty 1**
Academic year salary ($)	
Summer salary (total number of summer months)	
Research/laboratory space allocation (square feet)	
What type of research equipment was provided with the laboratory space?	
Year when research/lab was commissioned (YYYY)	
Post-doc/graduate research assistant	**Personnel**
- Post-doc (years of support)	
- PhD (years of support)	
- MS/MA (years of support)	
Teaching load	**Teaching load**
- 1st year (total number of courses to be taught)	
- 2nd year (total number of courses to be taught)	
- 3rd year (total number of courses to be taught)	
Total value of startup package (not including personnnel costs enumerated above)	
Leave Use:	**Faculty 1**
*Did faculty member take pre-tenure leave?	
*Did faculty member utilize COVID-19 tenure clock extension?	
*Did faculty negotiate additional leave upon hire?	
Additional Notes:	

Figure 1: IRB-approved data acquisition instrument for assessing startup equity.

Stakeholder Engagement

As described in the prior section, success of this effort relies heavily upon numerous staff members and administrative faculty providing detailed data. To that end, the assessment instrument was socialized amongst those professionals prior to finalization. In our outreach, we posed questions such as:

1. Are the data asks reasonable?

2. Are the data asks phrased logically, or would changes to the questions make the data pull easier?
3. What is a reasonable time frame for completion of this effort?

The feedback received allowed us to tailor the instrument in meaningful ways. For example, early versions of the assessment instrument included questions related to initial offer versus accepted offer. During this step of outreach to personnel, we learned that initial offer data was not tracked in the same manner as final offer data, and to include that component would significantly increase workload. With that information, the research team was able to weigh the relative benefit of requesting that data versus eliminating it from the ask in order to improve response time. Additionally, relevant suggestions were made at this stage of the effort. For example, we anticipated receiving anonymized data by College listed in Table 1. Personnel in the College of Engineering and Computing suggested separating faculty into two sets corresponding to the School of Computing and Volgenau School of Engineering, recognizing that infrastructure needs and salary expectations of computer scientists and engineers may differ widely.

Appointment type	Rank	Gender	Race/ethnicity
Term	Instructor	Female	American Indian/Alaska Native
Tenure-track	Professor of Practice	Male	Asian
Tenured	Assistant Professor	Not Reported	Black/African American
	Associate Professor		Hispanic/Latino
	Professor		Native Hawaiian/Pacific Islander
	University Professor		Non-resident Alien
			Two or more races
			White
			Not Reported

Research Equipment Status	Take pre-tenure leave?	Take covid tenure clock extension?	Negotiate additional leave upon hire?	Numbers
Shared	Yes	Yes	Yes	1
New	No	No	No	2
Shared+new	N/A	N/A		3
N/A				4
				5
				6
				7
				8
				9
				10

Figure 2: Nine pull-down lists for data acquisition instrument in Figure 1.

Preliminary Findings

At the time of draft work-in-progress paper submission, we are still recruiting the requested data. Preliminary findings will be provided, if available, upon presentation at ASEE 2023.

Conclusions

This paper describes a work-in-progress effort to gather data related to STEM faculty member's initial hire packages at George Mason University. The data gathering effort provides the foundation for a study into equity in recruitment and hiring of STEM faculty as it relates to race, gender, and intersectional identities. Findings are pending at the time of this writing.

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Appendix A: List of disciplines listed as eligible for the NSF Graduate Research Fellowship Program (GRFP) [12]:

CHEMISTRY	**GEOSCIENCES**	**MATHEMATICAL SCIENCES**
Artificial Intelligence	Aeronomy	Algebra, Number Theory, and Combinatorics
Chemical Catalysis	Artificial Intelligence	Analysis
Chemical Measurement and Imaging	Arctic-Antarctic	Applied Mathematics
Chemical Structure, Dynamics, and Mechanism	Atmospheric Chemistry	Artificial Intelligence
Chemical Synthesis	Biogeochemistry	Biostatistics
Chemical Theory, Models and Computational Methods	Biological Oceanography	Computational and Data-enabled Science
Chemistry of Life Processes	Chemical Oceanography	Computational Mathematics
Computationally Intensive Research	Climate and Large-Scale Atmospheric Dynamics	Computational Statistics
Environmental Chemical Systems	Computationally Intensive Research	Computationally Intensive Research
Macromolecular, Supramolecular, and Nanochemistry	Geobiology	Geometric Analysis
Other (specify)	Geochemistry	Logic or Foundations of Mathematics
Quantum Information Science	Geodynamics	Mathematical Biology
Sustainable Chemistry	Geomorphology	Other (specify)
	Geophysics	Probability
COMPUTER AND INFORMATION SCIENCES & ENGINEERING	Glaciology	Quantum Information Science
Accessibility and Ethical Models and Impacts	Hydrology	Statistics
Algorithms and Theoretical Foundations	Magnetospheric Physics	Topology
Artificial Intelligence	Marine Biology	
Bioinformatics	Marine Geology and Geophysics	**PHYSICS & ASTRONOMY**
Communication and Information Theory	Other (specify)	Artificial Intelligence
Computationally Intensive Research	Paleoclimate	Astronomy and Astrophysics
Computer Architecture	Paleontology and Paleobiology	Atomic, Molecular and Optical Physics
Computer Security and Privacy	Petrology	Computationally Intensive Research
Computer Systems and Embedded Systems	Physical and Dynamic Meteorology	Condensed Matter Physics
Computer Vision, Graphics, and Visualization	Physical Oceanography	Nuclear Physics
Databases, Data Mining, Data Science, and Information Retrieval	Quantum Information Science	Other (specify)
Formal Methods, Verification, and Programming Languages	Sedimentary Geology	Particle Physics
Human Computer Interaction	Solar Physics	Physics of Living Systems
Information Sciences	Tectonics	Plasma Physics
Machine Learning		Quantum Information Science
Natural Language Processing	**LIFE SCIENCES**	Solid State Physics
Other (specify)	Artificial Intelligence	Theoretical Physics
Parallel, Distributed, and Cloud Computing	Biochemistry	
Quantum Information Science	Bioinformatics and Computational Biology	**PSYCHOLOGY**
Robotics	Biophysics	Artificial Intelligence
Scientific Computing	Cell Biology	Cognitive Neuroscience
Social Computing	Computationally Intensive Research	Cognitive Psychology
Software Engineering	Developmental Biology	Comparative Psychology
Wired and Wireless Networking	Ecology	Computational Psychology

	Environmental Biology	Computationally Intensive Research
ENGINEERING	Evolutionary Biology	Developmental Psychology
Aeronautical and Aerospace Engineering	Genetics	Industrial/Organizational Psychology
Artificial Intelligence	Genomics	Neuropsychology
Bioengineering	Microbial Biology	Other (specify)
Biomedical Engineering	Neurosciences	Perception and Psychophysics
Chemical Engineering	Organismal Biology	Personality and Individual Differences
Civil Engineering	Other (specify)	Physiological Psychology
Computationally Intensive Research	Physiology	Psycholinguistics
Computer Engineering	Proteomics	Quantitative Psychology
Electrical and Electronic Engineering	Quantum Information Science	Quantum Information Science
Energy Engineering	Structural Biology	Social/Affective Neuroscience
Environmental Engineering	Systematics and Biodiversity	Social Psychology
Industrial Engineering & Operations Research	Systems and Molecular Biology	
Manufacturing Engineering		**SOCIAL SCIENCES**
Materials Engineering	**MATERIALS RESEARCH**	Anthropology, other (specify)
Mechanical Engineering	Artificial Intelligence	Archaeology
Nuclear Engineering	Biomaterials	Artificial Intelligence
Ocean Engineering	Ceramics	Biological Anthropology
Optical Engineering	Chemistry of Materials	Communications
Other (specify)	Computationally Intensive Research	Computationally Intensive Research
Quantum Engineering	Electronic Materials	Cultural Anthropology
Quantum Information Science	Materials Theory	Decision Making and Risk Analysis
Systems Engineering	Metallic Materials	Economics
Wireless Engineering	Other (specify)	Geography
	Photonic Materials	History and Philosophy of Science
STEM EDUCATION AND LEARNING RESEARCH	Physics of Materials	International Relations
Artificial Intelligence	Polymers	Law and Social Science
Computationally Intensive Research	Quantum Information Science	Linguistic Anthropology
Engineering Education		Linguistics
Mathematics Education		Medical Anthropology
Other (specify)		Other (specify)
Quantum Information Science		Political Science
Science Education		Public Policy
Technology Education		Quantum Information Science
		Science Policy
		Sociology
		Urban and Regional Planning

Appendix B: List of disciplines eligible for STEM OPT extension [13,14]:

Primary (all 2 digit CIP codes)
Engineering (14)
Biological and Biomedical Sciences (26)
Mathematics and Statistics (27)
Physical Sciences (40)

Others (selected 6 digits CIP codes from these groups; detailed list available at [13], [14]**)**
Agricultural/Animal/Plant/Veterinary Science and Related Fields (01)
Natural Resources and Conservation (03)
Architecture and Related Services (04)
Communication, Journalism and Related Programs (09)
Communications Technologies/Technicians and Support Services (10)
Computer and Information Sciences and Support Services (11)
Education (13)
Engineering/Engineering Related Technologies/Technicians (15)
Military Science, Leadership and Operational Art (28)
Military Technologies and Applied Sciences (29)
Multi/Interdisciplinary Studies (30)
Science Technologies/Technicians (41)
Psychology (42)
Homeland Security, Law Enforcement, Firefighting and Related Protective Services (43)
Social Sciences (45)
Transportation and Materials Moving (49)
Health Professions and Related Programs (51)
Business, Management, Marketing and Related Support Services (52)