Now Hiring! Empirically Testing a Three-Step Intervention to Increase Faculty Gender Diversity in STEM

JESSI L. SMITH, IAN M. HANDLEY, ALEXANDER V. ZALE, SARA RUSHING, AND MARTHA A. POTVIN

Workforce homogeneity limits creativity, discovery, and job satisfaction; nonetheless, the vast majority of university faculty in science, technology, engineering, and mathematics (STEM) fields are men. We conducted a randomized and controlled three-step faculty search intervention based in self-determination theory aimed at increasing the number of women faculty in STEM at one US university where increasing diversity had historically proved elusive. Results show that the numbers of women candidates considered for and offered tenure-track positions were significantly higher in the intervention groups compared with those in controls. Searches in the intervention were 6.3 times more likely to make an offer to a woman candidate, and women who were made an offer were 5.8 times more likely to accept the offer from an intervention search. Although the focus was on increasing women faculty within STEM, the intervention can be adapted to other scientific and academic communities to advance diversity along any dimension.

Keywords: diversity, women in science, science education and policy, behavioral science

A homogenous university faculty limits student and faculty creativity, discovery, and satisfaction (Page 2007, Apfelbaum et al. 2014), whereas diversity in science furthers social justice, expands workforce talent, and increases objectivity (Intemann 2009). However, university faculty are largely homogenous on the salient dimension of gender, because the majority of faculty at all ranks worldwide are men, especially within science, technology, engineering, and mathematics (STEM) fields (NSB 2012, European Commission 2013). For example, 68% to 89% of all academic grade C to grade A STEM personnel in the EU are men, and 81% of tenure-track STEM faculty at US public and land grant universities are men (European Commission 2013, Oklahoma State University 2013). Therefore, increasing gender diversity among STEM faculty is one straightforward way to enhance science education and scientific research innovation.

What is less straightforward are the reasons why STEM fields are male dominated and what can be done to enhance diversity. There is a tendency to blame "the pipeline" because few women candidates populate STEM-faculty search pools. It is true that fewer and fewer women advance at every transition point from secondary school to college to graduate study such that proportionally fewer women are qualified for STEM faculty positions than men (McCook 2011, NSB 2012). However, social psychological factors, such as implicit gender biases among university faculty and administrators that favor men in STEM, may inadvertently perpetuate homogeneity (Moss-Racusin et al. 2012, Shen 2013). Fortunately, educational programs could potentially actively counter this bias. What is more, search committees typically do not understand how to recruit and attract diverse candidates. For example, many assume that the competition for diverse candidates is fierce among institutions and therefore do not undertake efforts to broaden the pool of applicants. This scenario is consistent with social-judgment biases such as the false-consensus effect (Ross 1977), which occurs when people overestimate the extent to which others believe as they do. As a case in point, only 29% of white women who had won prestigious fellowships in the United States (Ford, Mellon, or Spencer fellows) received multiple tenure-track job offers for positions they desired; the majority of these women (71%) did not receive multiple offers or had limited choices among less than ideal offers (Smith DG et al. 1996). Acquiescence that universities cannot diversify their faculty is a form of system justification that ultimately maintains the homogenous status quo (Jost et al. 2004). Offering search committees concrete best-practice techniques to address these psychological considerations could potentially enhance diversity. Finally, search committees must understand that partner accommodations and other work–life integration

BioScience 65: 1084–1087.
doi:10.1093/biosci/biv138 Advance Access publication 10 October 2015

issues are central to recruiting women, because 83% of women scientists in academia have partners also in academic science (Schiebinger et al. 2008, Moors et al. 2014).

We designed an intervention to overcome these challenges. As Timothy Wilson noted in his 2006 *Science* article on the power of social psychological interventions, "Brief theory-based interventions that focus on people's construals can reap large benefits" (Wilson 2006). Intervening in the faculty search process is therefore one potential way to enhance the representation of women STEM faculty at an institution. Past intervention efforts to enhance gender diversity in academia focused mostly on the pipeline issue by supporting women students to perform well in, pursue, and persist in STEM (Hullerman and Harackiewicz 2009, Miyake et al. 2010, Moss-Racusin et al. 2012, Smith JL et al. 2013). One notable exception was a detailed case study of an ecology faculty search employing intuitive (albeit effort-intensive) gender-blind applicant tracking that achieved partial success (Jones and Urban 2013). Theory-driven, randomized control trials aimed at enhancing diversity are relatively rare in intervention research (Moss-Racusin et al. 2014), and few studies on the search process include faculty as participants (e.g., Stewart et al. 2004, Carnes et al. 2012, Fine et al. 2014). We designed and empirically tested an intervention guided by the tenets of self-determination theory (Deci and Ryan 2000) aimed at enhancing the recruitment processes for multiple and varied STEM-faculty search committees.

Self-determination theory (Deci and Ryan 1985, 2000) proposes that creativity, motivation, and performance thrive when three particular psychological needs are satisfied: to engage in opportunities for learning and mastery (*competency*), to have flexibility and control over processes and outcomes (*autonomy*), and to make meaningful connections with others (*relatedness*). Informed by this theory, we designed a three-step faculty search intervention to supplement the mandatory human resources (HR) training that would (1) enhance the *competence* of the search committee by delivering concrete strategies for conducting a broad applicant search in the form of a printed "faculty search toolkit," (2) enhance the *autonomy* of the search committee by showing them how to gain better control over possible unintentional biases in their decisionmaking through a 30-minute oral presentation by a faculty member on the role of implicit gender bias in skewing the candidate-screening and interview processes, and (3) enhance the *relatedness* of the search process more generally by both connecting the search committee with a peer faculty member who was supportive during the entire search process and by specifically connecting job finalists with a faculty "family advocate" totally independent from the search for a confidential 15-minute conversation. The faculty family advocate meetings were designed to meet all Equal Employment Opportunity rules by including all finalists, providing an overview of policies and practices without inquiring directly about a candidate's marital or family status, and maintaining the confidentiality of any information shared through the discussion of work–life related questions. Family-advocate conversations were in no way communicated to the search committee nor had any bearing on the hiring decision.

The search committees in the *no-intervention* (status-quo) condition received only the mandatory HR training. This brief in-person training was conducted by an assigned staff member from HR. The HR staff person provided a packet of handouts that outlined compliance issues (e.g., must have at least two people on every phone reference check) and procedure issues (e.g., how to submit paperwork for the web-posting of the vacancy advertisement). The HR training did include a brief overview of antidiscrimination law, including a handout with a list of protected classes and a list of questions committees were not allowed to ask. The emphasis on this part of the HR training was on avoiding discrimination lawsuits by treating everyone equally, akin to the colorblind or gender-blind notion that gender or race "should not and does not matter" (Neville et al. 2000, p. 60), which is limited (Bagenstos 2006) and may lead, however inadvertently, to greater bias (Richeson and Nussbaum 2004). More details on the intervention and no-intervention conditions, including the family advocate, are outlined in the supplemental method S1 section; materials and facilitator guides are also freely available at *www.montana.edu/nsfadvance/resources.html*.

Our hypothesis was that search committees randomly assigned to the intervention, compared with the no-intervention, as-usual search procedures, would have an increased number of women candidates considered for and offered tenure-track positions in STEM.

Methodology

Our experiment took place across a broad discipline of 23 STEM-faculty searches during one academic year at Montana State University (MSU), a Carnegie Foundation–ranked *Very High Research Activity* (VHR) university in the United States (see methods S1 for more details). At the time, the 235 STEM faculty at MSU were largely homogenous (81% men), making this a representative context that mirrored national faculty gender statistics (Oklahoma State University 2013) in which to test our intervention. Moreover, the rural setting of the university, its low salaries (lowest among the 102 VHR ranked universities; Curtis and Thornton 2014), and the lack of a medical school also posed recruitment challenges, allowing for a strong test of the intervention. Our research is the first to use STEM faculty as participants in a hypothesis-testing study on diversity faculty hiring.

Search committee chairs were identified and invited via email by a faculty peer to voluntarily participate in a supplemental training to coincide, if possible, with the mandatory human resource–search committee training, which all committees received (see supplemental methods and discussion S1). None refused to participate. The selection of a faculty peer to contact search committee chairs and to present the intervention material were intentional to increase participation (see discussion S1). Presenting material to each search committee separately ensured a small group setting meant to enhance engagement with the presentation.

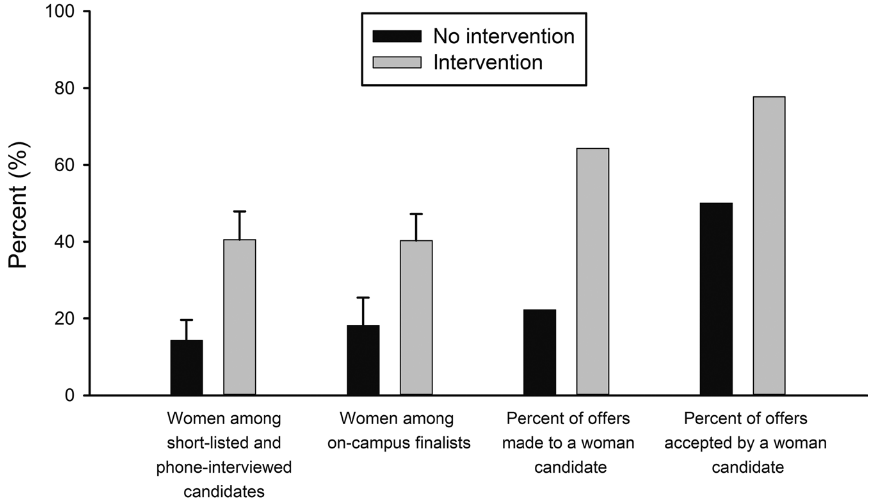

Figure 1. Mean percentages of women interviewed at two points in the science, technology, engineering, and mathematics (STEM) faculty search process and simple percentages of tenure-track job offers extended to and accepted by women, by intervention group. The error bars represent the standard error.

Results

The three-step intervention was successful. Among searches in the intervention condition, more applicants overall were short-listed and phone-interviewed (mean (*M*) = 9.5, standard error (SE) = 1.5) compared with those in the no-intervention condition (M = 4.7, SE = 1.3; Cohen's d = 0.99, $t(21)$ = 2.26, $p < .05$). Importantly, searches in the intervention condition phone-interviewed a significantly greater percentage of women applicants (M_{women} = 40.5%, SE = 7.4%) compared with searches in the no-intervention condition (M_{women} = 14.2%, SE = 5.4%; d = 1.16, $t(21)$ = 2.57, $p < .02$; figure 1), illustrating a large improvement in the representation of women on the short lists. Given that travel funding limits the number of finalists brought to campus for interviews in each search, no difference existed in the mean numbers of finalists brought to campus for interviews between searches in the intervention (M = 6.1, SE = 1.4) and no-intervention (M = 3.6, SE = 0.5; $p > .05$) groups. However, women made up a significantly greater percentage of on-campus interviewees for searches in the intervention group (M_{women} = 40.3%, SE = 6.9%) than in the no-intervention group (M_{women} = 18.2%, SE = 7.3%; d = 0.92, $t(21)$ = 2.12, $p < .05$), illustrating a large difference in the inclusion of women as finalists. Importantly, we ruled out alternative explanations and confirmed the effectiveness of our random assignment (see supplemental results and table S1).

Furthermore, 11 women were extended offers for tenure-track faculty positions—nine in the intervention condition and two in the no-intervention condition. Odds ratio statistics showed that a search in the intervention condition was 6.3 times more likely to make an offer to a woman candidate than a search in the no-intervention condition (d = 0.93; see figure 1). Moreover, women offered jobs were 5.8 times more likely to accept the offer from an intervention search (n = 7 accepted) than from a no-intervention search (n = 1 accepted; d = 0.80). The three-step intervention effectively increased the number of women hired as incoming STEM faculty at MSU. Subsequent application of our intervention to *all* STEM searches has continued this trend, with women representing precisely 50% of all STEM faculty hires with start dates in 2013–2014 academic year (n = 10 men and 10 women) and start dates in 2014–2015 academic year (n = 9 men and 9 women hired).

Conclusions

We tested a theory-derived three-step intervention that involved (1) a short presentation to search committees about overcoming the influence of unintentional (i.e., implicit) bias during the review process, (2) arming search committees with a guidebook on tactics for recruiting diverse candidates, and (3) providing access to a faculty family advocate who was unaffiliated with the search to confidentially discuss any work–life integration issues deemed appropriate by the candidates. The intervention measurably increased gender diversity among STEM faculty. Although the focus here was on increasing women faculty within STEM, the intervention can be adapted to other scientific and academic communities to advance diversity along any dimension.

Some pushback was experienced, as we expected, and a small number of male and female faculty expressed concerns that paying attention to gender diversity in STEM while conducting a faculty search was "lowering standards to fulfill a quota" (a sentiment that perfectly exemplifies gender bias). Indeed, a good next step would be to examine how faculty experience the intervention process itself (Moss-Racusin et al. 2014) versus the outcomes of the intervention as we reported here. For example, some faculty may believe that a focus on gender diversity is a form of reverse discrimination or that such a focus implies women are less competent and unable to make it on their own merits (Etzkowitz et al. 1994, Norton and Sommers 2011). Such mental frameworks probably have important ramifications for how people experience self-determination within what is perceived as a potentially threatening, high-stakes situation. Pushback notwithstanding, our brief three-step faculty search intervention was successful. We show that organizations can benefit from using psychological science to inform precise interventions. Although our data does not build on self-determination theory, it was inspired by and supports self-determination theory. Systematically testing theory through application can potentially contribute to theory-building in the future (e.g., Wilson 2006, Walton 2014). For example, future research could test which psychological need (competence, autonomy, or relatedness) was most essential to the success of the intervention and/or reveal the level at which it is important to foster psychological-need support, whether to the entire group (i.e., the search committee) or to an influential leader of the group (i.e., the search chair).

Worldwide, STEM funding agencies are investing heavily in diversifying the scientific workforce. As just two examples, the US National Science Foundation NSF ADVANCE-Institutional Transformation program and the European Commission genSET project have spent millions to bring about equality for women working in STEM. Our findings contribute to these important efforts. After all, a diverse faculty engenders social justice and betters the condition of underrepresented people working within STEM (Etzkowitz et al. 1994, Sekaquaptewa 2002). Diversity within STEM is essential for creating a thriving workplace and a learning environment replete with role models, diverse ways of thinking, and enhanced learning that elevates excellence and benefits scientific innovation, public health, and economic growth.

Acknowledgments

This research was supported by the National Science Foundation Grant no. 1208831. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. The Montana Cooperative Fishery Research Unit is jointly sponsored by the US Geological Survey; Montana Fish, Wildlife, and Parks; Montana State University; and the US Fish and Wildlife Service. We are grateful for the assistance of Kelli J. Klebe, Rebecca Belou, and Theresa Marchwick in particular and thankful for the support of the entire ADVANCE Project TRACS team. Portions of these data were also presented at the American Association for the Advancement of Science Conference in February 2015, in San Jose, California.

Supplemental material

The supplemental material is available online at *http://bioscience.oxfordjournals.org/lookup/suppl/doi:10.1093/biosci/biv138/-/DC1*

References cited

Apfelbaum EP, Phillips K, Richeson JA. 2014. Rethinking the baseline in diversity research: Should we be explaining the effects of homogeneity? Perspectives in Psychological Science 9: 235–244.

Bagenstos SR. 2006. The structural turn and the limits of antidiscrimination law. California Law Review 94: 1–47.

Carnes M, Devine PG, Isaac C, Manwell LB, Ford CE, Byars-Winston A, Fine E, Sheridan JT. 2012. Promoting institutional change through bias literacy. Journal of Diversity in Higher Education 5: 63–77. doi:10.1037/a0028128

Curtis JW, Thornton S. 2014. Losing Focus: The Annual Report on the Economic Status of the Profession, 2013–2014. American Association of University Professors. (9 September 2015; *www.aaup.org/sites/default/files/files/2014%20salary%20report/zreport_0.pdf*)

Deci EL, Ryan RM. 1985. Intrinsic Motivation and Self-determination in Human Behavior. Plenum Press.

———. 2000. The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. Psychological Inquiry 11: 227–268.

Etzkowitz H, Kemelgor C, Neuschatz M, Uzzi B, Alonzo J. 1994. The paradox of critical mass for women in science. Science 266: 51–54.

European Commission. 2013. She Figures 2012: Gender in Research and Innovation, Statistics and Indicators. Publications Office of the European Union. (9 September 2015; *http://ec.europa.eu/research/science-society/document_library/pdf_06/she-figures-2012_en.pdf*)

Fine E, Sheridan J, Carnes M, Handelsman J, Pribbenow C, Savoy J, Wendt A. 2014. Minimizing the influence of gender bias on the faculty search process. Pages 267–289 in Demos V, Berheide CW, Segal MT, eds. Gender Transformation in the Academy. (Advances in Gender Research, vol. 19). Emerald Group Publishing.

Hulleman CS, Harakiewicz JM. 2009. Promoting interest and performance in high school science classes. Science 326: 1410–1412.

Intemann K. 2009. Why diversity matters: Understanding and applying the diversity component of the National Science Foundation's Broader Impacts Criterion. Social Epistemology 23: 249–266.

Jones CS, Urban MC. 2013. Promise and pitfalls of a gender-blind faculty search. BioScience 63: 611–612.

Jost JT, Banaji M, Nosek BN. 2004. A decade of system justification theory: Accumulated evidence of conscious and unconscious bolstering of the status quo. Political Psychology 25: 881–919.

McCook A. 2011. Education: Rethinking PhDs. Nature 472: 280–282.

Miyake A, et al. 2010. Reducing the gender achievement gap in college science: A classroom study of values affirmation. Science 330: 1234–1237.

Moors AC, Malley JE, Stewart AJ. 2014. My family matters: Gender and perceived support for family commitments and satisfaction in academia among postdocs and faculty in STEMM and non-STEMM fields. Psychology of Women Quarterly 38: 460–474.

Moss-Racusin CA, Dovidio JF, Brescoll VL, Graham MJ, Handelsman J. 2012. Science faculty's subtle gender biases favor male students. Proceedings of the National Academy of Sciences 109: 16474–16479.

Moss-Racusin CA, et al. 2014. Scientific diversity interventions. Science 343: 615–616.

Neville HA, Lilly RL, Duran G, Lee R, Browne L. 2000. Construction and initial validation of the Color-Blind Racial Attitudes Scale (CoBRAS). Journal of Counseling Psychology 47: 59–70.

Norton MI, Sommers SR. 2011. Whites see racism as a zero-sum game that they are now losing. Perspectives in Psychological Science 6: 215–218.

[NSB] National Science Board. 2012. Science and Engineering Indicators 2012. National Science Foundation Report no. NSB 12-01. (9 September 2015; *www.nsf.gov/statistics/seind12/*)

Oklahoma State University. 2013. The 2012–2013 Faculty Distribution Survey of Selected Criteria. Office of Institutional Research and Information Management, Oklahoma State University.

Page SE. 2007. The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies. Princeton University Press.

Richeson JA, Nussbaum RJ. 2004. The impact of multiculturalism versus color-blindness on racial bias. Journal of Experimental Social Psychology 40: 417–423.

Ross L. 1977. The false consensus effect: An egocentric bias in social perception and attribution processes. Journal of Experimental Social Psychology 13: 279–301.

Schiebinger L, Henderson AD, Gilmartin SK. 2008. Dual-career academic couples: What universities need to know. Michelle R. Clayman Institute for Gender Research, Stanford University. (9 September 2015; *http://gender.stanford.edu/sites/default/files/DualCareerFinal_0.pdf*)

Sekaquaptewa D, Thompson M. 2002. The differential effects of solo status on members of high- and low-status groups. Personality and Social Psychology Bulletin 28: 694–707.

Shen H. 2910. Inequality quantified: Mind the gender gap. Nature 495: 22–24.

Smith DG, Wolf LE, Busenberg BE. 1996. Achieving Faculty Diversity: Debunking the Myths. Association of American Colleges and Universities.

Smith JL, Lewis KL, Hawthorne L, Hodges SD. 2013. When trying hard isn't natural: Women's belonging with and motivation for male-dominated STEM fields as a function of effort expenditure concerns. Personality and Social Psychology Bulletin 39: 131–143.

Stewart AJ, La Vaque-Manty D, Malley JE. 2004. Recruiting female faculty members in science and engineering: Preliminary evaluation of one intervention model. Journal of Women and Minorities in Science and Engineering 10: 361–375. doi:10.1615/JWomenMinorScienEng.v10.i4.50

Walton, G. M. The new science of wise psychological interventions. Current Directions in Psychological Science 23: 73–82.

Wilson T. 2006. The power of social psychological interventions. Science 313: 1251–1252.

Jessi L. Smith (jsismith@montana.edu) and Ian M. Handley are affiliated with the Department of Psychology at Montana State University, in Bozeman. Alexander V. Zale is affiliated with the US Geological Survey, the Montana Cooperative Fishery Research Unit, and the Department of Ecology at Montana State University, in Bozeman. Sara Rushing is affiliated with the Department of Political Science and Martha A. Potvin is with the Office of the Provost and the Department of Ecology at Montana State University, in Bozeman.