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Queer in STEM: Workplace Experiences Reported in a National Survey of LGBTQA Individuals in Science, Technology, Engineering, and Mathematics Careers

Jeremy B. Yoder, PhD[a] and Allison Mattheis, PhD[b]

[a]Department of Plant Biology, University of Minnesota, St. Paul, Minnesota, USA; [b]Division of Applied and Advanced Studies in Education, California State University, Los Angeles, Los Angeles, California, USA

ABSTRACT

A survey of individuals working in science, technology, engineering, and mathematics (STEM) fields who identify as lesbian, gay, bisexual, trans*, queer, or asexual (LGTBQA) was administered online in 2013. Participants completed a 58-item questionnaire to report their professional areas of expertise, levels of education, geographic location, and gender and sexual identities and rated their work and social communities as welcoming or hostile to queer identities. An analysis of 1,427 responses to this survey provided the first broad portrait of this population, and it revealed trends related to workplace practices that can inform efforts to improve queer inclusivity in STEM workplaces.

Introduction

Discussions about the role of science, technology, engineering, and mathematics (STEM) professionals in the United States often focus on these industries as key to maintaining the country's competitiveness on a global scale or the responsibility of educational institutions to prepare students for careers in these fields. Individual identity factors are often considered inconsequential or irrelevant to STEM professional achievement, but research suggests that being part of a marginalized or minoritized group can hamper job satisfaction, career success, and workplace productivity. Conversely, paying attention to the complex interplay of STEM professional norms and broader social group expectations can provide insight into how best to create supportive and welcoming spaces for researchers, scholars, and industry workers in these fields.

In this article we report results from the first broad national survey to focus on the experiences of advanced graduate students, postdoctoral scholars, academic faculty, researchers, and industry professionals in STEM fields

who identify as lesbian, gay, bisexual, trans*, queer, or asexual (LGBTQA). It is important to acknowledge that many different terms are used to describe people who identify as other than heterosexual or gender conforming. We choose to use the widely used *LGBTQA* as an admittedly imprecise umbrella term for a large range of identities, but one that captures a sense of the diversity of genders and sexualities of participants. When citing other authors, we use the terms included in their published works. We first contextualize this study relative to previous studies of LGBTQA populations in the United States and literature that discusses the significance of minority identity in STEM fields. Next, we provide an overview of the Queer in STEM study and report results of a national online survey exploring demographics and professional experiences of LGBTQA individuals working in STEM fields. Finally, we discuss the implications of our survey results for practice and propose directions for further research.

Study context

On average, about 3.5% of people in the United States identify as LGBT, a percentage that varies by state (Gates & Newport, 2013). Approximately eight million people in the nation's workforce identify as LGBT (Pizer, Sears, Mallory, & Hunter, 2012). Undeniably, LGBTQ individuals have gained legal and social protections at an increasing rate over the last several decades. In just the last four years, Congress ended the Don't Ask, Don't Tell policy that required LGBTQ individuals serving in the Armed Forces to remain "closeted"; 17 states enacted marriage equality for same-sex couples by legislative action, ballot initiative, or court decision; the U.S. Supreme Court ruled that the Federal government must recognize the marriages of same-sex couples and that state bans on legal recognition of same-sex marriages are unconstitutional; and the national Employment Non-Discrimination Act (ENDA) was passed by the Senate in a bipartisan vote (it has not yet passed in the House of Representatives). Polls also suggest that younger generations are increasingly knowledgeable of and tolerant toward nonbinary gender identities and a range of sexual orientations (Pew Research Center, 2013).

LGBTQA identit(ies) in the workplace

Even in the absence of direct hostility or discrimination, individuals who identify as LGBTQA work in environments that are marked by heteronormative assumptions that these identities do not exist in the present context or are abnormal. We borrow Rumens' (2014) definition of heteronormativity here:

the power relations, knowledge and institutions that sustain normative constructions of heterosexuality as 'natural' and privileged. Positioned as a cornerstone of the sex-gender system, one that insists on the duality of man/woman and masculine/feminine, and one in which particular heterosexual identities, norms, intimacies, and relationships to mention but a few are established as a normative standard. (p. 181)

Waldo (1999) used an understanding of "heterosexism" as "the normalizing and privileging of heterosexuality (rather than a fear of homosexuality)" (p. 218) to guide his investigation of how minority stress theory could describe GLB workplace experiences. We seek to position our work in conversation with other scholars who explore the "false dichotomies [of defining genders and sexualities] which cause problems for LGBT people at work" (Colgan & Rumens, 2014, p. 1). As much research in this area has discussed, the positioning of LGBTQ identities as "sexual orientations" reinforces binary understandings of sexuality and assumes heterosexuality (and heteronormative work environments) to be neutral (Ahmed, 2006, as applied in Colgan & Rumens, 2014). When we use this term, we keep in mind that this contested term refers to only one aspect of individual identity.

Despite increasingly progressive policies and widening social acceptance, LGBT employees may still encounter "differential treatment due to their sexual identity" even in ostensibly "gay-friendly" environments (Rumens & Kerfoot, 2009, p. 765). Studies exploring the impact of professional norms and workplace socialization have demonstrated ways in which heteronormative assumptions can increase pressure on LGBTQA individuals to downplay the importance of gender and sexual orientation in their personal lives or to hide their queer identities altogether. In contrast, higher rates of job satisfaction and lowered anxiety are reported by employees who disclose their identities at work (Griffith & Hebl, 2002), but in order to do so LGBTQA individuals must expect that their workplace is physically and psychologically safe. In describing a range of organizational responses to anti-discrimination ethics standards, Hill (2009) noted that despite progress toward greater inclusion, many individuals who identify as sexual minorities continued to experience workplace "invisibility, erasure, and silence, both self- and other-imposed" (p. 38). In a survey of LGBTQ nurses' experiences, Eliason, DeJoseph, Dibble, Deevey, and Chinn (2011) reported instances of homophobic behaviors and attitudes in medical settings, even though the majority of respondents rated their workplaces as LGBT-friendly. Mizzi (2013) introduced the term *heteroprofessionalism* to describe forces that discouraged gay men from expressing an identity seen as outside normal or acceptable professional standards in the field of international development work, while Rudoe (2010) described the ways in which lesbian teachers were engaged in constant navigation of identity and power in secondary school spaces influenced by both public and private constructions of "respectable" sexuality. In

addition to experiencing outright harassment, fear of discrimination can have a negative impact on LGBT employees in the workplace (Pizer et al., 2012). Welle and Button's (2004) review of research on workplace experiences of lesbian and gay employees reiterated the ways in which implicit bias, micro-aggressions, and fear of harassment can impact individuals' behaviors in the workplace and that organizations must take into account subtle messages and social context in addition to creating affirming formal practices and policies. Based on the changing landscape of social and employment policies related to LGBTQA individuals, more research is necessary to explore the workplace factors that promote or discourage inclusive behaviors and attitudes.

Issues of LGBTQA identit(ies) in STEM professions

Although by no means monolithic, there are enough similarities among the types of worldview and preparation expected of research and technical professionals in the sciences, engineering, and mathematics to constitute a widely identified group. However, there is a notable absence of broad scholarship focused on issues of LGBTQA identities in STEM professional workplaces. Studies exploring LGBTQA identities in particular STEM fields exist (see, e.g., Cech & Waidzunas, 2011; Riley, 2008), and a study of LGBQ faculty was recently published (Patridge, Barthelemy, & Rankin, 2014) that complemented earlier work done by Bilimoria and Stewart (2009), but none survey the STEM professions broadly. The study described in this article supports these efforts to open up this field of research and provides a large data set for comparison with other work.

Despite employment shifts over the last few decades, a broad stereotype of a White, male "scientist" exists in public perception (Nassar-McMillan, Wyer, Oliver-Hoyo, & Schneider, 2011), and correspondingly rigid expectations of gender and sexuality remain in many workplaces. The underrepresentation of women and racial and ethnic minorities in many fields further contributes to narrow constructions of what characterizes a "typical" STEM professional. In their review of factors contributing to women's success in STEM majors in college, Shapiro and Sax (2011) cited the "implicit and explicit messages about the masculine nature of math and science" as a persistent problem (p. 12). Fewer women are employed in physics, computer science, and engineering than in chemistry or biological sciences (National Science Board, 2014), a fact that also reinforces particular expectations of masculinity and can limit gender expression possibilities. Even fewer women from underrepresented minority groups (African Americans, Chicanas/Latinas, and Native Americans) have received advanced degrees and entered STEM careers; the additional challenges facing women of color is a situation scholars have referred to as a "double bind" (Ong, Wright, Espinosa, & Orfield, 2011).

Whitehead (2003) has built on the critiques of feminist scholars of "professionalism" itself in his efforts to trouble the assumptions of masculinity present in conceptualizations of "good managers," while Rhoton (2011) showed that gendered expectations in STEM fields can be reinforced by women policing other women's behaviors and maintaining pressure to adopt masculinized ideals of behavior and thinking. In a study heavily discussed in popular media as well as research circles, Moss-Racusin, Dovidio, Brescoll, Graham, and Handelsman (2012) found continued gender bias that privileged male candidates for a laboratory manager position in the hiring decisions of both male and female STEM faculty members. In her investigations of the gendered ways in which engineers navigate their workplaces and consider their roles, Faulkner (2009a, 2009b) found that the field tended to emphasize technical competence over communication skills and a separation of personal and professional lives. Such job expectations also contrast with stereotypically "female" jobs such as the "caring professions" (such as nursing and education) that prioritize relationship building and expect women to be empathetic and socially oriented. Due to links between misogyny and homophobia, gay men are also often stereotyped as effeminate and more "like women"—a further problematic way that binary assumptions of gender are asserted in public understanding. Calling for additional investigations into the ways in which these flawed expectations affect success in STEM fields, Cheryan, Siy, Vichayapai, Drury, and Kim's (2011) study of gendered behaviors in role modeling ends with a call to understand "when gender of role models matters and when STEM stereotypes have more of an influence" (p. 6).

In their study of LGB engineering students' experiences at "Gold University," Cech and Waidzunas (2011) built on Faulkner's (2000) application of the "technical/social dualism" in professional engineering workplaces. In addition to documenting heteronormativity in the university environment as a whole, they also demonstrated ways that the field of engineering (stereotypically dominated by White, heterosexual men) offered unique challenges to students whose identities did not align with the perceived stereotype of an "engineer" (Cech & Waidzunas, 2011). Those who "break the gender rules" can experience backlash in the workplace and increased pressure to conform to gendered expectations (Moss-Racusin, Phelan, & Rudman, 2010). Research on the experience of trans* individuals' experiences at work have complicated and elucidated the nuances of these gendered career expectations in a number of ways. Brown, Dashjian, Acosta, Mueller, Kizer, and Trangsrud (2012) found that transsexual women were more likely to pursue "female dominated" professions following their decision to physically transition. Dispenza, Watson, Chung, and Brack (2010) showed how female-to-male transgender individuals were subjected to explicit

discrimination as well as daily microaggressions from a variety of sources, including other LGBT people. Budge, Tebbe, and Howard (2010) highlighted that trans* individuals' processes of career decision-making was distinct from but intertwined with their decisions to transition. More expansively, Connell (2010) found transgender people's experience of "doing and undoing gender" in the workplace to offer unique insight into how to destabilize limited categorization of gender binary appropriate behavior.

Stereotypes that mistake gender expression for gender identity or that misalign sexual orientation with gender identity can also create stigma in the workplace. For example, a cisgender queer woman may be mistakenly assumed to be "straight" due to her feminine appearance, or a trans* man may "pass" and therefore be expected to engage in sexist stereotyping of his colleagues. Ragins (2008) referred to identities that are not readily apparent to the social groups with which individuals interact as "invisible stigmas" (p. 194) and explained how these stigmas are experienced and understood differently than discrimination based on external characteristics or publicly perceived identities. Schilt (2006) described how the experiences of female-to-male transsexuals positioned them in "outsider-within" roles and showed how White supremacist patriarchal expectations further affected their professional lives.

It is likely that socialization processes in STEM fields that encourage these professionals to assume "neutrality" of practices even within heavily gendered environments also translate into assumptions of tolerance for LGBTQA identities despite the existence of anti-discriminatory practices and policies. Research has demonstrated that women in male-dominated fields tend to deny that they have experienced gender bias, or to downplay its importance in their particular workplace even if they acknowledge it exists in the field more broadly (Rhoton, 2011). The same tendency to perceive one's own institution or setting as "friendly" while simultaneously describing situations of outright harassment appears to exist for LGBTQ individuals as well (see, e.g., Eliason, DeJoseph, Dibble, Deevey, & Chinn, 2011). The lack of attention paid to issues of gender and sexuality in many STEM workplaces contributes to the invisibility—and resulting exclusion—of many identities in these fields more broadly. Although social justice scholars have discussed the ways in which various "-isms" and discriminatory forces in society overlap and intersect to affect members of multiple minority categories in complex ways, many STEM professional organizations pay little attention to issues of diversity beyond a superficial understanding of the word. Hackman (2012) and others have pointed out that oppression of LGBTQ identities is, in fact, interdependent with other forms of oppression such as sexism and racism. Several studies of how gender and sexual minority identities are managed have applied models borrowed from multicultural research on how racial and ethnic minorities experience stigma and discrimination. Documenting

specific examples of ways that queer STEM professionals experience their workplaces is therefore essential in order to determine what types of policies and practices predict safer, welcoming environments for LGBTQA identities and to identify those that tacitly or explicitly discourage these professionals from disclosing information about their identities.

Overview of research questions and data collection approaches

This study used an interdisciplinary, mixed methods approach to data collection informed by queer theory and sociocultural approaches to individual and group identity development. In conceptualizing this project, we have drawn on our strengths and experiences as queer individuals and researchers as well as consideration of the resources available and the goals of the study. Such an approach is well suited to the pragmatic underpinnings of mixed methods research that combines both quantitative and qualitative approaches to data collection and analysis (see Johnson & Onwuegbuzie, 2004; Teddlie & Tashakkori, 2011). As co-investigators we overlap in our interest in the consequences and effects of openly identifying as queer in the workplace but bring expertise from different fields of thought and study. Jeremy Yoder is an evolutionary ecologist studying the genetics of adaptation using field studies and genomic datasets, while Allison Mattheis uses ethnographically informed approaches to investigate diversity and equity issues in educational policy and practice (and is a former secondary school STEM educator). Combining our familiarity with different research methods to best address the questions at the heart of this study is also aided by the addition of an explicitly transformative theoretical lens.

We choose a broadly defined *queer theory* approach that seeks to disrupt heteronormative and binary assumptions about gender and sexuality and attends to intersectional aspects of identity with the goal of promoting inclusive practice. Borrowing from Pinar's (1998) classic volume on queer theory in education, such an approach attempts to "find ways to decenter and destabilize the heterosexual normalization that so constructs...the public world we inhabit" (p. 6). Used as an umbrella term for a "diverse, often conflicting set of interdisciplinary approaches," it can also be used to embrace a fluidity of identity that emphasizes temporal and social contexts (Giffney, 2009, p. 2). The results reported in this article are based on over 1,400 responses to an online survey, the first phase of data collection and analysis for the overall study, which also included 150 open-response questionnaires completed by e-mail and 60 one-on-one interviews conducted by phone or online video conference. The overall research question guiding the study was: How do queer-identified individuals studying and working in STEM fields experience their professional environments? In this article we explore differences and similarities across fields and contexts and provide a portrait of respondents.

Methods

As a point of entry into LGBTQA experiences in STEM workplaces, we asked study participants to describe how open they were about their identities in personal, professional, and classroom settings. Previous research has documented the need to understand how workers "manage" minority gender and sexual identities in their places of employment and how this affects job satisfaction and productivity (Anderson, Croteau, Chung, & DiStefano, 2001; Brewster, Velez, DeBlaere, & Moradi, 2012; Chrobot-Mason, Button, & DiClementi, 2001; Lyons, Brenner, & Fassinger, 2005; Shih, Young, & Bucher, 2013). Croteau, Anderson, and VanderWal's (2008) comparison of different models that have been used to examine how workers choose to manage or disclose sexual identities emphasized the need for research in this area to integrate understandings of how individuals' personal understandings affect their perceptions with analyses and observation of organizational behaviors and practices. A large body of research has found that concealing a stigmatized sexual identity is a substantial source of stress, associated with higher rates of anxiety, depression, and other negative health outcomes (Chung, 2001; Huebner & Davis, 2007; Meyer, 1995, 2003; Pachankis, 2007; Ragins, Singh, & Cornwell, 2007; Ullrich Lutgendorf, & Stapleton, 2003) and job dissatisfaction (Ragins & Cornwell, 2001). In classroom settings, LGBTQA individuals may also fear a loss of perceived professorial authority if they disclose their identities to students (Russ, Simonds, & Hunt, 2002). Conversely, GLB individuals are more likely to disclose their identities to coworkers if they perceive those coworkers, and their supervisors, to be supportive of those identities (Ragins et al., 2007); and gay men and lesbians who are out in the workplace are more productive, have more positive attitudes toward their workplaces, and report greater commitment to their work (Day & Schoenrade, 1997; Human Rights Campaign Foundation, 2014). Therefore, the degree to which study participants reported disclosing their identities in workplace and classroom settings provides a proxy for their comfort in those settings and a standard of comparison among different STEM fields of expertise and workplaces. Specifically, we tested the following hypotheses:

(1) Based on prior research of LGBTQA experiences in the workplace, we hypothesized that STEM workplaces present a uniquely stressful environment. We predicted that study participants would report being less open about their LGBTQA identities with colleagues and students than with friends or family.

(2) We hypothesized that cultural differences between academic and non-academic workplaces would lead to differing experiences for LGBTQA professionals, and we predicted that participants in academic versus

nonacademic workplaces would report different degrees of openness. However, we had no a priori expectation as to which group would report greater openness.

(3) Because STEM careers are associated with masculinity, we hypothesized that the experiences of LGBTQA professionals, whose identities violate masculine gender norms, would have workplace experiences that resonate with those of straight women—so that better representation of women within a STEM field of expertise would be associated with better climate for LGBTQA individuals as well. This led us to predict that participants in STEM fields with better representation of women would report greater openness.

(4) Finally, we hypothesized that openness in the workplace would reflect participants' degree of comfort. We predicted that participants who described their workplaces as safe and welcoming and who said their employers provided specific support for LGBTQA employees would be more likely to be open about their identities in workplace and classroom settings.

Data collection

Drafting of items for the survey began in February 2013 and involved multiple rounds of revision and review. In order to compare the eventual results with existing data sets, we included options drawn from other sources: geographic regions followed the U.S. Census categories from 2010, lists of STEM career fields were drawn from a variety of professional organizations, and gender and sexual identity terminology were selected following a review of previous surveys and reports about queer identity broadly and LGBTQA issues in workplaces and higher education settings more specifically.

We finalized the wording of the survey following pilot testing with representative respondents and review by outside readers in March 2013. The final survey included 58 items, in six sections covering participants' fields of STEM expertise, current positions of employment and educational and career progress, current and past locations of residence, gender identities and sexual orientations, experiences in personal and social contexts relative to their LGBTQA identities, and experiences in professional and academic contexts relative to their LGBTQA identities. A final set of optional demographic questions asked participants to report their age, income, and race or ethnicity. We received approval from the University of Minnesota Institutional Review Board in April, and we opened the survey on the study Web site on May 7, 2013. We made minor adjustments in wording to two items on June 1, and we closed the survey on July 31, 2013.

Participant recruitment

A participant nomination or "snowball" sampling strategy was used to recruit LGBTQA-identified persons working in STEM careers as survey respondents. Such an approach relies on an initial pool of contacts to nominate other participants who meet the criteria for a study (Morgan, 2008). This sampling strategy can successfully reach specific target groups that may not be easily reached by random selection of participants (see Browne, 2005), although potential bias created by respondent social networks can reduce the statistical power in the resulting sample (Salganik, 2006). The survey was built using the Survey Monkey tool (surveymonkey.com) and located at the study Web site (queerstem.org). Participants followed a link to a landing page that introduced the study and its goals and provided informed consent information (a PDF file containing the IRB-approved consent form with institutional information was available for download, and the text was posted online). In keeping with Riggle, Rostosky, and Reedy's (2005) suggestions about online research with BGLT populations, the survey was posted on a public Web site and accessible without direct contact with the researchers in order to create a greater sense of anonymity and safety for participants.

The survey link was disseminated using the online social networks Twitter (www.twitter.com), Facebook (www.facebook.com), and Google+ (plus.google.com); via groups for LGBTQA science professionals on the LinkedIn network (www.linkedin.com); through the membership e-mail list of the National Organization of Gay and Lesbian Science and Technical Professionals (NOGLSTP); and on the e-mail listservs Ecolog-L (listserv.umd.edu/archives/ecolog-l.html) and EvolDir (evol.mcmaster.ca/evoldir.html), which serve ecologists and evolutionary biologists, respectively. We encouraged participants to forward the URL for the survey site to friends, colleagues, and additional Listservs that met the criteria of our target participant pool, and we provided links to do so via e-mail, Twitter, Facebook, Google+, and LinkedIn.

In the present work, we provide a portrait of respondents to the survey portion of the Queer in STEM study through a discussion of participants' self-reported fields of study, geographic context, and experiences in social and professional contexts. We asked participants to describe their sexual identities and orientations using two multiple-choice questions offering a range of common terms. To allow maximum flexibility in individuals' descriptions of their identities, participants could choose to select multiple terms (e.g., a participant could describe her orientation by selecting the options *lesbian, gay*, and *queer*), and we provided a follow-up question with space for an open-ended written response. The choice of gender and sexual identity terminology was subject to much debate among the researchers, the pilot-testers, and the study participants. Although we presented options in both the gender and sexual orientation categories, there was no

limit on number of options that could be selected, and an open-ended response option was included that allowed participants to write in words that better described their identities. We acknowledge the problematic nature of establishing categories using contentious terms (and that narrowing aspects of gender identity, gender expression, sexual and romantic attraction, and biological sex to two categories is limiting) but are satisfied with the range of identities represented in our final data set. Answers to questions about participants' identities were required, and we discarded any survey responses that failed to provide answers to them.

To test the specific hypotheses described above, we focus on results from the survey questions concerning the following.

Disclosure of LGBTQA identities in workplace and classroom settings

We asked participants to rate their openness about their LGBTQA identities to people they encounter in a variety of contexts, using a scale from 0 (*I am not out to anyone in this group*) to 5 (*As far as I'm aware, everyone in this group could know*), an approach comparable to prior studies (e.g., Human Rights Campaign Foundation, 2014; Patridge et al., 2014; Ragins et al., 2007). Following the broad manner in which queer theory is used as a conceptual framework in this study, "outness" here referenced those aspects of identity (gender identity or expression, sexuality and orientation) that were of personal importance to individual respondents. We asked participants to rate their openness to family, to friends, on online social networks, to coworkers or colleagues in the same department or division, to coworkers or colleagues in different departments or divisions, to undergraduate students, and to graduate students.

### Workplace climate and employer support for LGBTQA identities

In three multiple-choice questions, we asked participants to rate how safe and welcoming they perceived their workplaces to be and to describe the degree of support their employer provided for LGBTQ-specific needs. In the first question, participants rated their workplaces as "safe" or "unsafe," or said they were "not sure." In the second, participants selected options to indicate whether they felt their workplace was "welcoming" to LGBTQA individuals, whether they felt they were "treated the same" as their straight colleagues, whether they felt the workplace was "hostile," or if they were "not sure." Finally, participants indicated whether their employers provided "no support or benefits" to LGBTQ employees, "limited support," "support as good as that provided to straight employees," or that they "did not know" what support was provided.

To compare participant openness ratings to the representation of women within STEM fields of expertise (testing specific hypothesis 3), we used data reported in Appendix Table 3–13 of the National Science Board's (2014)

Science and Engineering Indicators report, which lists estimated counts of employed scientists and engineers by field of expertise and gender. We used these data to compile estimates of the proportion of women among employed scientists and engineers in the physical sciences, mathematics, life sciences, social sciences, engineering, earth sciences, and psychology.

Data analysis

We conducted all data processing and statistical analysis using the open-source analytic package R (version 3.1.1; R Core Team, 2014). We tested for differences in openness ratings among contexts (hypothesis 1) using one-tailed Wilcoxon sign-rank tests for differences in the medians of participants' openness scores in each context. The Wilcoxon sign-rank test is appropriate for comparison of medians in two groups of measurements, where the data do not conform to a normal, or Gaussian, distribution—as we found to be the case for the openness ratings (see Figure 1). We tested for differences in openness ratings between academics and nonacademics (hypothesis 2), different STEM fields (hypothesis 3), and differences in workplace descriptions (hypothesis 4) using Kruskal-Wallis rank sum tests for differences in median values among multiple groupings, which are also appropriate for highly non-normal data. As follow-up analysis, we also tested for differences in workplace descriptions given by academics and those given by non-academics using Pearson's χ^2 contingency table tests for count data. Because we tested the effects of multiple explanatory factors—workplace type, STEM field, workplace welcoming ratings, workplace safety ratings, and employer support for LGBTQA needs—we run the risk of observing false positive results with a greater probability than is reflected in the p value estimate from each individual test. We therefore employed a Bonferroni correction for multiple testing, under which we considered
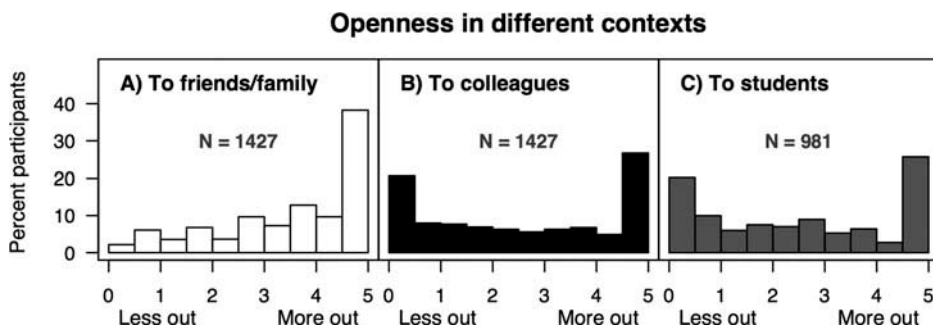
Figure 1. Histograms of participants' openness ratings in (A) personal contexts, (B) to colleagues, and (C) to students. Note that only participants working in degree-granting institutions (academics) are included in panel C.

differences among group medians to be statistically significant only if the estimated p value was less than .01, and we report p values below this cutoff to a precision of four decimal places.

Results and discussion

We received a total of 1,907 responses to the online survey. For analysis, we included only data from complete responses by participants who indicated their current primary occupation as one other than student at the undergraduate level. This left 1,427 responses for analysis.

Participant demographics

Responses were recorded from every U.S. Census Bureau region, with the largest numbers in the Pacific West followed by the East North Central and South Atlantic (see Table 1). Locations outside the United States were reported by 175 participants, mostly in English-speaking countries including Canada, Great Britain, and Australia. The number of participants in each Census Bureau region was positively correlated with the U.S. Census estimate of total population in 2012 (Pearson's $r = 0.66$, $p = .05$; U.S. Census Bureau, 2012), and with LGBTQ population in each region ($r = 0.78$, $p = .01$), calculated based on the percentage of respondents identifying as LGBT in a recent national survey (Gates & Newport, 2013). This suggests that our participant-driven sample approximates the geographic distribution we might have expected from a truly random sample. Most participants lived in larger cities: 74% reported that they lived in a community with 100,000 or more residents, and more than one quarter lived in a community of 1 million residents or more. Eighty-five percent of participants identified as White; while this is not reflective of the overall population of the United States, it is consistent with the disproportionate number of White people receiving advanced degrees and accessing professional networks in STEM fields (National Science Board, 2014).

Participant age and educational attainment

Responses to questions regarding age and educational attainment show that our participant pool skews young and highly educated. Well over one half of respondents (58%) were between 20 and 29 years old, and more than one quarter (27%) were between 30 and 39 years old. Almost one half of respondents (52%) indicated that they were either currently PhD students or had completed PhD degrees. Another 21% were master's students or had completed master's degrees. All together, 77% of participants were in the process of earning or had completed postgraduate degrees.

Table 1. Study participants by geographic location and size of towns of residence.

Location[a]	Community size					
	<9,999	10 k to 99,999	100 k to 499,999	500 k to 999,999	>1 million	Totals (%)
East North Central (WI, MI, IL, IN, OH)	6	44	75	12	64	201 (14%)
East South Central (KY, TN, MS, AL)	2	8	8	5	1	24 (2%)
Mid-Atlantic (NY, PA, NJ)	9	47	38	7	49	150 (11%)
Mountain West (ID, MT, WY, UT, CO, AZ, NM)	5	21	27	21	14	88 (6%)
New England (ME, NH, VT, MA, RI, CT)	11	42	27	39	24	143 (10%)
Pacific West (AK, WA, OR, CA, HI)	10	75	55	77	88	305 (21%)
South Atlantic (DE, MD, DC, VA, WV)	4	49	50	42	35	180 (13%)
West North Central (MO, ND, SD, NE, KS, MN, IA)	1	15	40	13	32	101 (7%)
West South Central (OK, TX, AR, LA)	0	9	13	23	15	60 (4%)
Outside U.S.	4	14	55	30	72	175 (12%)
Totals (%)	52 (4%)	324 (23%)	388 (27%)	269 (19%)	394 (28%)	1,427

[a]Locations correspond to U.S. Census Bureau regions.

Participant career types and fields of expertise

The largest single group of participants worked in the life sciences (42% of total), followed by engineering (21%), physical sciences (15%), Earth sciences (7%), mathematics (6%), social sciences (4%), and psychology (3%). A majority of respondents (69%) worked at degree-granting educational institutions; in further analyses we refer to these participants as *academics*. The representation of different STEM fields was broadly similar among academics and nonacademics, but the largest number of academics reported working in the life sciences, while the largest group of nonacademics worked in engineering.

Participant gender identities and sexual orientations

Almost one half of participants identified as female (48%); 44% identified as male, 7% as trans*, 4% as androgynous, and 9% as genderqueer (see Table 2). Just over 11% of participants selected more than one of these gender identity terms. That the largest group of participants identified as female may be surprising given the general underrepresentation of women

Table 2. Gender identities and sexual orientations reported by participants.

Orientation	Gender identity					Totals (%)[a]
	Female	Male	Trans*	Androgynous	Genderqueer	
Gay	62	512	12	12	13	576 (40%)
Lesbian	301	1	17	21	27	315 (22%)
Bi	247	70	23	13	41	334 (23%)
Queer	214	76	57	32	93	345 (24%)
Questioning	23	14	2	3	7	38 (3%)
Straight	41	30	10	0	4	76 (5%)
Asexual	43	17	11	10	12	71 (5%)
Other terms[b]	44	17	26	5	26	66 (5%)
Totals (%)	697 (48%)	630 (44%)	98 (7%)	54 (4%)	124 (9%)	

[a]Because respondents were able to choose multiple categories, totals are not summed from columns and rows; they represent the total number of participants selecting the given term.
[b]Common additional terms provided in the open-response portion of this survey item included poly (amorous), non-monogamous, pansexual, and, for many trans* participants, indication of pre- or post-op status.

in scientific careers (Larivière, Ni, Gingras, Cronin, & Sugimoto, 2013; Moss-Racusin et al., 2012; National Science Board, 2014); however, as noted above, participants were mostly younger than 40 years old, many were in the process of earning postgraduate degrees, and the single largest group worked in life sciences—all factors associated with greater representation of women in the broader U.S. STEM workforce (National Science Board, 2014).

Forty percent of participants selected *gay* from the list of sexual orientation terms, 22% selected *lesbian*, and 23% selected *bisexual*. The term *queer* was selected by 24% of respondents as their only orientation response; over one half of those who chose *queer* also selected at least one other orientation term. Overall, 16% of participants selected more than one sexual orientation term, and 5% wrote in responses to the open-ended question; the most frequent orientation terms provided in these written answers included *poly(amorous), non-monogamous*, and *pansexual*.

Participant experiences

Openness about gender and sexual identity

Participants' openness ratings were strongly and positively correlated across contexts—that is, participants who were entirely open in one context were more likely to be entirely open in other contexts as well (see Table 3). For subsequent analysis of differences in openness across contexts, we collapsed the openness ratings into three broader categories: (1) "personal," the mean of each participant's openness ratings for family, friends, and online social networks; (2) "colleagues," the mean of ratings for colleagues in the same and

Table 3. Correlations among outness ratings for different contexts[a].

Degree of Outness to …	Family	Friends	Online social networks	Colleagues (same div.)	Colleagues (diff. div.)	Undergrad students	Grad students
			Correlation with degree of outness to …				
Family	–	0.61	0.54	0.61	0.57	0.44	0.47
Friends		–	0.62	0.67	0.63	0.53	0.58
Online social networks			–	0.61	0.61	0.56	0.56
Colleagues, same division				–	0.88	0.67	0.74
Colleagues, diff. division					–	0.71	0.76
Undergrad students						–	0.78
Grad students							–

[a]Spearman rank correlation, scaling from 0 (*no relationship*) to 1 (*complete correlation*). All estimates are greater than expected by chance with $p < .001$.

different departments or divisions; and (3) "students," the mean of ratings for undergraduate and graduate students.

Consistent with hypothesis 1, participants reported a significantly greater degree of openness in personal contexts than either to colleagues or to students (see Figure 1). Participants' median openness rating for personal contexts was greater than their median openness rating for either colleagues or students (Wilcoxon sign-rank tests, $p < .0001$ for both comparisons); the difference between outness ratings for colleagues and for students was no greater than expected by chance ($p = .23$). In personal contexts, participants were most likely to be entirely open about their identities, with 54% having an openness rating of 4 or more on our 0–5 scale, and only 8% had ratings of 1 or less; this is consistent with results from other recent studies of LGBTQ Americans (Human Rights Campaign Foundation, 2014; Pew Research Center, 2013). With colleagues and students, however, substantial groups of participants said that they were not out at all. For colleagues, 29% of participants had openness ratings of 1 or lower; and for students, 30% had ratings of 1 or lower.

Out of all survey participants, 43% rated their openness to colleagues on our scale as 0 (*no one in this group knows*), 1 (*a few people in this group know*), or 2 (*less than half of people in this group know*). For comparison, 53% of participants in a recent survey by the Human Rights Campaign Foundation (2014) reported being only "open to a few" or "not open to any" of their coworkers. This may suggest that participants in our survey of STEM professionals are somewhat more likely to be out to their coworkers than participants in the broader workforce sample surveyed by the Human Rights Campaign Foundation—though we note that our slightly different rating scale makes precise comparison difficult.

Workplace type and STEM field

Contrary to our hypothesis 2, there was no greater difference than expected by chance in academics' openness to colleagues versus nonacademics' openness (Kruskal-Wallis rank sum p = .02). Participants' openness in personal contexts did not differ significantly among different STEM fields (p = .07). However, in confirmation of hypothesis 3, participants' openness to colleagues differed significantly among STEM fields (p = .0018), as did openness to students (p = .0090). Examination of outness ratings across the personal, workplace, and community contexts sorted by field reveals that personal outness ratings are generally high across all fields (see Figure 2). Participants working in Earth sciences, engineering, mathematics, and psychology reported being less out to colleagues, and participants working in the life sciences, physical sciences, and social sciences reported being more out.

Across all the STEM fields we examined, there was a positive correlation between the percentage of scientists or engineers in that field who were women, as estimated from the National Science Board (2014) data, and participants' median rating of openness to colleagues (Figure 3), which supports our hypothesis 3. However, a linear regression predicting median openness to colleagues did not explain more variation than expected by chance (p = .31; solid line in Figure 3). On inspecting the data, we observed that participants in one field, psychology, had much lower openness (median rating of 2.5) than expected based on its gender ratio (69.6% women). We speculated that professional standards of nondisclosure in this field may make openness about LGBTQA identity less likely, independent of the effects of workplace climate. We therefore fitted a second regression with data from psychology excluded—this
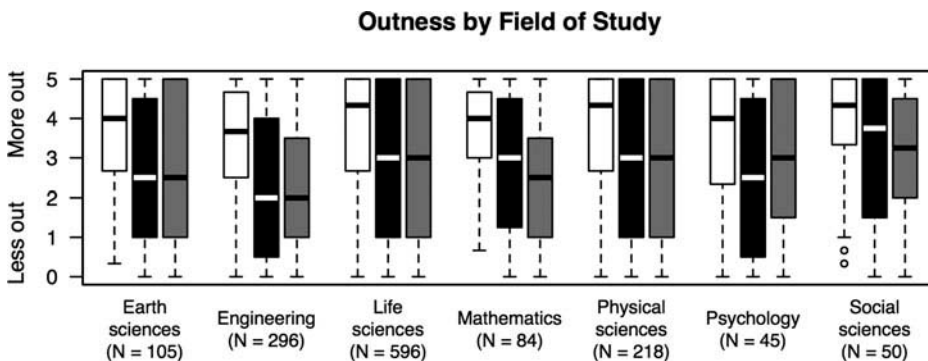
Figure 2. Box-and-whisker plots of participants' openness ratings for personal contexts (white boxes), to colleagues (black boxes), and to students (gray boxes), broken down by participants' fields of STEM expertise.
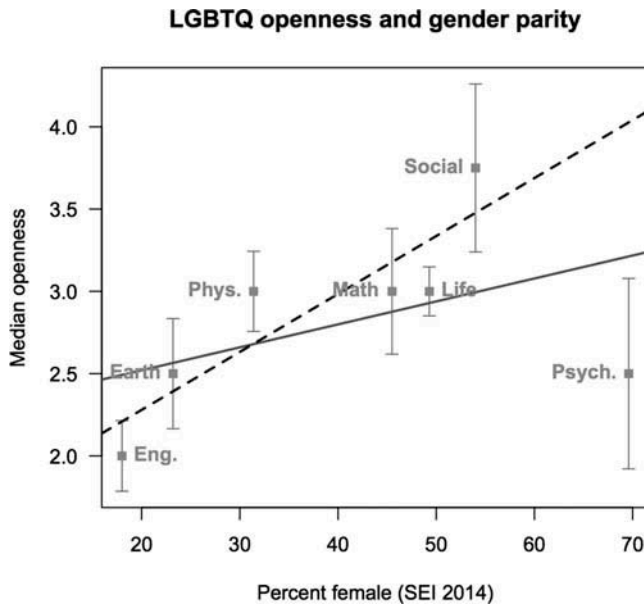
Figure 3. Across major STEM fields of expertise, the relationship between proportion of employed scientists and engineers who are women and participants' median (±95% confidence interval) rating of openness to colleagues. A regression across all points is nonsignificant with $p = .31$ (solid line). However, a regression excluding data from psychology, in which professional standards may prevent openness independent of workplace climate, is significant with $p = 0.02$ (dashed line).

found a significant relationship between gender parity and participants' openness to colleagues ($p = .02$; dashed line in Figure 3).

Workplace experiences

We found that participants' descriptions of their workplaces were closely related to how open they were to colleagues and students (see Figure 4). An overwhelming majority of participants rated their workplaces as safe for LGBTQA people (92%), and most either described their workplaces as "welcoming" (40%) or said they were "treated the same" as their straight colleagues (45%). Consistent with hypothesis 4, whether participants rated their workplaces as welcoming and safe showed a strongly significant association with their openness to colleagues and to students (Kruskal-Wallis rank sum $p < .0001$ in all cases).

This result corroborates prior research, which has found that LGB individuals are more likely to disclose their orientation or identity in the workplace if they perceive their coworkers to be supportive of LGB identities, and if their employer enacts and enforces policies in supportive of those identities (Clair, Beatty, & Maclean, 2005; Ragins et al., 2007). However, it is in direct contradiction to the results of prior work most similar to our study, in which
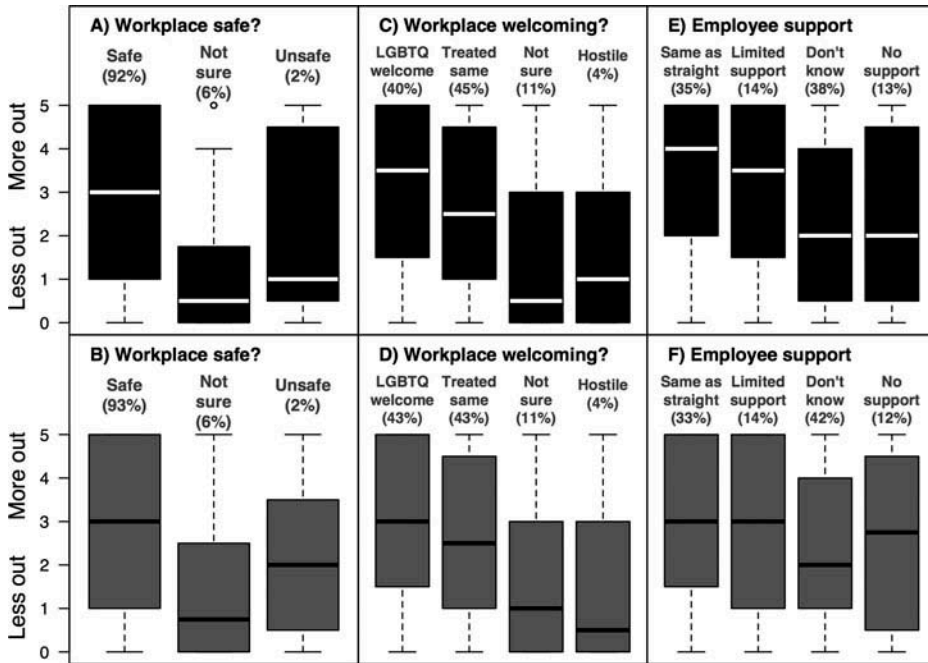
Figure 4. Box-and-whisker plots of participants' openness ratings for colleagues (top row) and for students (bottom row), in relation to their descriptions of the safety (A, B), welcoming climate (C, D) and their employers' support for LGBTQ needs (E, F).

Patridge et al. (2014) found that lesbian and gay STEM faculty who were out to their colleagues were more likely to describe their home departments as "uncomfortable" than STEM faculty who were not out. Multiple differences between the data set analyzed by Patridge and colleagues and our own may explain this disparity. First, Patridge and colleagues reanalyzed results from a 2010 survey (Rankin, Weber, Blumenfield, & Frazer, 2010), so the differences in our results may reflect 3 years of progress in conditions for LGBTQA individuals. Second, the earlier study considers survey responses from just 133 academic faculty members in (as the authors identify them) STEM or social science fields—so the difference may be due to the stochastic effects of small sample size. Finally, Patridge and colleagues considered only faculty members, while our survey included graduate students and nonacademic professionals. This concentration on individuals at later career stages may explain some of the difference from our results. Among our participants, we found that openness in all contexts differed strongly with age (Kruskal-Wallis rank sum $p < .0001$), and that older participants were consistently less open. However, we also found that early career academics (postdoctoral researchers, medical residents, laboratory technicians or managers; $N = 182$) reported lower openness to colleagues (median rating = 3) than survey participants at later career stages (assistant, associate, and full professors, or emeritus/

retired; $N = 132$; median rating = 4.5). Overall, the participants in the study of Patridge and colleagues reported a much lower degree of openness than participants in our study: 14% were completely out in professional contexts, compared to 38% of our participants who described their openness to colleagues with ratings of 4 or greater. We can only conclude that the contrasts between our results and those of this prior study highlight the need to carefully consider what populations may be reached by different survey recruitment methods.

Despite the seemingly positive ratings of workplaces by participants in our study, evidence of what these respondents' workplaces did to create such climates was mixed. Participants' descriptions of institutional support for LGBTQA employees at their workplaces varied more than their descriptions of workplace climate. The largest single group of participants, 38%, selected the option indicating they "did not know" whether their employers provided support specific to LGBTQA needs. Almost as many, 35%, reported support "as good as that provided for straight employees," while 14% reported "limited support." Finally, 13% reported their employers provide "no support" for LGBTQA-specific needs. Participants' openness ratings for colleagues and students differed significantly based on their descriptions of employer support ($p < .0001$ in both cases), which is further consistent with our hypothesis 4.

Academics were significantly more likely than nonacademics to say that they did not know what support their employers provided for LGBTQA employees: 42% of academics versus 29% nonacademics; $\chi^2(3, N = 1,427) = 24.62, p < .0001$. A possible explanation for this result is the high proportion of graduate students among the academic participants (53% of academics were MA, MSci, MD, JD, or PhD students, versus 8% of nonacademics), as students may be less aware of or have different access to same-sex partner benefits or trans*-specific health insurance coverage than faculty or staff members. Indeed, participants who were currently working on degrees were more likely to say they did not know what benefits or support their employers provided: 51% of that group selected "do not know" for this question, compared to 38% of all participants.

Conclusions and implications for research and practice

To understand how sexual orientation and gender identity interact with careers in science, technology, engineering, or mathematics, we surveyed 1,427 professionals working in STEM fields who identified as lesbian, gay, bisexual, trans*, queer, asexual, or other minority sexual orientations or gender identities. Participants answered an anonymous online survey describing their fields of expertise, career progress, orientation and identity, how they perceived the climate in their workplaces, and how open they were regarding their identity in professional contexts.

Participants were more likely to report that none of their professional colleagues knew their LGBTQA identity than they were to report not being "out" in personal contexts. However, a majority (57%; Figure 1) also reported that one half or more of their colleagues knew their LGBTQA identity, a somewhat larger proportion than found in a recent national survey across the entire U.S. workforce (47%; Human Rights Campaign Foundation, 2014). Participants working in STEM fields with better representation of women reported a higher degree of openness (Figure 3). Finally, those who reported a higher degree of openness in the workplace were more likely to describe their workplace as safe and welcoming and to say that their employers provided support or benefits specific to LGBTQA needs (see Figure 4).

The most important impact of this study to date is the documentation of the lived experiences of hundreds of individuals working in science, technology, engineering, and mathematics fields who identify as LGBTQA. By increasing visibility in the broader professional community, mentoring of students and early career scholars can be encouraged and existing networks of support reinforced. The LGBT+ Physicists advocacy group released a "Best Practices Guide" for academic physics departments in 2013 that calls for efforts to improve climate in the present and future. Suggestions include using gender-neutral and inclusive language, inviting LGBT+ speakers to campus, and joining "Out Lists" as an LGBT+ Physicist or Ally (LGBT+ Physicists, 2013). Our data support the importance of institutional and collegial support in providing welcoming climates for queer individuals across STEM fields, but organized efforts such as those by the LGBT+ Physicists continue to be limited in scope, and many STEM professional organizations are only now beginning to address diversity issues broadly. Further, the positive experiences reported by the majority of participants are encouraging but may mask those of individuals who have already self-selected out of the STEM career pipeline. Future research that investigates the role of "out" mentors in and out of academia and the development of broader "ally" trainings in professional settings is needed to help all promising STEM students achieve success in their fields.

A recent survey of workplace climate in the United States by the Human Rights Campaign Foundation (2014) provided a broader context for our study of experiences in STEM careers. That study found that more than one half (53%) of survey respondents reported being open about their LGBT identities with few or none of their coworkers; and a large majority (70%) described discussion of gender identity or sexual orientation in the workplace as "unprofessional." The authors of that study argued that this reflects an internalization of the perception that sharing of details about dating or family life by LGBT individuals constitutes "over-sharing," even though similar discussion by straight individuals is perceived as routine. In STEM careers, the separation of individual identity from professional contexts, as part of an

ideal of scientific objectivity, may increase pressure against openness. However, a perceived or actual need to conceal one's identity can contribute to stress and negative mental health outcomes (Meyer, 1995, 2003; Pachankis, 2007) and can strain social relationships (Ullrich et al., 2003). Because of these factors, concealment is expected to reduce workplace productivity, even in the absence of active discrimination (Clair et al., 2005; Human Rights Campaign, 2014; Patridge et al., 2014; Ragins et al., 2007).

At the same time, prior study of workplace climate has also found that LGB individuals are more likely to disclose their identity in the workplace if they perceive their coworkers as supportive (Ragins et al., 2007), and if their employer sets and enforces policies protecting their identities and providing support for needs specific to those identities (Clair et al., 2005). Our survey also found that participants who described their workplaces as safe and welcoming and who said their employers provided support for LGBTQA-specific needs reported greater openness to their colleagues and their students (Figure 4). Interestingly, we also found that participants working in STEM fields with better representation of women were more likely to disclose their identities to their colleagues (Figure 3). This suggests two hypotheses, which are not mutually exclusive: that better gender parity fosters a workplace climate welcoming to LGBTQA identities, or that some broader factor of tolerance for non-masculine gender expression may influence the workplace climate for both LGBTQA individuals and straight, cisgender women. Closer examination of the specific factors that contribute to welcoming and supportive work environments through in-depth qualitative analysis of individual participants' experiences is a next step in promoting these practices to spaces currently perceived as less welcoming or hostile to LGBTQA identities. In order to attend to the important ways that sexuality and gender "intersect with other facets of our identities: race, ethnicity, nationality, (dis)ability, age, class, and religious affiliation" (Giffney, 2009, p. 3) we plan to examine the personal experiences of individuals whose responses at times support and at times trouble the general trends suggested by statistical analyses of the survey data presented here.

As we continue this research, we also seek to explore the potential for promoting a robust interdisciplinary scholarship of queer experiences in particular professional fields—one that reaches beyond paradigmatic and methodological divisions. We have already begun discussing the impact of the study with researchers interested in more localized studies or those focused on a particular subfield and researchers interested in promoting diversity in STEM professions more broadly and hope to expand these conversations. With further analyses of the qualitative data that accompany

these survey results, we aim to provide more nuanced understandings of how people with particular identities experience STEM professions differently.

Finally, we seek to highlight the value of institutional and social policies that promote supportive working environments for all employees across a spectrum of identities as positive steps for productivity and inclusiveness. We do, however, heed Rumens' (2014) caution that assuming that movements toward (re)framing all workplaces as LGBT-inclusive as "natural" can also have unforeseen regulatory effects. Rather, the experiences of participants in the Queer in STEM study remind us to attend to the differences that characterize individual experience as evidence of the need for workplaces to allow these differences to exist and be expressed, not just recategorized as "normal." King and Cortina (2010) framed the issue of addressing the need for organizations to become LGBT-inclusive as "a social and economic imperative" and "an ethical obligation" (p. 69). Recognizing that heterosexism and heteronormative attitudes exist in STEM fields is a first step toward developing these spaces as inclusive for a diversity of gender and sexual identities.

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References

Ahmed, S. (2006). *Queer phenomenology: Orientations, objects, others*. Durham, NC: Duke University Press.

Anderson, M. Z., Croteau, J. M., Chung, Y. B., & DiStefano, T. M. (2001). Developing an assessment of sexual identity management for lesbian and gay workers. *Journal of Career Assessment*, 9, 243–260. doi:10.1177/106907270100900303

Bilimoria, D., & Stewart, A. J. (2009). "Don't ask, don't tell": The academic climate for lesbian, gay, bisexual, and transgender faculty in science and engineering. *NWSA Journal*, 21, 85–103.

Brewster, M. E., Velez, B., DeBlaere, C., & Moradi, B. (2012). Transgender individuals' workplace experiences: The applicability of sexual minority measures and models. *Journal of Counseling Psychology*, *59*, 60–70. doi:10.1037/a0025206

Brown, C., Dashjian, L. T., Acosta, T. J., Mueller, C. T., Kizer, B. E., & Trangsrud, H. B. (2012). The career experiences of male-to-female transsexuals. *The Counseling Psychologist*, *40*(6), 868–894.

Browne, K. (2005). Snowball sampling: Using social networks to research non-heterosexual women. *International Journal of Social Research Methodology*, *8*, 47–60. doi:10.1080/1364557032000081663

Budge, S. L., Tebbe, E. N., & Howard, A. S. (2010). The work experiences of transgender individuals: Negotiating the transition and career decision-making processes. *Journal of Counseling Psychology*, *57*, 377–393. doi:10.1037/a0020472

Cech, E. A., & Waidzunas, T. J. (2011). Navigating the heteronormativity of engineering: The experiences of lesbian, gay, and bisexual students. *Engineering Studies*, *3*, 1–24. doi:10.1080/19378629.2010.545065

Cheryan, S., Siy, J. O., Vichayapai, M., Drury, B. J., & Kim, S. (2011). Do female and male role models who embody STEM stereotypes hinder women's anticipated success in STEM? *Social Psychological and Personality Science*, *2*, 656–664. doi:10.1177/1948550611405218

Chrobot-Mason, D., Button, S. B., & DiClementi, J. D. (2001). Sexual identity management strategies: An exploration of antecedents and consequences. *Sex Roles*, *45*, 321–336. doi:10.1023/A:1014357514405

Chung, Y. B. (2001). Work discrimination and coping strategies: Conceptual frameworks for counseling lesbian, gay, and bisexual clients. *Career Development Quarterly*, *50*, 33–44. doi:10.1002/cdq.2001.50.issue-1

Clair, J. A., Beatty, J. E., & Maclean, T. L. (2005). Out of sight but not out of mind: Managing invisible social identities in the workplace. *Academy of Management Review*, *30*, 78–95. doi:10.5465/AMR.2005.15281431

Colgan, F., & Rumens, N. (2014). Understanding sexual orientation at work. In F. Colgan, & N. Rumens (Eds.), *Sexual orientation at work: Contemporary issues and perspectives* (pp. 1–27). New York, NY: Routledge.

Connell, C. (2010). Doing, undoing, or redoing gender? Learning from the workplace experiences of transpeople. *Gender & Society*, *24*, 31–55. doi:10.1177/0891243209356429

Croteau, J. M., Anderson, M. Z., & VanderWal, B. L. (2008). Models of workplace sexual identity disclosure and management: Reviewing and extending concepts. *Group & Organization Management*, *33*, 532–565. doi:10.1177/1059601108321828

Day, N. E., & Schoenrade, P. (1997). Staying in the closet versus coming out: Relationships between communication about sexual orientation and work attitudes. *Personnel Psychology*, *50*, 147–163. doi:10.1111/peps.1997.50.issue-1

Dispenza, F., Watson, L. B., Chung, Y. B., & Brack, G. (2010). Experience of career-related discrimination for female-to-male transgender persons: A qualitative study. *Career Development Quarterly*, *60*, 65–81. doi:10.1002/cdq.2012.60.issue-1

Eliason, M. J., DeJoseph, J., Dibble, S., Deevey, S., & Chinn, P. (2011). Lesbian, gay, bisexual, transgender, and queer/questioning nurses' experiences in the workplace. *Journal of Professional Nursing*, *27*, 237–244. doi:10.1016/j.profnurs.2011.03.003

Eliason, M. J., Dibble, S. L., & Robertson, P. A. (2011). Lesbian, gay, bisexual, and transgender (LGBT) physicians' experiences in the workplace. *Journal of Homosexuality*, *58*, 1355–1371. doi:10.1080/00918369.2011.614902

Faulkner, W. (2000). Dualisms, hierarchies, and gender in engineering. *Social Studies of Science*, *30*, 759–792. doi:10.1177/030631200030005005

Faulkner, W. (2009a). Doing gender in engineering workplace cultures. II. Gender in/authenticity and the in/visibility paradox. *Engineering Studies*, 1, 169–189. doi:10.1080/19378620903225059

Faulkner, W. (2009b). Doing gender in engineering workplace cultures. I. Observations from the field. *Engineering Studies*, 1, 3–18. doi:10.1080/19378620902721322

Gates, G. J., & Newport, F. (2013). LGBT percentage highest in D.C., lowest in North Dakota. *Gallup state of the states*. Retrieved from http://www.gallup.com/poll/160517/lgbt-percentage-highest-lowest-north-dakota.aspx

Giffney, N. (2009). Introduction: The "q" word. In N. Giffney & M. O'Rourke (Eds.), *The Ashgate research companion to queer theory* (pp. 1–13). Burlington, VT: Ashgate.

Griffith, K. H., & Hebl, M. R. (2002). The disclosure dilemma for gay men and lesbians: "Coming out" at work. *Journal of Applied Psychology*, 87, 1191–1199. doi:10.1037/0021-9010.87.6.1191

Hackman, H. W. (2012). Teaching LBGTQI issues in higher education: An interdependent framework. *Diversity & Democracy*, 15(1), 2–4.

Hill, R. J. (2009). Incorporating queers: Blowback, backlash, and other forms of resistance to workplace diversity initiatives that support sexual minorities. *Advances in Developing Human Resources*, 11, 37–53. doi:10.1177/1523422308328128

Huebner, D. M., & Davis, M. C. (2007). Perceived antigay discrimination and physical health outcomes. *Health Psychology*, 26, 627–634. doi:10.1037/0278-6133.26.5.627

Human Rights Campaign Foundation. (2014). *The cost of the closet and the rewards of inclusion: Why the workplace environment for LGBT people matters for employers*. Retrieved from http://hrc-assets.s3-website-us-east-1.amazonaws.com//files/assets/resources/Cost_of_the_Closet_May2014.pdf

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14–26. doi:10.3102/0013189X033007014

King, E. B., & Cortina, J. M. (2010). The social and economic imperative's of lesbian, gay, bisexual, and transgendered supportive organizational policies. *Industrial and Organizational Psychology*, 3, 69–78. doi:10.1111/iops.2010.3.issue-1

Larivière, V., Ni, C., Gingras, Y., Cronin, B., & Sugimoto, C. R. (2013). Bibliometrics: Global gender disparities in science. *Nature*, 504, 211–213. doi:10.1038/504211a

LGBT+ Physicists. (2013). *Supporting LGBT+ physicists: A best practices guide for departments*. Retrieved from http://lgbtphysicists.org

Lyons, H. Z., Brenner, B. R., & Fassinger, R. E. (2005). A multicultural test of the theory of work adjustment: Investigating the role of heterosexism and fit perceptions in the job satisfaction of lesbian, gay, and bisexual employees. *Journal of Counseling Psychology*, 52, 537–548. doi:10.1037/0022-0167.52.4.537

Meyer, I. H. (1995). Minority stress and mental health in gay men. *Journal of Health and Social Behavior*, 36, 38–56. doi:10.2307/2137286

Meyer, I. H. (2003). Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: Conceptual issues and research evidence. *Psychological Bulletin*, 129, 674–697. doi:10.1037/0033-2909.129.5.674

Mizzi, R. C. (2013). "There aren't any gays here": Encountering heteroprofessionalism in an international development workplace. *Journal of Homosexuality*, 60(11), 1602–1624. doi:10.1080/00918369.2013.824341

Morgan, D. L. (2008). Snowball sampling. In L. Given (Ed.), *The SAGE encyclopedia of qualitative research* (pp. 816–817). Thousand Oaks, CA: Sage.

Moss-Racusin, C. A., Dovidio, J. F., Brescoll, V. L., Graham, M. J., & Handelsman, J. (2012). Science faculty's subtle gender biases favor male students science faculty's subtle gender

biases favor male students. *Proceedings of the National Academy of Sciences of the United States of America*, 109, 16474–16479. doi:10.1073/pnas.1211286109

Moss-Racusin, C. A., Phelan, J. E., & Rudman, L. A. (2010). When men break the gender rules: Status incongruity and backlash against modest men. *Psychology of Men & Masculinity*, 11, 140–151. doi:10.1037/a0018093

Nassar-McMillan, S. C., Wyer, M., Oliver-Hoyo, M., & Schneider, J. (2011). New tools for examining undergraduate students' STEM stereotypes: Implications for women and other underrepresented groups. *New Directions for Institutional Research*, 152, 87–98. doi:10.1002/ir.v2011.152

National Science Board. (2014). *Science and engineering indicators 2014*. Arlington, VA: National Science Foundation (NSB 14-01).

Ong, M., Wright, C., Espinosa, L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research. *Harvard Educational Review*, 81, 172–209. doi:10.17763/haer.81.2.t022245n7x4752v2

Pachankis, J. E. (2007). The psychological implications of concealing a stigma: A cognitive–affective–behavioral model. *Psychological Bulletin*, 133, 328–345. doi:10.1037/0033-2909.133.2.328

Patridge, E. V., Barthelemy, R. S., & Rankin, S. R. (2014). Factors impacting the academic climate for LGBQ STEM faculty. *Journal of Women and Minorities in Science and Engineering*, 20, 75–98. doi:10.1615/JWomenMinorScienEng.v20.i1

Pew Research Center. (2013). *A survey of LGBT Americans: Attitudes, experiences and values in changing times*. Retrieved from http://www.pewsocialtrends.org/2013/06/13/a-survey-of-lgbt-americans

Pinar, W. F. (Ed.). (1998). *Queer theory in education*. Mahwah, NJ: Erlbaum.

Pizer, J. C., Sears, B., Mallory, C., & Hunter, N. D. (2012). Evidence of persistent and pervasive workplace discrimination against LGBT people: The need for federal legislation prohibiting discrimination and providing for equal employment benefits. *Loyola of Los Angeles Law Review*, 45, 715–780.

R Core Team. (2014). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from http://www.R-project.org

Ragins, B. R. (2008). Disclosure disconnects: Antecedents and consequences of disclosing invisible stigmas across life domains. *The Academy of Management Review*, 33(1), 194–215.

Ragins, B. R., & Cornwell, J. M. (2001). Pink triangles: Antecedents and consequences of perceived workplace discrimination against gay and lesbian employees. *Journal of Applied Psychology*, 86, 1244–1261. doi:10.1037/0021-9010.86.6.1244

Ragins, B. R., Singh, R., & Cornwell, J. M. (2007). Making the invisible visible: Fear and disclosure of sexual orientation at work. *Journal of Applied Psychology*, 92, 1103–1118. doi:10.1037/0021-9010.92.4.1103

Rankin, S., Weber, G., Blumenfield, W., & Frazer, S. (2010). *2010 State of higher education for lesbian, gay, bisexual & transgender people*. Charlotte, NC: Campus Pride.

Rhoton, L. A. (2011). Distancing as a gendered barrier: Understanding women scientists' gender practices. *Gender & Society*, 25, 696–716. doi:10.1177/0891243211422717

Riggle, E. D. B., Rostosky, S. S., & Reedy, C. S. (2005). Online surveys for BGLT research. *Journal of Homosexuality*, 49(2), 1–21. doi:10.1300/J082v49n02_01

Riley, D. M. (2008). LGBT-friendly workplaces in engineering. *Leadership and Management in Engineering*, 8, 19–23. doi:10.1061/(ASCE)1532-6748(2008)8:1(19)

Rudoe, N. (2010). Lesbian teachers' identity, power, and the public/private boundary. *Sex Education*, 10, 23–36. doi:10.1080/14681810903491347

Rumens, N. (2014). Is your workplace "gay-friendly?" Current issues and controversies. In F. Colgan & N. Rumens (Eds.), *Sexual orientation at work: Contemporary issues and perspectives* (pp. 181–196). New York, NY: Routledge.

Rumens, N., & Kerfoot, D. (2009). Gay men at work: (Re)constructing the self as professional. *Human Relations*, *62*, 763–786. doi:10.1177/0018726709103457

Russ, T. L., Simonds, C. J., & Hunt, S. K. (2002). Coming out in the classroom … an occupational hazard? The influence of sexual orientation on teacher credibility and perceived student learning. *Communication Education*, *51*, 311–324. doi:10.1080/03634520216516

Salganik, M. J. (2006). Variance estimation, design effects, and sample size calculations for respondent-driven sampling. *Journal of Urban Health*, *83*(1), 98–112.

Schilt, K. (2006). Just one of the guys? How transmen make gender visible at work. *Gender & Society*, *20*, 465–490. doi:10.1177/0891243206288077

Shapiro, C. A., & Sax, L. J. (2011). Major selection and persistence for women in STEM. *New Directions for Institutional Research*, *152*, 5–18. doi:10.1002/ir.v2011.152

Shih, M., Young, M. J., & Bucher, A. (2013). Working to reduce the effects of discrimination. *American Psychologist*, *68*, 145–157. doi:10.1037/a0032250

Teddlie, C., & Tashakkori, A. (2011). Mixed methods research: Contemporary issues in an emerging field. In N. Denzin & Y. Lincoln (Eds.), *The SAGE handbook of qualitative research* (pp. 285–299). Thousand Oaks, CA: Sage.

Ullrich, P. M., Lutgendorf, S. K., & Stapleton, J. T. (2003). Concealment of homosexual identity, social support and CD4 cell count among HIV-seropositive gay men. *Journal of Psychosomatic Research*, *54*, 205–212. doi:10.1016/S0022-3999(02)00481-6

U.S. Census Bureau. (2012). *The 2012 statistical abstract*. Retrieved from http://www.census.gov/compendia/statab/cats/population.html

Waldo, C. R. (1999). Working in a majority context: A structural model of heterosexism as minority stress in the workplace. *Journal of Counseling Psychology*, *46*, 218–232. doi:10.1037/0022-0167.46.2.218

Welle, B., & Button, S. B. (2004). Workplace experiences of lesbian and gay employees: A review of current research. In C. L. Cooper & I. T. Robertson (Eds.), *International review of industrial and organizational psychology* (Vol. 19, pp. 139–170). West Sussex, England: Wiley.

Whitehead, S. (2003). Identifying the professional "man"ager: Masculinity, professionalism, and the search for legitimacy. In J. Barry, M. Dent, & M. O'Neill (Eds.), *Gender and the public sector* (pp. 85–103). New York, NY: Routledge.