

LGBTQ+ IDENTITIES IN STEM: A STEADY LEAK

BY DANIEL TROTTER



Innovation and creativity in science, technology, engineering, and mathematics (STEM) are best fostered through a diverse researcher population [1]. However, lesbian, gay, bisexual, transgender, queer, and other sexuality and gender minority populations (LGBTQ+) have been underrepresented in these fields, undermining this goal [2]. Underrepresentation of these groups emerges in two streams: low numbers of STEM researchers who are comfortable openly identifying as members of the LGBTQ+ community (*i.e.*, being ‘out’) at their institutions; and a pervasive culture in STEM that discourages visibility, lowering retention of LGBTQ+ researchers in these fields.

The outflow of minorities from STEM has been modeled as a leaky pipeline [3], where individuals leave STEM at various stages of their careers. In this review we will focus on identifying obstacles to LGBTQ+ retention in STEM using the leaky pipeline model, concentrating on the undergraduate to late career stages of the pipeline.

Past research shows retention in STEM is strongly correlated with science identity — a personal sense of belonging in STEM [4]. Undergraduate research participation, which bridges the gap between the classroom and practical application, is correlated with strong science identity [4,5]. Curiously, while LGBTQ+ STEM students were found 8% more likely than their non-LGBTQ+ peers to be involved in undergraduate research, the same LGBTQ+ students were 10% less likely to stay in STEM, even when controlling for other factors known to support retention (*e.g.*, having parents/guardians in STEM) [4]. This is a sizeable loss of LGBTQ+ students from STEM, occurring at an even faster rate than for women [4]. The contrast between high involvement of LGBTQ+ students in undergraduate research and their poor retention raises several

questions: If research participation is not retaining LGBTQ+ STEM students, what is preventing it? What extra challenges might drive LGBTQ+ people from STEM?

It is generally assumed that STEM has comparable amounts of LGBTQ+ people to other fields; however, estimates suggest that STEM has 17-21% fewer LGBTQ+ people than expected by the general population [2]. Additionally, LGBTQ+ people in STEM are less likely to be *out* at their institutions than in their private lives compared to in non-STEM fields [4-7]. Lower overall visibility of LGBTQ+ STEM majors leads to feelings of isolation among those members remaining in STEM, discouraging their retention. Why are LGBTQ+ scientists not *out*? Studies of American LGBTQ+ physicists found that 30% were told not to come *out*, and 50% of transgender and non-binary scientists had experienced harassment in their departments [1,5,6]. When surveyed, LGBTQ+ faculty and students often cite the uncertainty of reception by colleagues and supervisors as strongly influencing their willingness to be *out*, with approximately 20% of LGBTQ+ people reporting feeling uncomfortable in their departments [1,2,8]. A commonly reported fear is that coming *out* will hurt, or cost them, their careers as many countries lack legal protections from job loss due to gender identity and sexuality [4,6,7]. This leaves individuals with the hard choice of being *out* and risking backlash or termination, or remaining hidden, which often leads to poor mental health [6]. This sense of isolation and discomfort experienced by LGBTQ+ people in STEM creates feelings of being unwelcome, prompting exits from the STEM stream.

A 2016 report by the American Physical Society [1] found 36% of LGBTQ+ respondents had seriously considered leaving STEM in 2015. Similarly, a UK study in 2019 [8] found 28% of LGBTQ+ respondents, rising to 50% in transgender and non-binary participants, had also considered leaving STEM; however, only 16% of non-LGBTQ+ participants had considered the same. Why? A highly cited reason is the atmosphere in STEM around discussing sexuality and gender identity [2,4-7]. The prevailing mindset in STEM is that LGBTQ+ identities are a personal topic, and unnecessary to discuss within STEM’s ideally objective, merit-based environment [2,6,7]. This persists even within STEM’s diversity programs: research chair competitions in Canada, as well as NSF and NIH

SUMMARY

The ‘leaky pipeline’ in science is notably leakier in minority groups. Among and intersecting with these groups are LGBTQ+ individuals; however, the reasons for the leak in this demographic, particularly retention after entry to undergraduate programs, and unique challenges LGBTQ+ scientists may face, bears further exploration and reflection.

Daniel Trotter
<dtrot074@uottawa.ca>
PhD student,
University of Ottawa,
Ottawa, Ontario
K1N 6N5

competitions in the United States, do not include LGBTQ+ identities in their equity and diversity targets [2,9]. To perpetuate the notion that discussions and visibility of LGBTQ+ identities are unimportant in STEM, or within institutional diversity criteria, demonstrates an oversight of the challenges LGBTQ+ people can face and pushes many potential STEM majors out of the stream [1,2,4-8].

Networking with peers and colleagues often critically influences success in STEM [10-12]; however, the same networking opportunities are not always available to LGBTQ+ people. Casual conversation rapidly becomes daunting for LGBTQ+ individuals to navigate when questions like “Do you have a husband/wife?” mean deciding whether or not to come *out*. As many peers and colleagues are from cultures less accepting of LGBTQ+ people, being *out* can strain or cost connections and collaboration opportunities. These challenges are often most pronounced for transgender and non-binary populations [2,8], where legal name changes mean coming *out* repeatedly to claim any publications that exist under their previous name, or abandoning their claim to those works. In STEM’s global community these difficulties are greatly hindering, as many institutions are located in regions where it is unsafe or illegal to be LGBTQ+.

Adding to the challenges LGBTQ+ people face being *out* in their professional lives, personal issues can also greatly impact their success. Notably, many young LGBTQ+ people face rejection and abandonment by their families [2]. Moreover, LGBTQ+ people are at higher risk for homelessness or poverty with LGBTQ+ youth being five times more likely to be homeless than the general population [13]. The strain of fiscal instability, as well as emotional distress and mental health effects of rejection, can make continuing professionally unfeasible. This ultimately contributes to LGBTQ+ people having to leave STEM due to purely socioeconomic factors.

We have reviewed several factors discouraging LGBTQ+ scientists from coming *out* publically in their institutions, particularly in education and early career, and how this contributes to the leaky pipeline. These factors ultimately impact LGBTQ+ visibility in STEM, causing subsequent leaks as careers progress to more senior positions. Many academics report being unable to identify any colleagues who are publicly *out* as LGBTQ+ and academics, more than non-academics ($p < 0.0001$), were found less likely to know if any LGBTQ+ supports exist at their institutions [6]. This unawareness is even more pronounced in undergraduates, many of whom cite never knowing of any LGBTQ+ scientists [2], which contributes to feelings of seclusion that can drive them out of the STEM stream. Put simply, LGBTQ+ researchers will not be well retained in STEM when they cannot see themselves in it.

Out LGBTQ+ faculty know this best, as several have reported receiving visits from LGBTQ+ students outside their disciplines under the guise of having vaguely related questions to their field, hoping to find confirmation of LGBTQ+ scientists [2]. Faculty more prominent in advocacy have gotten emails from students at other institutions looking for advice on how to exist as an LGBTQ+ person in STEM [10]. This demonstrates a clear need to close the gap between perceived and true numbers of LGBTQ+ scientists to retain these students in STEM. As described earlier, strong science identity is important to retention; when upcoming researchers cannot see themselves, it will be difficult for such an identity to form. Improving on this for young LGBTQ+ STEM majors requires creating and fostering work and study environments where academics feel comfortable coming *out*.

In addition to invisibility and isolation, LGBTQ+ STEM majors have reported higher rates of discrimination and harassment than their non-LGBTQ+ counterparts [1,8]. Unsurprisingly, such harassment is a potent driving force for leaving STEM and undoubtedly contributes to the low retention of LGBTQ+ populations. Harassment rates are even higher among subpopulations of the LGBTQ+ community, with non-binary and transgender people being approximately twice as likely to experience harassment in their workplace than LGB people, and these risks are higher still for LGBTQ+ people of colour [1,7,11]. For many LGBTQ+ STEM students and staff, concerns of harassment factor heavily into their choice to not be *out* [1,2,6,7,11]. This is a self-feeding effect: low visibility leads to leaking LGBTQ+ populace from the STEM stream, however those who are *out* become bigger targets of harassment, and so themselves “leak out”, leading to a net reduction of LGBTQ+ individuals in STEM. Given the previously discussed low retention of LGBTQ+ students despite undergraduate research participation, it may well be that exposure to harassment events in early research dissuades them from continuing.

LGBTQ+ people are increasingly more visible in the population. Despite this, they have been poorly retained within STEM due to: low visibility, isolation, fear, harassment, and the prevalent mindset that such identities are too personal for open discussion in STEM. This can be improved upon, and efforts have been made by various advocacy groups (e.g., 500 Queer Scientists, Pride in STEM, etc.) to facilitate spaces for LGBTQ+ scientists to connect and encourage more scientists to be *out*. However, there is still much room for improvement, particularly in increasing awareness of STEM’s diversity to undergraduates and working to include conversations about identity in STEM at large. Improving visibility will reduce the leaks of LGBTQ+ people in the pipeline, which can only serve to increase STEM’s diversity and foster greater innovation going forward.

REFERENCES

1. T.J. Atheron, *et al.*, “LGBT Climate in Physics: Building an Inclusive Community”, *American Physical Society*, (2016).
2. J. Freeman, “LGBTQ scientists are still left out”, *Nature*, **559**, 27-28 (2018).
3. J.N. Ahn, *et al.*, “Motivating students’ STEM learning using biographical information”, *International Journal of Designs for Learning*, **7**, (2016).
4. A. Mattheis, *et al.*, “A model of queer STEM identity in the workplace”, *J. Homosex.*, 1-25 (2019).
5. B.E. Hughes, “Coming out in STEM: Factors affecting retention of sexual minority STEM students”, *Sci. Adv.* **4**, eaao6373 (2018).
6. J.B. Yoder, and A. Mattheis, “Queer in STEM: Workplace experiences reported in a national survey of LGBTQA individuals in science, technology, engineering, and mathematics careers”, *J. Homosex.* **63**, 1-27 (2016).
7. D.K. Smith, “A personal matter?”, *Matter*, **1**, 1439-1442 (2019).
8. “Exploring the workplace for LGBTQ+ physical scientists, Royal Society of Chemistry”, *Institute of Physics, Royal Astronomical Society and Royal Society of Chemistry*, (2019)
9. Canada Research Chairs. (2020). “Equity, Diversity and Inclusion Requirements and Practices”, Retrieved from Canada Research Chairs website: <https://www.chairs-chaires.gc.ca/program-programme/equity-equite/index-eng.aspx>.
10. B. Barres, *et al.*, “Coming out: the experience of LGBTQ+ people in STEM”, *Genome Biology*, **18**, 1-4 (2017).
11. E. Gibney, “Discrimination drive LGBTQ+ scientists to think about quitting.”, *Nature*, **571**, 16-18 (2019).
12. Y.J. Xu and C.L. Martin, “Gender differences in STEM disciplines: From the aspects of informal professional networking and faculty career development”, *Gender Issues*, **28**, 134 (2011).
13. I.A. Abramovich, “No safe place to go-LGBTQ youth homelessness in Canada: Reviewing the literature”, *Canadian Journal of Family and Youth*, **4**, 29-51 (2012).