Centering LGBT+ perspectives in STEM Career Decision Making

Prof Bryce Hughes
Montana State University
Dr Clara Barker
University of Oxford
Dr Lisa Smith
University of San Diego

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Executive summary

This project, "Centering LGBT+ Perspectives in STEM Career Decision Making," explored the experiences and decision-making processes of LGBT+ individuals who have left STEM fields in the United States and the United Kingdom. The study aimed to understand the factors contributing to the higher attrition rates among LGBT+ individuals in STEM and to provide insights for policymakers, educational leaders, and employers to improve retention and inclusivity.

Key Findings:

1. *Compartmentalising and Compromising*: LGBT+ individuals often feel the need to mask or hide their identities in STEM environments, leading to psychological stress and reduced engagement. This constant vigilance and identity surveillance can compromise their ability to perform effectively.

2. *Conflicting Values and Purpose*: Many participants left STEM because their work did not align with their personal values or did not serve a meaningful purpose. They sought careers that promote sustainability, social justice, or community well-being.

3. *LGBT in the Background*: For some participants, their LGBT+ identity was not the primary reason for leaving STEM. Other factors, such as interdisciplinary interests, need for human connection, and academic struggles, played significant roles. However, the LGBT+ climate often exacerbated these issues.

4. *Movement in STEM*: Some participants moved within the broader STEM ecosystem rather than leaving STEM entirely. These moves were often motivated by the search for more inclusive and supportive environments.

5. *Career Stages of Departure*: Most participants tended to leave STEM at a specific career stage, particularly during graduate training or early career stages. This pattern highlights the importance of targeted interventions at these critical points to improve retention.

6. *National Context Differences*: The study found notable differences between the US and UK contexts. In the UK, issues such as immigration policies and public attitudes towards trans individuals influenced career decisions. In the US, state-by-state variations in LGBTQ+ protections and access to healthcare played a significant role.

Research Methodology:

The study employed a qualitative approach, including in-depth interviews with 32 participants who had left STEM fields. Participants were recruited through LGBT+ and STEM organizations in the US and UK. The data was analysed using a hybrid inductive and deductive approach to identify key themes and patterns.

Policy Implications and Recommendations:

1. *Creating Inclusive Environments*: Higher education institutions, employers, and policymakers should ensure that STEM environments are inclusive and supportive of LGBT+ identities. This includes clear protections against discrimination and active efforts to celebrate diversity.

2. *Aligning STEM Work with Personal Values*: Efforts should be made to highlight the diverse career paths available within STEM that align with values such as sustainability and social justice. This can help retain individuals who are motivated by these values.

3. *Addressing Intersectional Challenges*: Policies and practices should consider the intersectional nature of identities and address the compounded challenges faced by LGBT+ individuals in STEM. This includes providing targeted support for those who face multiple forms of marginalization.

4. *Supporting Movement Within STEM*: Recognize and support the movement of individuals within the STEM ecosystem. This includes creating pathways for career transitions and ensuring that all sectors of STEM are inclusive and welcoming.

5. *Protecting Confidentiality in Data Collection*: Data collection and reporting on discrimination should be designed to protect the confidentiality of LGBT+ individuals, ensuring they are not at risk of being 'outed' against their wishes.

6. *Targeted Interventions at Early Career Stages*: Implement targeted interventions during critical career stages, such as graduate training and early career stages, to improve retention of LGBT+ individuals in STEM fields. These interventions may need to be targeted to graduate supervisors and workplaces to establish more welcoming climates.

7. *Addressing National Context Differences*: Develop policies that consider the unique challenges faced in different national contexts. In the UK, consider how policy and environment can help trans people feel safer and more welcome despite negative public attitudes. In the US, focus on state-by-state variations in LGBTQ+ protections and access to healthcare; colleges and employers can mitigate these variations through their policies and healthcare benefit plans.

Conclusion:

This study highlights the unique challenges faced by LGBT+ individuals in STEM and provides actionable recommendations to improve retention and inclusivity. By addressing these challenges, we can create a more diverse and innovative STEM workforce that benefits society as a whole.

Introduction and project background

The growth of the workforce in Science, Technology, Engineering, and Mathematics (STEM) fields has become a global need. However, STEM fields across countries share a common issue of the retention of scientific and engineering talent among people from groups underrepresented in STEM. One group that has recently garnered attention for disproportionate rates of attrition from STEM fields are people who are lesbian, gay, bisexual, transgender, queer/questioning, or other minoritized sexual and gender identities (LGBT+). Data from the United States and the United Kingdom shows that LGBT+ people are more likely to leave STEM degrees (UK) /majors (US) before completing college and to leave STEM occupations after entering the workforce (Cech & Waidzunas, 2021; Hughes, 2018; Maloy et al., 2022).

To retain LGBT+ individuals in STEM, we need to understand their experiences in STEM programs and careers. STEM environments may not be physically or psychologically safe for LGBT+ individuals who have experienced unwelcoming, hostile cultures and harassment (Marosi et al., 2024; Royal Society of Chemistry, Institute of Physics, and Royal Astronomical Society, 2019). By privileging the cis, White, straight male majority (Cech, 2022), STEM environments also tend to impose career limitations and the professional devaluation of LGBT individuals (Cech & Waidzunas, 2021; Marosi et al., 2024). To note, LGBT+ individuals are almost twice as likely to consider leaving their studies/career than non-LGBT+ individuals, 28% vs 16%, increasing to nearly half of trans respondents (Royal Society of Chemistry, Institute of Physics, and Royal Astronomical Society, 2019). Although we know there are negative experiences associated with identifying as LGBT in STEM, most studies have surveyed LGBT students or professionals who may have considered leaving STEM but maintained their roles in those environments.

To complicate the matter further, the fact that LGBT+ people leave STEM at a higher rate than their cisgender, heterosexual colleagues has only recently been demonstrated due to demographic data on LGBT+ people in STEM becoming available in just the past couple of years (Freeman, 2020). This project is based in two countries that have begun exploring the collection of LGBT+ demographic data to inform policy-related decisions regarding broadening the participation of people historically underrepresented in STEM. In the United Kingdom, sexual orientation and gender identity (SOGI) data have begun to be collected as part of the UK Census. Further, STEM learned-societies have also started to collect these data, following a commonly used set of guidelines regarding the collection of data on diverse populations (DAISY). In the United States, several research institutes have spearheaded efforts to collect SOGI data, followed by a couple federal agencies, though a plan to collect SOGI data on the US Census was reversed by the Trump administration in 2020. Without adequate data on LGBT+ representation in the general population, it had been difficult to even determine the levels of LGBT+ participation in STEM, let alone whether LGBT+ people experienced disproportionately negative outcomes. One effort to overcome this barrier was a recent meeting at Wilton Park between stakeholders in the US and the UK to discuss solutions to this problem, share promising practices, and develop partnerships to build a more inclusive future (Coffield, et al., 2023).

To some extent, learning about what people who are LGBT+ go through who have remained in STEM can tell us quite a bit about the conditions that lead to attrition, but people who

ultimately leave may still differ in important ways from their peers and colleagues who do not. What, then, contributes to the choice to leave? Our project focused on the pathways of those who left STEM, examining the conditions, factors, and processes by which LGBT+ people made the decision to leave a STEM degree or career. We were especially interested in the transnational context of the United States and the United Kingdom, two countries with a special relationship in matters of foreign policy, yet each featuring unique cultural, social, political, and economic factors that shape the pathways into, through, and out of STEM fields. This report presents the experiences of queer and trans individuals to identify the factors that LGBT+ students and professionals weigh the heaviest when making decisions to leave STEM.

Research Methodology

The overall purpose of this project was to understand how LGBT+ people who left STEM decided to leave. This purpose was proposed to be achieved through three specific aims. The first aim was to explore the decision-making processes of LGBT+ people in the US and the UK. This aim would help us uncover patterns in terms of people's pathways into, through, and out of STEM fields as well as compare and contrast the national context in ways that would offer insight into policy-making to support broadening the participation of LGBT+ people in STEM in both countries. The second aim was then to conduct a latent class analysis, based on the factors identified in the first aim, to determine the extent to which these patterns were representative of LGBT+ people who had left STEM. Finally, the data from both of the previous aims were then to be analysed into a theoretical model explaining why and how LGBT+ people leave STEM, focusing on the factors and conditions that policy could help alleviate to reduce the attrition of LGBT+ people from STEM fields.

We were able to complete the first research aim of this project, and we present our initial results from that analysis in this report. We plan to continue analysis and dissemination of this data following completion of this particular grant programme. We plan to complete the second research aim as part of a future endeavor due to project delays as a result of a lengthy ethics review process and difficulty recruiting the number of UK participants we had proposed.

Participants

Participants in this study were people who had left a STEM field, whether that be at the career stage or the degree stage. We did not specify what "leaving STEM" meant for participants; rather, we let participants decide if they had left STEM before they agreed to participate in the study. We also anticipated reaching an audience who have 'left' STEM fields to be a challenge. Our sampling approach was primarily a snowball sample, which is commonly recommended for hard-to-reach populations (Creswell & Poth, 2017). Snowball sampling relies on people who receive a study invitation to pass that invitation along to others who meet the study participation criteria. Our recruitment began with disseminating an invitation through LGBT in STEM organisations in the United States and the UK, including organisations such as oSTEM, Pride in STEM, House of STEM, Intertech LGBT, Proud Science Alliance, as well as on the social media and LinkedIn profiles of the research team. Whilst some of these individuals may stay in touch with STEM specific networks, this cannot

be assumed to be the case. However, the most practical approach was determined to reach out through these networks and ask members to forward our invitation along to others they might know who fit our inclusion criteria.

Participants were primarily recruited through an electronic project flyer with a QR (see Appendix II) code embedded. This QR code led prospective participants to a screening survey (see Appendix III) to collect demographic data and contact information which would allow us to maximise diversity within our sample along the lines of various LGBT+ identities and other social identity groups, such as ethnicity, disability, and STEM field. As an example, out of the 54 people from the US who completed the survey, we prioritized 24 people from the survey data based on their reported ethnicity, disability, and gender or sexual identity as a group underrepresented in both STEM and LGBT+ communities. This way we included an overrepresentation of people of colour, people with disabilities, and people who were transgender or nonbinary in our sample. Contact information was used to contact prospective participants to schedule an interview for this study.

We attempted to have equal representation among participants from each country, though differences in response elicitation and national population size resulted in a greater number of prospective participants from the US as compared to the UK. For reference, the UK is approximately one sixth that of the US. Overall, 54 people from the US and 8 from the UK completed the screening survey, of which 24 from the US, and all prospective participants from the UK, were invited to participate.

We thus conducted interviews with 33 participants, though one of these participants ultimately did not meet our inclusion criteria (identifying as heterosexual and cisgender) and their interview data was excluded from analysis. Please see Appendix I for tabulated demographics on our study participants. We did collect demographic data initially through a screening survey, but the demographic data we report here are from the open-ended form provided to participants at the start of each interview. Most of our participants were in an engineering field (n=14, 44%), but other STEM fields represented included the biological sciences (n=7), physical sciences (n=4), computer science (n=4), and science in a broad or interdisciplinary sense (n=3).

One of our goals was to ensure inclusion of transgender or nonbinary people in our sample, which we well-reached. Fifteen participants shared a transgender identity with us (47%), including twelve (38%) who were agender, nonbinary, or genderqueer. As we asked participants to provide their gender identities and other demographics through open-ended responses, participants shared with us how they define their gender identities in their own words. As such, only two participants specified being cisgender, so it’s possible this is an undercount. We also observed a variety of sexual identities within the sample, encompassing 12 (38%) queer participants (including some who indicated queer and another identity), 9 (28%) gay or lesbian participants, 8 (25%) bisexual or pansexual participants, and 3 (9%) asexual spectrum participants.

Our sample was not as diverse in terms of racial or ethnic identity, as 24 (75%) of our participants reported being white. Of our 8 participants of colour, three are Latinx or Hispanic

participants and four are multiracial or multiethnic participants[1]. About half of our participants disclosed a physical or mental disability (n=17, 53%), and 12 (38%) indicated they were the first in their family to achieve a college or university degree.

Procedures

Participants who were selected following the screening survey were emailed to schedule in-depth, semi-structured interviews using the protocol in Appendix IV. Immediately prior to the interview, participants were emailed two Qualtrics (Qualtrics, Provo, Utah) links to document informed consent and to collect more precise demographic information than had been collected via the screening survey. This second demographic survey (see Appendix V) was open-ended to allow participants to provide demographic information in their own words, though responses were also categorised as needed for research purposes. Interviews lasted approximately 45-90 minutes, conducted via Zoom and Webex video conferencing platforms, and recorded for transcription, with one exception. One participant consented to participate in the study, but not to be recorded, so this interview was conducted with notes taken by the interviewer in place of a transcript. Recordings were transcribed by Rev.com. For the 32 completed interviews, transcriptions yielded 332 pages of data. Data sources included transcribed data and responses to open-ended demographic questions. Demographic questions were open-ended to allow for flexibility and multiple identities in participants' responses. Transcripts were de-identified for analysis, meaning that identifying information was replaced with pseudonyms or generic descriptors so as to protect participant confidentiality, and de-identified transcripts were shared with participants as part of the member checking process.

Data Analysis

Transcript data was analysed using a hybrid inductive and deductive approach (Fereday & Muir-Cochrane, 2006) following Bingham's five-phase process (Bingham, 2023).

1. Data Management. We categorised all research data into folders utilising the Montana State University secure OneDrive platform. First, we organised and prepared data for analysis by gathering all transcripts. Second, we proceeded with data cleaning by reviewing the data and correcting any errors or inconsistencies and de-identifying personal information to ensure confidentiality of participants. Third, to ensure participant validation, we send transcripts to participants for their revision and make any necessary corrections. Fourth, once we received the revised transcripts, we proceeded with the coding process.
2. Initial Coding: We applied both deductive and inductive coding and thematic analysis looking for and identified codes, patterns, and themes that emerged from the data.
3. Memoing: We wrote detailed notes, memos and reflections on the meaning of the data that documented emerging patterns, themes, and answers to research question.
4. Analytic Questioning: We discussed patterns, relationships, and themes that emerged within the data.
5. Theme development: To assure depth of analysis, we synthesised codes and memos, identified clusters codes and themes using a dual-method coding system, by using manual coding (excel and word documents) and subsequently, using Dedoose Software to

[1] We will not report categories with very small numbers, such as the remaining ethnicity category with one participant, for privacy purposes.

systematically code data and enhance data visualisation helping to validate findings that addressed the research inquiry.

Data Trustworthiness
We employed one primary method to ensure the trustworthiness of our data. We employed member checking to involve study participants in the process of verifying the accuracy of our data and analysis.

Member checking consists of two activities we employed to engage participants in reviewing our study findings. First, we shared interview transcripts with participants, both in terms of their verification of these transcripts' accuracy, and for ethics reasons to remind them of the content they shared with us in interviews. We shared de-identified transcripts with participants to help them see how well we masked their identities in our transcript review process as well. We will also share drafts of our themes with participants both to allow them to respond to our interpretation and integration of interview data as well as to help them see their data in context and, for a second time, ensure we have adequately protected their confidentiality.

Research Findings

We have identified several potential themes through our preliminary analysis of the transcripts we have collected to date. Three of these themes included feeling compromised or conflicted in expressing LGBT+ identity in a STEM work environment, experiencing a conflict between personal values and the values of one's STEM environment, or other factors related to dissatisfaction with STEM unrelated to being LGBT+, though often exacerbated by the LGBT+ climate. We also have a fourth theme, Movement in STEM, which we identified through the participant recruitment process and found evidence for in interview transcripts. Pseudonyms provided by participants are used in this section; for others we use a general identifier in place of their names, which will be replaced by a researcher-identified pseudonym in future dissemination.

Compartmentalizing and Compromising
One theme represented by several participants in their discussions was the role that masking or hiding their identity, or feeling the need to, played in making the decision to leave STEM. Responses within this theme illustrated participants' dissatisfaction with needing to only show part of themselves in STEM environments or compromising who they were to fit in those roles.

Individuals felt that they could not be fully out, such as Jack who stated: "I was navigating actually through this whole period…of how out I wanted to be or how out I felt comfortable being".

Further, this created a pressure to mask identities for some participants, in both STEM education and industry. For instance, **P7,** a STEM student had to modify their appearance to avoid attention and for not feeling safe in the classroom environment, " I was showing up to something that was like physics, intro physics is a super like 500 people and they're all mechanical engineers and I probably... I wouldn't femme myself because I'm super uncomfortable with that, but I would definitely baggy sweatshirt, baggy pants, sit in the back,

don't make a fuss, just don't look like anyone you would want to talk to. Put yourself as a wallflower. Don't be out or loud or anything just because it's not the environment to safely do that." Similarly, Alex, a STEM professional shared that: "If you're at a job and you don't want to get fired, I felt a need to [mask]...In order to be creative fully and really fully present in my job, I have to be fully myself. I can't be focused on masking…"

Therefore, queer and trans individuals decided to leave STEM because they could or would no longer compartmentalise or compromise their identity, as illustrated by Rick, who shared: "I can't hide who I am just based on my mannerisms and appearances. It's really hard for me to clock into other areas and code switch on myself…I also told myself I wasn't going to do that anymore."

Conflicting Values and Purpose

Another dominant theme in discussing reasons for leaving STEM was that individuals felt that who they had to be or what they did in STEM did not align with their values or serve a larger purpose in solving meaningful problems in the world or for the LGBT community.

Put eloquently, Logan explained: "I wasn't driven out by the methods. I enjoyed doing the work, but I wanted that work to have a different purpose."

For some participants, being in STEM not only represented a conflict of values but that functioning within that conflict required changes they were not willing to make. For example, K shared: "this degree [computer science] was turning me into something that I didn't want to become."

Participants like K left to be who they needed to be for themselves, and some participants expanded this to others by being who they needed for someone else. Scot left chemical engineering for a role in education that served the purpose of bettering the environment for others. Scot stated: "When students are saying things that are anti-gay or anti-trans in one way or another, it now falls to me…to talk to these people and try to get them to a better place to protect the community here. That part of my job is the part that I love more than science is certainly creating a better little corner of my society here."

One important pattern has been between people who have experienced discrimination and have been unable to continue in STEM, and people who experienced incongruity between STEM and their personal values. This pattern reflects a difference in level of perceived control over the decision to leave STEM.

Participant 10 who left a STEM career to the high education labour movement, expressed relief and satisfaction with their new path, sharing " I eventually left Engineering Justice and Peace, and I left [University2] just this May. I'm fully out of it. I feel a lot better not trying to juggle multiple different identities and careers. For better or for worse, I am in the higher education labor movement, and I'm a lobbyist in the [US Pacific Northwest], and that's just where my life has taken me. Yeah. I have health insurance and I feel safe and secure, and everyone's nice to me at work, so that's what matters."

LGBT in the Background

Though several participants reflected that a primary reason for leaving STEM centered their LGBT identity or identities, others suggested that their identity as a member of the LGBT community was in the background to other factors. Participants described factors such as having interdisciplinary experiences, needs for human connection, and struggling academically as reasons for leaving STEM that were not primarily associated with their identities, at least not that they were aware. Within these responses, several participants shared a sense of helplessness in which the decision was made *for* them, not *by* them.

For example, Liam stated: “Academically, it was like ‘Well I don’t really have a choice.’ And then professionally it was like ‘Oh, I want to talk to people more.’”

Ash stated: “I decided to give up when I realised all the doors were shut…the combination of having no connections, being poor as shit, and being autistic and queer, the combination of those stacked against me. I just wasn’t able to overcome.”

Movement in STEM

We have also gained additional insights into what movement within the STEM ecosystem looks like for LGBT+ people. Many people who have participated in the study have moved from one sector of the broader STEM ecosystem to another.

For instance, **P13**, share their perspective on leaving a traditional engineering job in industry and finding a more fulfilling and inclusive STEM job as an engineering educator: “I don't really think I left STEM or at least I left the intersectional bit of STEM where it's like science and engineering and I went just to science. So I left the part of STEM that I didn't like and I landed in the part of STEM that I did like. I feel like I have more stronger relationships now that I'm in engineering education, in academia. It is a more welcoming space than industry is, I think.” This participant also expresses how the transition to education means a feeling of positive change and redemption, noting: “ I feel like my decision to leave professional engineering as it was... I don't know, maybe this sounds weird. I feel like I've had a lot of great opportunities to rewrite what had happened to me as a young engineer, where now I feel like I've really helped create a space here where what happened with me would be unthinkable now.”

Alex’s experience shows how people have moved from one industry to another where they can still employ their STEM skillset. She said, “So while it is somewhat STEM, the industry is I guess less STEM and more entertainment, instead of STEM-focused.” She indicated having been hired for the kind of work she did at her previous employers, but in this case her difference as a queer, neurodivergent person was welcomed and celebrated, and she felt, “I was able to fully maybe more focus on the work, and not necessarily how to try to fit in.”

We are unsure how these kinds of moves relate to the ways people respond to surveys that indicate attrition from STEM as these people responded to our call for participants because, to them, they left STEM in some fashion. Yet the factors that go into this decision-making appear similar whether someone moves into different parts of the STEM ecosystem or leaves STEM altogether. Defining this STEM ecosystem is important for policy, and

determining the value of performing STEM work or utilising STEM skills in settings outside of that ecosystem is also important to understand in setting policy.

Career Stages of Departure from STEM

One important element of departure we hoped to catch was the career stage at which people seemed likely to depart from STEM. For the most part, people seemed to depart around the graduate training stage or the early career stage, especially as they gained a more realistic picture of the climate and conditions they would experience working in STEM. Seven participants reported leaving during a graduate programme, and six more reported leaving upon completion of their graduate programmes. In most cases, it was a combination of the working conditions within a STEM lab and the LGBTQ climate in the department, mostly around discomfort with LGBTQ identities. Two participants reported leaving after completing a postdoctoral programme, with the reason being attributed to no longer having resources to support their science.Three participants changed at the undergraduate level, and one participant changed engineering programs between the undergraduate and graduate levels, the reasoning for which was attributed partly to the LGBT+ climate.

Seven participants left industry, especially their first placement or job in industry, with several deciding to return to academia and pursue a STEM discipline-based education programme. One person changed companies from an organisation with a poorer climate to one with a more supportive climate, and one participant moved several times between industry and academia, primarily in response to poor climate and working conditions. Three people had not left yet but were planning to leave, and all three are currently in industry.

The Role of National Context in Departure from STEM

Although our data are not completely representative of all LGBTQ people in STEM in both the US and the UK, our participants offered insights into the comparative role that national context plays in their decision-making around departure from STEM. In both countries, participants faced hostile and exclusionary environments at various stages in their careers, ranging from unsupportive graduate training experiences through hostile interactions with coworkers or supervisors in professional settings. Participants also wished for greater access to and visibility of LGBTQ role models within their fields to help them better envision how they can thrive in a STEM career. Mental health concerns, like high stress and burnout, were also common, especially at the graduate training level; these concerns then were compounded with experiences pertaining to the LGBTQ climate in STEM.

Our UK participants offered some insight into UK-specific factors that shape career trajectories into, through, and out of STEM fields. Foremost among these is the changing environment around immigration into the UK; a couple of our participants immigrated to the UK for a STEM academic program or career, and they noted that post-Brexit such movement is becoming far more difficult. A second important factor is the recent increase in public intolerance of trans people, coupled with the heightened visibility of so-called "gender criticalism" which has threatened to separate transgender, nonbinary, and gender nonconforming communities from lesbian, gay, bisexual, and queer communities. The UK response to COVID through lockdown played a significant role in many participants'

trajectories as several found themselves making decisions based on being isolated from others, trying to maintain a sense of mental well-being while dealing with the stressors of the pandemic. One innocuous difference between the US and the UK is the structure of PhD programs in particular; in the UK a PhD comprises solely research, so a couple participants found it easy to move into a PhD program as they were required to complete any prerequisite coursework in prior programs.

In the US context, then, the biggest difference is how widely the nation can vary state-by-state and region-by-region in terms of LGBTQ legal protections and access to services. Whereas the UK health system is nationalised through the NHS, the US system is a patchwork of private medical providers funded through public and private health insurance plans, and access to trans-affirming healthcare in particular varies by the state a person resides. As a result, participants described looking for career opportunities in places or with organisations where they knew they could access the healthcare they needed. Similarly, many participants described being cognisant of the broader political context within each state, with several choosing career opportunities in states with stronger LGBTQ protections or states with more positive attitudes toward LGBTQ people. Many found though that they were able to access the protections and services needed through their employers as frequently an employer's protections against discrimination and healthcare plans may be far more LGBTQ-friendly than the state or regional context. Participants did note that recent politicization of LGBTQ people, and transgender communities in particular, has increased their concerns about social, psychological, and physical safety in locations where anti-LGBTQ legislation is being enacted.

Research Products to Date

Hughes, B. E., Barker, C., & Smith, L. (2024). *Centering LGBT+ perspectives in STEM career decision-making* [Webinar presentation in the *LGBTQ+ in STEM: Using data to foster inclusion* series]. Royal Society of Chemistry.

Smith, L. M. R., Hughes, B. E., Vasconcelos, C. P., & Barker, C. (accepted). *What does this STEM from? Queer and trans voices in the decision to leave STEM programs and careers* [Paper presentation]. AERA Annual Meeting 2025, Denver, CO, USA.

Policy Implication and Recommendations

For the purposes of this report, we bulleted out some high-level implications related to each preliminary theme, along with recommendations for higher education providers, policymakers, employers and funders to improve the retention of LGBTQ+ people in STEM.

Implication of finding: **Compartmentalizing and Compromising**

- Primary implication here is that this process of keeping queer or trans identities out of STEM requires constant vigilance of one’s identity expression and surveillance of the working environment

- Compartmentalizing gender identity from STEM can mean compromising gender expression while in STEM environments, which can range from decisions about subtle ways one expresses trans or nonbinary identities all the way to delaying transition out of fear of employability in STEM
- Exerts additional psychological energy to engage in this practice, reduces cognitive resources to do STEM work

At a very basic level, higher education providers, policymakers, and employers need to make clear the protections people have around the expression of LGBT+ identities in work settings. Transgender, nonbinary, and gender nonconforming people specifically need assurance that expressing their gender identity in a work or learning environment will not lead to negative repercussions, and LGBQ people need assurance that speaking about their families or relationships will not as well.

Protection from discrimination is a bare minimum, however, and knowing that LGBT+ people are welcomed and celebrated in work environments helps alleviate the additional cognitive load that compartmentalizing demands. “Lowering one’s guard” in a classroom or workplace frees up cognitive resources to tend to the task at hand, leading to improved success and higher productivity. Funders may take special heed to consider how resources could be employed to better understand what an LGBT+ welcoming workplace looks like in STEM and the benefits that accrue to LGBT+ employees, as well as their cis-hetero colleagues, when implemented.

Implication of finding: **Conflicting Values and Purpose**

- Motivation to stay in STEM: am I doing something I value?

Many LGBT+ people were leaving STEM because the work they were performing conflicted with their values, especially since so much STEM work is related to defense or resource extraction and consumption. These participants cared about the ways STEM could be utilized to enhance sustainability or promote national and international cooperation. Higher education providers can help people in STEM degrees or majors to see the diversity of occupations they might pursue after completing a STEM degree, and policymakers might leverage this interest toward policy goals of sustainability and peace. Funders might consider how to align funding opportunities with these kinds of goals as another way of engaging the skills of LGBT+ STEM professionals toward projects they will be motivated to pursue.

Implication of finding: **LGBT in the Background**

- Queer and trans people in STEM have needs that are not directly related to being queer and trans, but being queer and trans can complicate or exacerbate these conditions
- Reminder not to think that LGBT+ people are only dealing with feeling included as an LGBT+ person

This finding is a preliminary theme toward unpacking the role that intersectionality plays in the lives of LGBT+ people in STEM. In many cases, participants were facing other kinds of barriers, especially those related to disability status and race or ethnicity, and the LGBT+ climate in STEM simply exacerbated their discontent with their learning or working conditions. Higher education providers, employers, policymakers, and funders who are

concerned with broadening the participation in STEM of people who have been historically excluded from STEM should be mindful of the ways that these social categories do not exist in isolation from others, and that multiple forms of marginalisation may lead to quantitatively and qualitatively different experiences than even singular forms of marginalisation.

Implication of finding: **Movement in STEM**

- Attrition from STEM is complex as the broader ecosystem that encompasses STEM does not have defined boundaries
- STEM skills are necessary in multiple settings and industries
- Most people leave at either the graduate training or first industry placement stage of their STEM careers

This project will have a significant impact for LGBT+ communities in STEM broadly. First, our study will help validate the experiences of LGBT+ people in STEM fields by revealing these unique experiences and struggles which may be welcome to other LGBT+ people feeling isolated or alone as they navigate STEM environments. Our results offer implications for different stakeholders who may be able to transform these environments to become more welcoming in turn.

With regard to universities, our results point to a need to help faculty learn how to be better mentors and supervisors for LGBT+ people and those with disabilities. Universities could implement training programs to enhance faculty awareness and support for these communities.

Our results indicate that workplaces need to pay closer attention to interpersonal relationships to make sure that colleagues can work across interpersonal differences and build the trust needed to work together effectively. Creating inclusive policies and fostering a supportive work culture are essential steps.

Legal protections must be put in place that offer LGBT+ students and workers a framework that protects their right to fully participate in the STEM field they have selected, including the right to express LGBT+ identities authentically. Governments should also collect demographic data that helps track inequities and attrition from STEM among LGBT+ people to be able to measure over time how legal and policy interventions shift these measures toward greater equity. However, this holds tension itself, as outlined in a 2023 report produced between stakeholders in the US and the UK (Coffield, et al., 2023).

Finally, the sociopolitical differences between the US and the UK also affect people's experiences. The UK tends to experience a bit more in-migration from other countries than the US, with some immigrants choosing to live in the UK for its better LGBT+ protections than other countries. To note, in 2024 the UK ranks 28th in the Equaldex (2024) ranking of LGBT+ rights, behind the US at 26, out of 196 countries ranked. The US experiences some immigration like this, but to a lesser extent, and people in the US experience a patchwork of legal protections that vary by state. These sociopolitical differences inform LGBT+ people's decision-making around leaving STEM, which is important for transnational cooperation and industry operating in both contexts. Additionally, the shifting landscape around immigration, influenced by Brexit and growing anti-immigration sentiments in both countries, further complicates the decision-making process for LGBT+ individuals in STEM.

Conclusions

This study uniquely considered the perspectives of individuals who identify as LGBT+ and who identify as having left STEM in some way, adding a distinct population and perspective to the literature exploring STEM students and professionals. The data yielded by these and future interviews will be used to create a model of LGBT+ career-decision making. Our goal is to have a product that is informative for policymakers, educational leaders, and funders to make decisions around directing resources toward policy and practice interventions that will improve the conditions for LGBT+ STEM professionals, aiding in their retention in these fields. We expect our research will help uncover systemic barriers and inequities as well as other challenges that should be the target of policymaking to foster broader participation in STEM. Broadening participation among LGBT+ people in STEM fields benefits not only the individuals involved but also society as a whole. Diversity of perspectives improves innovation and enhances the development of more effective solutions to complex problems. Inclusivity in the workplace also creates more supportive and welcoming environments, empowering LGBT+ individuals to fulfil their personal potential.

One important next step in this research is to complete our proposed latent class analysis to test our findings with a larger set of participants. Our second goal had been to take the factors identified in the first stage of the project to see if individual factors, or sets of factors, emerged as discernible patterns to help explain the pathways out of STEM taken by LGBT+ people. These patterns could point to salient predictors of attrition that could be the focus of future policy or funding, especially if they unveiled systemic reasons underpinning attrition from STEM.

A second next step would be to better understand what people who have left STEM, both LGBT+ and not, are currently engaged in. Training in STEM is not a monolithic experience, and all people have a multitude of skills and interests that drive the decisions they make about how they build their careers. The STEM ecosystem may be less clearly defined than the way it is articulated in policy and research, and many different industries could benefit from STEM skills and training beyond those most recognizably defined as “STEM.” A more comprehensive understanding of this ecosystem could shape policy in a manner that includes sectors of national economies, like in the US and UK, outside of traditional STEM fields which also benefit from STEM skillsets. Economic development likely encompasses a wider variety of industries than just STEM, and such an approach could offer a more complex view.

Finally, the thrust behind this project funding mechanism was to improve cooperation between the US and the UK in understanding LGBT+ attrition from STEM through lessons learned from each other in this endeavor. Yet both countries are facing sociopolitical conditions that have kept LGBT+ people and experience politicised in a manner which is harming people in both countries. STEM fields strive to remain apolitical and detached from political debates, but this politicisation is a reminder that STEM is a social system, and, as such, cannot shy away from these controversies. What impact is this politicisation having on STEM, and what do STEM fields stand to gain from acknowledging this impact? Science communication in particular plays a tremendous role in the power of science to inform public policy, and perhaps better understanding why STEM fields value inclusion and diversity through clear and compelling communication with the public may be important to making inclusion less controversial and more celebrated.

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Appendix

Appendix I: Demographics Tables

Country of residence		Nationality		STEM Field		Years in Field		First generation at Uni	
UK	8	Of Colour	8	Biological science	7	0-5	8	yes	12
US	24	White	24	Physical science	4	6-10	12	no	18
				Computer science	4	11-15	9		
				Engineering	14	16+	3		
				Other STEM	3				

Age		Gender		Sexuality		Religious		Disability**	
20-24	2	Agender, nonbinary, genderqueer	12	Asexual spectrum	3	Yes	9	Physical disability or chronic illness	6
25-29	10	Man (incl 3 trans men)	14	Bisexual or pansexual	8	No or atheist/ agnostic	13	disability or neurodiversity	11
30-34	9	Woman	6	Queer*	12			No	10
35-39	6			Gay or lesbian	9				
40+	5								

Note. N=32, though some columns do not add up to 32 where participants left spaces blank.
*Several participants who indicated a queer sexual orientation also included a second label.
**Some participants shared multiple forms of disability with us; five left this space blank.

Appendix II: Recruitment Flyer with QR Code

Appendix III: Centering LGBT+ Perspectives in STEM: Screening Questionnaire

Start of Block: Default Question Block

Q1 Hi friends! Thank you for agreeing to participate in our study. In this questionnaire, we will ask several questions about how you identify. The purpose of these questions are to help the research team ensure that our work represents individuals across different STEM fields, gender identities, and sexual identities. We will also ask how you identify racially and ethnically to ensure we represent the intersectionality of these identities. We ask that you provide your name and contact information only so we can reach out to schedule an interview

Start of Block: Contact

Q2 Please provide your first and last name.

Q3 Please provide your email address and telephone number.

Phone (1) _____
Email (2) _____

Q4 How would you prefer to be contacted regarding future participation in an interview with our team.

Email (1)
Phone or WhatsApp text message (2)
Phone or WhatsApp call (3)

Q5 Where do you primarily reside?

United Kingdom (1)
United States (2)

Q6 What is your age?

Start of Block: SOGI

Q7 What is your sex (as assigned at birth on your original birth certificate)? Note: A question about gender identity will follow.

Female (1)
Male (2)
Prefer not to say (3)

Q8 How do you currently describe yourself? Please select all that apply.

Female (1)
Male (2)
Transgender (3)
I use a different term (4)

Q9 To confirm, you were assigned ${Q7/ChoiceGroup/SelectedChoices} at birth and now describe yourself as ${Q8/ChoiceGroup/SelectedChoices}. Is that correct?

Yes (1)
No (2)

Q10 Which of the following best represents how you think of yourself?

Gay (1)
Lesbian (2)
Straight (3)
Bisexual (4)
I don't know (5)
I use a different term (6) _____

Start of Block: Disability/Impair

Q14 Do you consider yourself to have a disability or long-term condition (such as dyslexia, diabetes, arthritis, a heart condition, or a mental health condition)?

Yes (1)
No (2)
Prefer not to say (3)

Q15 Do you experience barriers or limitations in your day-to-day activities related to any disability, health conditions, or impairments?

Not applicable (1)
No (2)
Yes (3)
Prefer not to say (4)

Q16 Which option best describes what type of barriers or limitations you face?

I have a social/communication impairment, such as an Autism spectrum condition. (1)
I am blind/have a serious visual impairment uncorrected by glasses. (2)
I am deaf/have a serious hearing impairment. (3)
I have a longstanding illness or health condition such as cancer, HIV, diabetes, chronic heart disease, or epilepsy. (4)
I have a mental health condition such as depression, schizophrenia, or anxiety disorder. (5)
I have a specific learning difficulty such as dyslexia, dyspraxia, or AD(H)D. (6)
I have a physical impairment or mobility issues, such as difficulty using my arms or using a wheelchair or crutches (7)
Prefer not to say (8)
Other impairment not listed above (please describe) (9)

Start of Block: Block 3

Race/Eth/Origin Which of the following categories best describe you?

American Indian or Alaska Native(Eg: Navajo nation, Blackfeet tribe, Mayan, Aztec, Native Village or Barrow Inupiat Traditional Government, Nome Eskimo Community, etc) (1)
Asian (Eg: Chinese, Filipino, Asian Indian, Vietnamese, Korean, Japanese, etc) (2)
Black or African American (Eg: African American, Jamaican, Haitian, Nigerian, Ethiopian, Somalian, etc) (3)
Hispanic, Latino or Spanish origin (Eg: Mexican or Mexican American, Puerto Rican, Cuban, Salvadoran, Dominican, Colombian, etc) (4)
Middle Eastern or North African (Eg: Lebanese, Iranian, Egyptian, Syrian, Moroccan, Algerian, etc) (5)
Native Hawaiian or Other Pacific Islander (Eg: Native Hawaiian, Samoan, Chamorro, Tongan, Fijian, etc) (6)
White (Eg: German, Irish, English, Italian, Polish, French, etc) (7)
Some other race, ethnicity, or origin (8)

Start of Block: STEM

Q12 Which STEM field did you or do you work in primarily?

Astronomy (1)
Biology (2)
Chemistry (3)
Computer Science (4)
Engineering (5)
Earth Sciences (6)
Health Sciences (7)
Information Technology (8)
Mathematics (9)
Physics (10)
Other STEM Field (Please Specify) (11)

Q13 Which specific discipline within {Q12/ChoiceGroup/SelectedChoices} are you most aligned with?

End of Survey

Appendix IV: Interview Protocol

Semi-Structured Interview Protocol

Introduction and consent:

a. Thank you for participating
b. Purpose of this study: understand how queer and trans people decide to leave STEM fields
c. Information collected for research purposes only
d. Interview will be recorded, please speak loud and clearly
    i. Can pause recorder for “off the record” comments
e. Interview should last 60-90 minutes
f. Confidentiality will be protected in writing up findings
g. Especially interested in examples and stories to help illustrate statements
h. Do you have questions about the study?
i. Do you consent to participate in the study?
j. What would you like to use as a pseudonym as reference to you in the study?
k. Additional Demographic Questions Sheet

Interview questions:

1. Tell me about yourself.
2. What STEM field did you pursue?
3. What interested you in [field] initially?
4. What was it like for you to enter that [field]?
    a. (probe role of [any] identity in the process)
    b. [consider asking about coming out, if relevant]
5. What was the environment like for you in [field]?
    a. Learning environment, or STEM department
    b. Work environment
    c. Emotionally? How did you feel in these environments?
    d. Socially? What were your relationships like with others in these environments?
6. Tell me the story about the process of deciding to leave [field]? (Or, how did you decide to leave [field]?)
    a. It might be useful to first ask what the participant meant by “leaving STEM” to help contextualize this question.
    b. What would you say were the most important factors in your decision?
7. What role did any identities you hold play, if at all, in your decision-making process?
8. What did you decide to do after leaving [field]?
    a. How does this environment compare to the STEM environment you left?

Appendix V: Demographic Questionnaire

Please complete the following questionnaire. Do not write any specifically identifying information, such as a name, birthdate, or contact information, on this form. What you provide is completely voluntary; please leave any spaces blank for information you do not want to provide us. We are happy to answer any questions you have about the data we are collecting. This data will help us develop a demographic profile of our study sample as well as identify points of contrast within the sample to compare interview themes.

Which STEM field did you work or study in?

How many years were you in STEM?

What is your gender identity?

What is your sexual orientation?

What is your racial or ethnic background?

Do you have a disability or long-term condition, or do you experience barriers or limitations in your day-to-day activities? How would you describe your disability?

What is your age?

What is your religion or strongly held belief, if any?

If you have a college degree, were you the first in your family to earn a degree?

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