Behind Closed Doors: The Untold Challenges of Transgender and Nonbinary Graduate Students in Chemistry

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Abstract

Transgender, nonbinary, two spirit, and gender-expansive students are marginalized in higher education and have significantly different college experiences than their cisgender peers. Through in-depth interviews, this research illuminates the nuanced experiences of transgender students navigating academia in chemistry graduate programs, revealing the disparities between institutional rhetoric and tangible support. From grappling with the absence of inclusive policies to the burdens of advocating for institutional change, participants confronted systemic barriers that impeded their academic and personal growth. This study underscores the imperative for transparent and proactive support structures within academic departments to foster an environment where transgender and nonbinary individuals can thrive. As the political landscape intensifies with escalating threats to transgender rights, this research serves as a clarion call for academia to confront and ameliorate the challenges faced by marginalized populations in STEM fields.

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Introduction

Transgender, nonbinary, two spirit, and gender-expansive students (herein referred to by the umbrella term *trans* students) are marginalized in higher education and have significantly different college experiences than their cisgender peers.[1] Furthermore, science, technology, engineering, and mathematics (STEM) academic communities, including chemistry, are known to be less diverse than other disciplines due to oppressive learning and working environments, especially along dimensions of gender, race, and disability.[2–6] Most work aiming to characterize or ameliorate systemic issues thus far has focused on marginalized identities that are easily measurable. Because trans identities are not obviously apparent and must be disclosed by individual people, current research often makes trans people invisible or deliberately excludes them.[7–10] Furthermore, collecting data about trans experiences carries potential danger posed by rapidly changing, hostile environments, requiring nuanced approaches that prioritize both understanding and safeguarding participants' privacy.

The erasure of trans voices is reflected not only in the amount of research published regarding LGBTQ+ people in STEM, but also on the lack of data in the workforce. The *Exploring the Workplace for LGBT+ Physical Sciences* report identified a systemic problem in physical sciences which culminates in LGBTQ+ people leaving the field, with 28% of LGBTQ+ and 50% of trans participants having considered leaving STEM due to hostile workplace climates.[11] In the US, the National Center for Science and Education Statistics does not currently collect data on LGBTQ+ identities, though they plan to begin doing so in 2025.[12] However, quantitative endpoint data will not be useful without understanding the experiences and barriers trans students face because quantitative methods are not equipped to provide this contextualizing information. Without community input and building trust, we create unreliable data that are incapable of empowering LGBTQ+ people. In addition, the centering of white cisgender women in STEM within quantitative studies due to sample sizes omits the experiences of Black, indigenous, and people of color (BIPOC) and erases trans and nonbinary people.[9,13] Therefore, examining the specifics of how students make sense of their trans identities and their scientific identities is an important endeavor for understanding their decision-making process regarding STEM careers.

In this project we chose to focus on the critical transition moment between college and graduate school. We hypothesize that there are distinct factors that trans STEM students must weigh in their decisions to move forward into graduate school which are of low or no concern to their cisgender peers. These barriers may be a significant contributor to retention and success in STEM. We expect that these barriers manifest differently when compounded by other systems of hegemonic power, especially when racialized.[14–18] This research aims to co-create trans-informed counterstories about the graduate application process and subsequent lived experience in chemistry graduate departments. These counterstories will be followed with specific policy suggestions on how to improve the application process, departmental environment, and faculty mentoring.

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STEM Culture and Epistemological Border Crossing

Marginalization of trans students in chemistry is heightened by STEM discipline cultural ideologies that falsely define their knowledge domains as purely technical, apolitical, asocial, and meritocratic, rendering scientists' personal identities as irrelevant to their scientific work.[19,20] However, science is a social project and failure to confront trans oppressive norms in STEM culture leads to the replication and reinforcement of transphobia, gender binarism, and gender essentialist beliefs.[21] In practice, these assumptions about the proclaimed neutrality of STEM enforce a cisheteronormative culture that has been likened to "don't ask, don't tell," where LGBTQ+ scientists are made invisible or actively excluded.[19,22–24] Reports in both popular media and scholarship have described a climate in chemistry that expects LGBTQ+ people to stay closeted, separate their queerness/transness from their scientific work, and accept a steady beating drum of microaggressions to remain in the field.[11,23,25–28]

Furthermore, STEM students are socialized into reproducing these ideologies as part of the process of "becoming" a STEM professional through official pedagogical materials, institutional policies, and interactions with faculty and peers.[20,29,30] Miller and coauthors reported a pervasive "dude/bro culture" in STEM departments that "assumed heterosexuality and prized masculinity."[31] Queer and trans students in their study were forced to weigh the social rewards and consequences of participating in, resiting, or blending into the cisheteronormative culture in STEM, with some participants even excusing these norms as an apparent coping mechanism. In a recent report by Chan and Stewart about the experiences of two nonbinary undergraduate chemistry students, participants felt pressure to downplay their trans identities in chemistry spaces and "perform a gender that their colleagues will accept" to protect their psychological safety and to align with the cisnormative expectations of their peers, instructors, and mentors.[32] One participant commented that they believed their chemistry peers viewed basic education about trans identities as "more of a liberal arts kind of matter," leading to discomfort with the participant's existence in chemistry spaces. In Goldberg and coauthors' investigation into trans students' deliberations in choosing a graduate program, the researchers described a similar hostility: participants in STEM "simply could not prioritize program climate because their field was not LGBTQ-informed or savvy."[33] Another study comparing the experiences of trans graduate students being misgendered in the natural sciences (*n*=118) versus the social sciences (*n*=127) found that nearly half (46%) of participants in the natural sciences were chronically misgendered compared with 18% in the social sciences, indicating a significantly more hostile educational environment.[29]

Epistemological border crossing refers to the tension marginalized students experience while trying to reconcile their science identities with the social identities that they consider fundamentals to their being. Professional culture is one factor that makes the negotiation between trans students' identities as scientists and identities as trans people difficult to reconcile. This lack of "border crossing," or resolution of the conflict, is reflected in the few studies available in the literature. In the same report by Chan and Stewart, the two participants discussed tension between their identities as chemists and as nonbinary people.[32] One participant "wanted to enjoy chemistry more and loved what they were learning," but decided to

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leave the field after graduation because of an unwelcoming professional culture that made them "feel like I'm not supposed to be here." These experiences signal that the transition from undergraduate education to graduate school is an important juncture for trans students, during which they must decide whether staying in STEM is worth the possibility of experiencing erasure and marginalization. The present study is a critical contribution to our understanding of the impacts of STEM culture generally and has implications for policy development regarding the retention of trans students.

Methodology

Design and Participant Recruitment

To investigate barriers and supports that trans graduate students in chemistry experience, we decided on two eligibility criteria for participation. Participants should 1) be current doctoral students in chemistry departments who have not yet defended their PhD dissertations, and 2) self-identify as part of the trans community. We felt it was important to inform potential participants of our expansive usage of the term *trans*, making it clear that a wide range of gender experiences were welcomed. Disclosure of trans identities to other people in the students' personal and/or professional lives was not a requirement for participation (how "out" or "stealth" a trans person navigates the world). We also wanted students who are exploring their gender identities ("gender-questioning") to feel empowered to share their perspectives. Recognizing that language describing transness is imperfect, we chose to communicate our understanding of the term *trans* to potential participants through the following statement in our recruitment announcement:

> *We use the term "trans" as a broad umbrella for all people whose gender identity and/or gender expression differs from from what is culturally assigned, including (but not limited to) identities like transgender, nonbinary, genderqueer, agender, gender fluid, multigender, two spirit, and beyond. We welcome transfolk to participate regardless of how out, stealth, or currently gender-questioning they are in their personal and/or professional lives.*

Participants were recruited by circulating an interest form in Qualtrics through chemistry-specific LGBTQ+ email lists. Thirteen interested students contacted the research team about participation. Due to scheduling availability, ten participants were recruited to participate in one of three group interview sessions. Participants completed a 90 minute group interview over Zoom (in groups of 3 or 4) and completed a brief exit survey in Qualtrics. Participants were instructed to choose a pseudonym for themselves to use in the interview and survey. Audio was the only source used for the purposes of transcription and any potentially identifying information was redacted from the interview transcripts before analysis.

Limited demographic data were collected in the exit survey: only the participants' pseudonyms, self-described pronouns and gender identities, and approximate graduate program institution

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size were recorded (Table 1). While we would have liked to include other demographic information, such as the participants' racial and ethnic identities, the research team felt the risk of participant exposure would be too high. We want to acknowledge that gender identity does not exist in isolation: trans people conceptualize their genders through the lenses of race, ethnicity, and other salient identities.[34–37] Additionally, trans people who are multiply marginalized face unique barriers which require intentional consideration when designing interventions and support systems for students.[15,38,39]

Table 1. Profiles of Study Participants

Interview Group	Pseudonym	Self-Described Pronouns	Self-Described Gender	Graduate Institution Enrollment Size
Group 1	Cameron	they	nonbinary	Large (more than 30,000 students)
Group 1	Jack	he or they	transmasc	Large (more than 30,000 students)
Group 1	Kayden	they	nonbinary, genderfluid, transmasc	Small (fewer than 5,000 students)
Group 2	Anna	she	trans female	Medium (15,001 - 30,000 students)
Group 2	Eris	they	nonbinary, transfemme	Haven't chosen a school yet
Group 2	Nat	they or she	nonbinary, transfemme	Large (more than 30,000 students)
Group 3	Alex	she or they	transfemme, genderfluid	Small (fewer than 5,000 students)
Group 3	Farren	he or they	trans man	Large (more than 30,000 students)
Group 3	Indigo	she	trans woman	Medium (15,001 - 30,000 students)
Group 3	Theo	she or sie/hir/hirs	genderfluid, genderqueer	Large (more than 30,000 students)

Group Interview Procedure

We chose a semi-structured group interview procedure based on Sista Circles, a methodology rooted in Black feminism for the collective building of counterstories.[40–42] In Sista Circles, participants actively engage as co-constructors in the research process, mitigating power dynamics. Counter-storytelling centers participant empowerment and interrogates existing

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systems of power by drawing on lived encounters with oppression. It's crucial to emphasize that Sista Circles shouldn't be misconstrued as merely a different name for a focus group. In this methodology, the act of sharing stories serves as both a means of data collection and as a platform for fostering supportive group dynamics to build community.

This rationale guided our use of a semi-structured interview protocol, encompassing questions vital to our research objectives while allowing participants to lead discussions towards topics relevant to our research questions. The facilitators offered starting prompts and the participants drew attention to experiences they felt were important to share; as such, the conversations in each of the three group sessions addressed our research questions, but did not strictly respond to the same topics. Participants were not required to turn their Zoom cameras on, but most chose to share their video anyway. We paid special attention to observe when participants reacted to other speakers (e.g. nodded, snapped fingers, rolled eyes) and we encouraged deeper discussion in these moments. To foster an environment where participants felt comfortable sharing their stories, the data collection process was solely facilitated by members of the research team who identified as trans, promoting a space of shared lived experiences and trust. Although we did not use responses from the research team members as data for analysis, the two facilitators also shared personal stories with the group to make the conversation reciprocal and challenge the researcher/subject extractive dynamic.

Reflexive Thematic Analysis

Reflexive thematic analysis (RTA) is an interpretative qualitative method. We chose this approach for three reasons: 1) We wanted to avoid coding processes that center qualitative reliability, 2) We did not have preexisting ideas about codes or themes before data collection, and 3) We believed our identities as members of the LGBTQ+ community should not be left at the door when analyzing data or synthesizing findings. In order to conduct RTA, one must have four orientations within the data: a theoretically driven approach to analysis (deductive), a focus on understanding the meaning behind the surface of the data (latent), a critical theoretical framing, and a focus on the social construction of meaning.

Reflexivity Statements

The first step in RTA is the acknowledgement that the researcher’s position, identity, and contribution is an integral part of the analysis process. The "reflexive" component of RTA involves drawing on the researcher's preexisting knowledge and relationships to critically interrogate how our position in the world influences our understanding of the data. For that reason we first present here the reflexivity/positionality statements of the research team:

Nolan

Michelle (any/all) is white, queer, and genderqueer. After completing my PhD in chemistry, I left the field and became a chemistry librarian. I have remained active in LGBTQ+ chemistry affinity groups and I have served as an LGBTQ+ policy advisor in the field. I am a grassroots community organizer and I have lived experience with the research topic. I am also a lifelong

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resident of arguably the most trans-hostile state in the US and I experienced the recent reactionary political shift firsthand while working on this project. As a white academic with US citizenship, Isaac and Paulette held me accountable for ensuring my privileges were not projected on the data during analysis.

Blythe

Isaac (they/he) is queer and trans. I am also an inorganic chemist and I was a graduate student at the time of initial data collection and analysis. As such, I am part of the demographic being studied in this work and have first hand knowledge of many of the experiences described by participants. Due to the population size of "out" trans chemistry graduate students in the US and the method of participant recruitment, I know many of the participants and was held accountable for not bringing this external knowledge into the analysis by Michelle and Paulette.

Vincent-Ruz

Paulette identifies as a queer latine cis woman of color. I was born and raised in Mexico City. English is my second language, and I have an accent when I speak English. As the only cis member of the research group I acknowledge that I have participated in trans erasure and oppression in my past research related to "Gender and STEM." I was not part of any of the interviews as I wanted to make sure my presence didn't disrupt the safe space created for participants to share their stories. Furthermore, I was held accountable by Michelle and Isaac on not bringing my biased cis perspective or on trying to unconsciously impose a binary analysis in our data.

We want to further emphasize how our team believes that research about trans people that is not community informed is by definition extractive. We echo Jourian and Nicolazzo's call for research to be performed *with* trans participants, rather than *on* trans participants.[43] Our team has lived experience with the subject matter and our methodology allows participants to have agency over their stories.

Phase 1: Familiarization

The goal of familiarization is to become deeply engaged with and cognizant of the data. We implemented a structured approach, beginning with writing analytical memos after each interview and then individually reflecting on the transcripts. Following individual reflection, we convened as a group to discuss salient points aligning with our experiences and any surprising discoveries. We incorporated insightful questions suggested by Braun & Clarke,[44] such as "What kind of world is 'revealed' through their account?," "Why might I be reacting to the data in this way?", and "What assumptions do they make in describing the world?" These questions served as valuable prompts, guiding our deeper exploration of the data and enhancing our understanding.

Phase 2: Coding

Coding entails a systematic review of the data, meticulously seeking out segments that are intriguing, pertinent, or thought-provoking in relation to the research questions. Concise

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descriptions (codes) are then assigned to these segments. This process, as described by Braun & Clarke (p.64), is inherently exploratory.[44] Our approach began with *in vivo* coding accompanied by group discussions to establish definitions for each code. Subsequently, we embarked upon three rounds of coding, interspersed with breaks for reflection and team deliberation. Through this iterative process, we reached a consensus on the codes that best encapsulated the participants' narratives. Our coding decisions were also influenced by our lived experiences as members of the LGBTQ+ community. We drew upon these experiences to enrich our understanding of the data, particularly in discerning how the narratives resonated with our own encounters with oppression.

Phase 3: Generating Themes

In this phase, we engaged in clustering the identified codes to uncover shared meanings and synthesize them into greater themes, particularly focusing on their relevance to our research questions. Through multiple discussions, we reviewed and refined these themes. This iterative process allowed us to highlight the nuanced ways in which trans students navigate decisions concerning graduate school. Our aim was to demonstrate the intricacies of their experiences. We ensured that the selected themes both addressed our research question and provided insights to inform best practices aimed at transforming institutions to better support trans students through their graduate education. Five themes are presented below, which we chose to title in the participants' own words.

Results and Discussion

"I Just Hedged My Bets": Calculated Risks in Choosing a Chemistry Graduate Program

> *I had a hard time because a lot of the places that I applied, I didn't know anyone there. And like, I hadn't been there, obviously. So I kind of just hedged my bets.* -Kayden

In all of the group interviews, the participants described making calculated tradeoffs in academic and non-academic factors when considering graduate programs. This arduous evaluation process weighed many factors that their cisgender peers largely did not need to consider. The majority of the students undertook extensive research about state, local, and institutional LGBTQ+ policies, geographic location, trans community presence at local and institutional levels, gender-affirming healthcare access, personal contacts, and other LGBTQ+ support systems before they considered submitting applications to chemistry doctoral programs. There was a recurring narrative during the group interviews about how the only way to truly know how "trans friendly" a place will be is to live there personally or know another trans person who lives there, neither of which were feasible for most prospective institutions. The best that the participants could do was gather as much information as they could and "hedge [their] bets" about where they would most likely succeed as graduate students.

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The specific variables participants weighed in their decision-making process is included in the Supplemental Information. However, we do not want to lose sight of the larger issue by hyperfocusing on the specific factors participants considered: these students were trying to gauge whether they could survive and thrive as trans people at an institution based on limited or unspoken information. Herein, we will discuss the trends we observed about *how* the participants hedged their bets and the factors outside their control which made the process so difficult.

The participants' decisions were consequential in ways unique to the trans experience because life-altering conditions (e.g. medical autonomy, queer community networks) were weaved with the factors all new graduate students must consider (e.g. university resources, future research agenda). Complicating the situation, many participants had no avenues through which to ask essential questions for their evaluation process without disclosing their trans identities ("outing" themselves) to other people, which caused "turmoil" for some participants. Hedging bets was a source of distress because ultimately the participants "wouldn't be able to tell for sure if it was a [trans] friendly campus" and could not ensure their safety at an institution before committing. Sometimes, policies about health insurance coverage, restroom access, or campus LGBTQ resource centers were unavailable or unreasonably difficult to locate. Whether a deliberate choice by the institution or not, the absence of information about trans needs sent the participants a message about the school's priorities and who "belongs" on campus, with one participant saying "if you can't find that on school website, it's probably not going to be a good school in general for anything." Prospective departmental climate could only be assessed through "academic whisper networks," where the students relied on "word of mouth" endorsements or warnings from their undergraduate mentors, current graduate students in prospective departments, and other personal contacts for advice. The participants described having to read "between the lines" to gauge whether a department would be supportive of their trans identities, usually from online information, departmental communications, or campus visits. For Kayden, a nonbinary, genderfluid, transmasculine person, their ultimate decision on where to enroll came down to "vibes" and determining "a certain level of 'I'm not going to get beat up'" at their institution.

When the research team asked participants whether any prospective departments or individual professors proactively gave indicators of trans support, examples were slim. The only participant who experienced a meaningful show of support was Anna, a trans woman who had already developed a relationship with a future PI whom she trusted to be her advocate. Some participants (n=3) noticed when faculty provided their pronouns in email signatures or Zoom names, which the participants interpreted as a positive sign. However, we believe those who mentioned disclosed pronouns in email signatures were stretching to find any indicator of support in the absence of explicit information. A meaningful indicator of trans support would have been departmental representatives expressly providing campus resources and information related to the trans experience. In this case, the paucity of evidence in the interviews was an important observation to the research team. Indigo, a trans woman, offered a similar observation when thinking back on her entry to graduate school: for her, the absence of

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information about diversity, equity, and inclusion (DEI) efforts from a department should have been an unspoken signal of hostility.

> *If I was to give advice to people that are coming into graduate school from what I know, basically, if they don't say anything about it [DEI] at all, then you should stay away. If they say something, then I can't tell you whether or not to stay away or not. [...] But if they don't say anything about the diversity at all, then don't go there.* -Indigo

Participants' impressions of trans acceptance were implicitly associated with geographic locations: almost all of the participants (*n*=9) discussed location as a high or highest priority factor in comparing graduate programs. However, we observed that location was largely discussed as a proxy for other priorities, including political climate, bodily safety, and existence of local trans communities. The consideration about location must be understood against a backdrop of increasingly hostile legislation targeting trans people in the US.[45] That is, students are not only hedging bets on campus climate, but also on whether the future legislative environment will constrict their freedoms during graduate school.[46–49] One participant exemplifying these concerns pointed to specific legislation as a major cause of distress during the graduate school application process. Jack, a transmasculine person who is a "from a northern place, now living in a southern place," shared that he had one acceptance offer in a state where legislation limiting trans people's access to public restrooms was under consideration during his admissions process.

> *At the time, the state that I was going to be moving to was proposing bathroom bills. And literally the legislation was happening the same like week or two after visitation weekend. And so it was just kind of that awkward time, and then it died in committee a week before I was supposed to start there. So it was just kind of in general an internally tumultuous time. That wasn't going to be something that anyone would be able to answer except for the state government. And so that was just kind of looming in the back of my head. Is this actually going to affect me?* - Jack

Without information about trans support in a prospective department, the participants were forced to rely on cultural narratives about location to make their best judgment calls (e.g. liberal US states are more accepting, large cities are more diverse, the US South is more trans antagonistic). They assumed that the climate and politics of an institution would reflect those of the surrounding area and they applied to institutions in "friendly" geographic regions. Several participants felt resigned to the fact that there would be limited or non-existent trans community inside prospective chemistry departments, leading them to prioritize locations where they hoped to find a critical mass of trans people external to the university. In retrospect, two participants called their past selves "naive" for believing these narratives about location because they did eventually face hostility in their graduate programs, even in "accepting" places. For example, Indigo put all other factors aside and applied to institutions in seemingly "friendly" areas that she "somewhat naively" assumed would be trans supportive.

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I had come out a year before and I had not pursued any medical transition options yet. I had looked into it, but being from the rural south, I ran into many roadblocks in trying to get that. So I had not yet started. So one of the big things on my mind was how easily it would be to medically transition. And so I applied to schools, probably somewhat naively, based upon where trans people seemed to be very accepted. So I applied to some schools in [US west coast]. I had some other schools in mind that I decided not to apply to because they were geographically located also in the south or the southeast. I had a school in Texas that I was really interested in, and I did not apply because I did not want to be in Texas. -Indigo

In contrast to prevailing advice on choosing a graduate program,[50] a minority (n=4) of the ten participants discussed their future research agenda as a factor that influenced decisions. When chemistry research areas were raised, it was always in combination with other weighted factors (e.g. location, mentor suggestion) and research agenda was not considered the highest priority for any participant. We observed that future research was only discussed in a way that prioritized supportive and trans inclusive doctoral advisors, rather than research interest in isolation. The relatively low attention given to doctoral research agenda demonstrated that for trans students, non-academic factors are often more important for choosing a graduate program than academic factors. Overall, the students lamented that they could not truly know what conditions of support or oppression they would face wherever they chose to study. Similar to the recent findings of Goldberg and coauthors, our conversations with the participants demonstrated that "for trans students specifically, there is no 'perfect school.'"[33]

"I Feel I Live Two Lives": Compartmentalization and Negotiating Outness

It's very alienating. I feel I live two lives, my queer life out of lab and then my life in lab, which I hate a lot. -Alex

While applying to graduate school and acclimating to new departments, participants navigated a complicated border crossing negotiation regarding the presentation of their trans identities. Weighing whether to come out as trans, with whom to share their identities, and when to have these coming out conversations were questions to approach with utmost care, especially for those who felt isolated as "the only one" in their chemistry programs. This tension was especially salient for the nonbinary participants, who experience coming out as a constant process of conversation with no true arrival at "being out" because "every time that you meet someone new, you have to come out and put yourself at risk." Connection to other trans people was essential for students to feel like they had a community where they could be their authentic selves. Conversely, the absence of fellow trans students left participants feeling alienated, isolated, and as if they live "two lives" inside versus outside the academy. Throughout their graduate education, many of the participants were made to feel like their identities as trans people were invisible or irrelevant to their identities as chemists, which further enforced compartmentalization of their transness outside of chemistry spaces.

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Participants first needed to negotiate whether to disclose their trans identities in the written graduate school application. The data intake consequences of these applications are discussed in depth in the following theme ("Decide Your Own Level of Outness"), but the philosophical question regarding whether to authentically present their gender identities in the application was an underlying issue that affected the majority of the participants (all but one who identified as trans at the time of application, *n*=7). Some of the participants did not want to reveal their transness at the written application stage for a variety of reasons, including that it was too personal to reveal in a professional statement. Others were afraid that conscious or subconscious discrimination from graduate admission committees would place increased scrutiny on their application materials if they revealed their trans status, similar to sentiments reported by trans jobseekers.[51] Even Eris, a nonbinary transfemme who described themselves as "very vocally out," and generally prefers "the sledgehammer approach" to asserting her transness, felt pressured to represent herself in a way that was more palatable to the presumed cisgender evaluators of their application.

> *I had to have a very internal conversation with myself, and maybe some other people I know who are my advocates, on whether I should use she/her pronouns or they/them pronouns in my application materials. Specifically, in my letters of recommendation. I was tempted to ask them to change pronouns every other sentence, but I was advised that would probably not look great. So I did not instruct my letter writers to do that. I think I defaulted to she/her pronouns because I didn't want the potential for an old man reading my application to subconsciously or consciously judge my application based on the merits of what pronouns I use. [...] It was a source of incredible turmoil, deciding whether to censor my identity or whether to express my identity because of the potential for impropriety in application judging.* -Eris

Eris's thought process reflected what scholars have termed "covering," in which members of an oppressed group feel obligated to downplay what is perceived as a negative trait in order to emulate or assimilate into dominant norms, behaviors, and expectations.[52] As Nicolazzo has described, trans people may feel "compelled" to partially or fully cover their transness in response to "perceived or real threat" in an environment, responding to trans oppression with self-censorship.[1] Eris wanted to authentically express their identity through varying usage of *she* and *they* pronouns, but because the nature of nonbinary identity is unintelligible to many cisgender people,[53,54] she felt obligated to compromise on using one set of gendered pronouns against her wishes. Others chose to cover their trans identities entirely, including Kayden, who said they "talked about things other than being trans" in their personal statements because "they were just safer topics" to disclose. Without knowledge of who would be judging their application materials, Kayden found the risk of discrimination to outweigh their desire for authentic expression.

What Eris called "incredible turmoil" about describing her identity resonated with other participants, including Alex, a genderfluid transfemme. Alex approached the graduate application as a kind of litmus test for prospective institutions, believing that if she was

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forthcoming about her trans identity and was still accepted, then those departments must be somewhat welcoming to trans people. This strategy was similarly observed by Goldberg and coauthors, who found that some trans graduate students used being out in their written statements as “a way to effectively ‘weed out’ potentially invalidating environments.”[33] However, the process of doing so was still painful for Alex because she was personally exploring her understanding of gender and pronoun choices. Finding a way to articulate their identity was challenging, but Alex felt that it was necessary to ensure their department would “see me as a person” instead of “just a chemist on a bench.” For Alex, being a trans person and being a chemist were inseparable parts of their identity which both needed to be acknowledged.

> *The fact that I had to explain my identity in each application was very hard for me. It was like, I had to apply for a school, talk about myself, but I don't know who I am. It was so hard, and trying to choose pronouns, it was a mess. I didn't like that. [...] It did make me feel uncomfortable. It was really bad. But I told myself that I had to be as open as possible just so that I make sure if they pick me, they know who I am already. Which was hard for me to accept it and go through it while writing, but I think it did pay off in the end.* -Alex

Beyond personal statements in the written applications, many institutions also required diversity statements in various forms. Several of the participants struggled with writing these statements because the rationale behind the diversity statement was unclear and many felt that discussing their trans identities would be misunderstood or might invite discrimination. Particularly, there was friction with “Women in STEM” demographic categorization, with which the participants felt an implicit pressure to align in order to access gendered support networks and to be “counted” as a gender diverse member of the student cohort. Kayden, for example, said “Well, I'm not a woman, but also you really don't have many of me, as a like nonbinary or trans student. So it's like, I guess I'll click that box?” Kayden wanted to be acknowledged as a gender minority in the applicant pool, but the cisnormative categorization of presumed binary men and women excluded them from being recognized. The “Women in STEM” demographic question was particularly consequential to navigate when it was associated with gendered economic or academic opportunities (e.g. fellowships, awards). The students understood that these initiatives were designed to broaden participation in chemistry, but because their own gender identities were not acknowledged, they experienced trepidation about whether they were viable applicants. Nat, a nonbinary transfemme, said that she felt “trans imposter syndrome” regarding programs for women. Eris experienced a similar discomfort, but ultimately did elect to align with the women in STEM demographic because they considered themselves “woman-adjacent enough.” She acknowledged that she should not have to miss career opportunities because of the cisnormative program designs, saying “don't internalize the failures of the system to harm yourself, don’t take responsibility for that.”

Narratives about covering also extended to the participants’ in person experiences in chemistry departments, where decisions about passing, covering, and authentic presentation were highly situational and often influenced by level of safety. For example, Eris experienced a dehumanizing interaction with a potential advisor where the faculty member was attempting to

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“clock” her, meaning that the professor was trying to determine whether Eris was trans and make invasive assessments about her anatomy without Eris’s consent. In this situation, Eris felt coerced into holding back information about her gender identity and trying to “pass” as a woman in order to minimize the harassment she was facing. Even reflecting on this situation during the group interview was palpably uncomfortable for Eris.

> *There was a potential PI that I met with who I believe was actively trying to clock me during our interview. She asked leading, borderline questions to try to gather more information about my identity. She was towing the line of not asking me outright what was in my pants, but she was implying wanting to know why I made certain choices about my identity and my presentation. Um, which is like, you know, that's not, that's not super kosher.* -Eris

Some participants were not out as trans on campus or were only out to select, trusted individuals. Some nonbinary participants found themselves in the uncomfortable position of needing to either enforce usage of their lived pronouns or allow themselves to be misgendered by faculty and peers, many of whom were ignorant of or resistant to gender neutral pronouns. Needing to constantly correct others’ pronoun usage was “exhausting to say the least, and potentially dangerous to say the most,” leading a few participants to stay closeted at work and present themselves as their sex assigned at birth. Theo, a genderqueer person, covered hir identity to accommodate other people’s discomfort with neopronouns and never felt comfortable sharing hir trans identity in chemistry settings, instead “defaulting” back to hir pronouns assigned at birth. This compartmentalization of transness outside of chemistry spaces echoes back to the “don’t ask, don’t tell” culture of STEM regarding LGBTQ+ identities and can inflict harmful psychological consequences.[19]

> *I use sie/hir pronouns when possible, but a lot of people aren't familiar or comfortable with them, so she/her depending on the day can even feel better. And at work, I use he/him. [...] I probably would be out somewhat already, except COVID. I'm writing my thesis, so I haven't been in the lab since January. I've probably spent under a month in the lab since last March. So there's grad students in my lab I've met at group meeting on Zoom and that's it. So it's hard. There's not the social time to sit down and come out. [...] I'd need some way to meet the other queer people in the department because we can kind of be invisible.* -Theo

One of the major barriers to coming out for participants like Theo was social isolation during the COVID-19 pandemic, which limited hir ability to develop relationships with other members of hir student cohort. This experience was shared by Cameron, a nonbinary person. Cameron did not get to visit prospective departments in person due to pandemic travel restrictions and therefore did not have the opportunity to meet their future peers. They “braced” themselves for “not being out at work and school” when starting their graduate studies because they were unsure about finding any trans community at their new institution. Fortunately, Cameron met a senior trans student in their department and they were “pleasantly surprised” to realize that they were not alone, saying “there aren't very many of us, but we're not the only trans people in the

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department." The presence of trans community in their chemistry department empowered Cameron to come out as nonbinary on campus, and the knowledge that they were "not the only one" ultimately made Cameron satisfied with their choice of school.

These pandemic experiences illustrate a greater story: students' decisions about whether to share their trans identities in their place of study are deeply influenced by their connection to other trans people and their immediate social environments, whether affirming, apathetic, or hostile. Participants who described themselves as the "only" trans graduate students in their departments (at least, to their knowledge) described more acute feelings of isolation and alienation than Cameron experienced (n=7). Indigo, a trans woman who said she is the "token" trans person of her department, described feeling constantly othered and without community among her chemistry peers.

> *As someone who's a joint student in two different labs and also basically the only trans person in my department, I feel like I belonged nowhere.* -Indigo

Indigo's pain was clear, and it was echoed by others in the group discussion. Farren, a trans man who came out during his graduate studies, did not find queer or trans community inside his chemistry program, necessitating that he spend "the first three years of graduate school establishing my queer community that was outside of the department." His status as the only out trans person in his program led to heightened personal visibility, but also intense isolation. As a graduate student undergoing transition related medical care, Farren's experiences blended the lines between typical graduate school challenges (e.g. coursework, research, teaching) and trans-specific challenges (e.g. medical care, transphobic climate). However, he felt that he did not have a platform to discuss his struggles with fellow students because his cisgender peers could not relate to his experiences and responded with discomfort.

> *When I move through my department, I can just tell that there are some people who feel comfortable in their knowledge of the trans community and they act normal. And then other people just avoid me or act like walking on eggshells around me. And that sucks. [...] I don't like feeling like I'm hanging out with a bunch of snowflakes where you just can't say certain things about transness or queerness. There's not really a floor for you to complain about how difficult it is being trans and in grad school. And I feel like that's the way that you bond with other graduate students is you just complain about how hard it is. And when there's no other trans people, it's like... Yeah. It was really funny. In o[rganic] chem, I had to draw all my mechanisms on the board and they were all on the bottom half of the board because I had gotten top surgery and wasn't allowed to raise my arms up above my head. And then if you say stuff like that, cishet people freeze because they just don't know what to say.* -Farren

Farren was about to graduate at the time of the interview and reflected that he did not receive "the same community support system that everybody else in the department talks about being essential in graduate school," and that he was only able to find support through "non-university, non-graduate students" external to his institution. Alex agreed, adding "I feel I live two lives, my

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queer life out of lab and then my life in lab, which I hate a lot." These statements once again reflect the pressure participants felt to separate their trans identities from her STEM identities, despite their aversion towards (or even ability to) do so.

"Decide Your Own Level of Outness": Agency of Identity and Personal Information Disclosure

> *When you fill out an application, you should be able to decide your own level of outness to a given institution. I had some schools that would just straight up put my deadname on a name tag, and I was like, "that's a no."* -Nat

Most of the graduate program applications that the participants encountered did not have a method to indicate the applicant's gender beyond a binary legal sex question (i.e. "male" or "female"). For trans men and women whose government identification did not reflect their gender identities, the students were obligated to either "perjure" themselves by answering with their lived gender identity or report their misgendered legal sex. For nonbinary participants, there was no option to answer a gender question accurately even if they wished to do so because the option was simply not available. Additionally, most applications only offered space to provide a "legal name" but not a "preferred name," feeding information about the students' former names ("deadnames") into institutional information systems in ways that were difficult or impossible to subsequently correct. These issues with personal data for trans people are not unique to university settings,[55–59] but had major implications for the participants during graduate school.

The data collected by application intake forms determined how students would be named and gendered in their graduate programs, revoking the students' agency over their identifying information and oftentimes disclosing the participants' trans identities without their consent ("outing" them). The participants' institutions effectively reassigned their deadnames and misgendered pronouns back to them again. For example, Anna, a trans woman who was already living under her chosen name before applying to graduate programs, did not have the option to provide her lived name to the university she wound up attending. This violation of her agency led to the disclosure of her deadname to others, assignment of an email address under the wrong name, and confusion about who she was within her chemistry department for the first several months of her doctoral studies. Anna shared that "everybody was very good about just switching over" to her lived name in spoken interactions once she settled in, but the impacts of these cisnormative identity management systems were painful and unnecessary. For Anna, being able to provide her lived name upfront would have saved her from the effort of repeatedly coming out to correct others on how she should be addressed.

> *For the application process, it would be great if you could put down a lived or preferred name, and how you want that used in contacting you, or contacting your permanent address, anything like that. It would be really great if the university had a system in place*

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that allowed your email to have that name so that everybody in the department isn't confused for a few months. That'd be really great. Yeah, that's the big one for me. I'm very bitter. -Anna

Other institutions did provide the ability to provide a preferred name (or sometimes a "nickname"), but multiple participants were frustrated to find that this information did not appear to be used. Kayden said that of all the programs they applied to, "one school used the name that I put as my preferred name, every other school used my legal name" in communications. Kayden learned after enrolling in their graduate program that online institutional portals "show other people my deadname." They did not realize this discrepancy was widespread across institutional systems until other people began to ask them about their deadname, which made them feel "miserable times ten." Jack also explained that even though he had been given the opportunity to provide his lived name in some applications, the information linked to his academic records, email correspondence, and online learning platforms were inexplicably addressed to his deadname anyway. In characterizing how the application data was used in reality, he called the "preferred name" data meaningless.

It would be like "Here, input your legal name. And then if you have a preferred first name, you can enter this in another box here. Except everything ever is going to be linked to your legal name, not your preferred name. I don't know why we're even asking you for this, honestly." -Jack

Another significant issue emerged when participants were denied the opportunity to determine how their data would be shared with individuals from their personal circles or undergraduate institutions. This lack of choice exposed their private information without their consent, stripping them of agency and potentially jeopardizing their relationships and financial security. For example, two participants had their trans identities disclosed to their recommendation letter writers through automated emails triggered by the application management systems, and two other participants were outed to their families through written mail sent to their permanent addresses. For these students, having the foreknowledge of how their data would be used and the ability to choose how their names were presented to others would have kept agency over their identity in their own hands. Nat, a nonbinary transfemme, was not out to her undergraduate professors when she submitted applications to graduate programs. Most institutions sent recommendation letter requests listing her legal name, but she was surprised that one institution sent letter requests under her "preferred name," disclosing her trans identity. Nat said that having the ability to tailor how these automated emails were sent out would have saved her from the discomfort of coming out to a professor before she was ready, saying she should have been "able to determine the level of outness" she wanted with her contacts.

Campus visit accommodations were also predetermined for the participants based on intake data without the students' input. Legal gender marker data were used to make decisions on the participants' behalf regarding gendered spaces (e.g. hotel roommates, bathrooms). Even more egregious, three participants said that upon arriving for a department visit, they were handed printed name tags with their deadnames displayed even though they had already spoken to the

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departmental representatives about their lived names. Jack was extremely uncomfortable wearing a name tag with his deadname, but did not want to endanger himself by correcting people onsite. Instead, he chose to literally cover his deadname by obscuring the name tag lanyard, saying “I just kind of flipped it around for the entire weekend, but if I saw my name out, I would flip it back. [...] I wasn't going to come out to strangers if it wasn't going to be a meaningful connection, but I also really was in a space where I could not be referred to by the other [dead]name.” Kayden experienced complete disregard for their lived name at one institution, even after trying to correct the visitation organizers multiple times. This situation again forced a trans student to provide emotional labor that was not imposed on their cisgender peers.

> *There was another school where I emailed back and forth like 10 million different times [about my name]. And then I showed up and they had still written my deadname, my like legal name, on my name tag. And then when I talked to the person I was like, “Please, please change that,” they spelled it wrong. Even though I had told them how to spell it.* -Kayden

At the department level, participants’ legal name data were internally circulated to introduce the applicants to faculty members without consulting with the students beforehand. Several participants experienced direct confrontations about their lived names by faculty, dehumanizing them and outing them to their peers. In a meeting with fellow prospective students and the chemistry department chair at one institution, Kayden said the chair was initially confused about their name. When Kayden specified how they would like to be addressed, the chair insisted “I don’t see why I can’t just use your legal name” and continued to do so. Nat experienced a similar confrontation in front of an audience, during which Nat felt pressured to cover her trans identity and acquiesce to cisnormative expectations of professionalism.

> *At one institution, I had a professor straight up ask me at a table full of people why I used my current name instead of my legal name. And that was a very awkward question to answer. A part of me wanted to be like “Oh, well I use that name because I'm transitioning,” and part of me wanted to be like, “Well, let me not burn that professional bridge.”* -Nat

There is little we can say as authors to further express how unprofessional and dehumanizing it is to publicly out trans people. Addressing these entrenched attitudes about trans people goes beyond improving information intake forms and educating people in our departments. The participants’ experiences illustrate the need for a massive cultural change in STEM to provide safety and an affirming climate for trans scientists. Whitley and coauthors have argued that chronic misgendering of graduate students in the academy is itself pedagogical because “it teaches participants and bystanders to dismiss transgender people’s identity and self-designated pronouns” as part of the professional socialization in their fields [29]. The reassignment of deadnames to the participants was a similar tool of disempowerment in these chemistry departments. Faculty members did not consider the participants to be the sole information authority concerning their names and instead revoked the participants’ agency over

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their identities, reinforcing the trans-antagonistic culture of chemistry and teaching bystander peers to do the same.

When trans students tried to retake authority over their identity and personal information by updating their listed names or gender markers, several participants ran into dead ends. Many advisors, mentors, and administrators did not know the procedures to make such changes, if procedures existed at all, and they did not know an appropriate referral from whom to get answers. Furthermore, information databases at institutions were often not connected to each other, requiring students to research, contact, and follow up with multiple campus offices.This impasse left trans students to fend for themselves without support. When Anna sought to update her information, "nobody knew what to do, nobody had done it before, and they didn't actually have a good process in place for doing it." She had to figure out how to get these changes made herself, which required outing herself to multiple people across three different campus offices. Kayden initially sought help from their department, but instead was pointed through a series of referrals that ultimately led to no satisfactory method for updating their information.

> *The only thing I really want or need from my department is knowing who to point me out to ask these things because when I was trying to figure it out I got pointed to like three different people who all like pointed to three more different people. [...] And thankfully I found the right person, but their answer was, "Oh we know this is a problem and we're going to fix it in the future. Is it okay if we wait until then?" And it's like, do I have to? Could you jerry-rig a fix for me now?* -Kayden

The same roadblocks to institutional information updates existed for students who came out as trans while already enrolled in graduate school, including Farren, a trans man near the completion of his graduate studies. Farren was able to get his government identification updated to reflect his lived name, but his deadname was still in the university information systems and was never rectified, despite numerous attempts to correct his personal information. He said that his university's internal information system was easily capable of changing last names, but not first names, leading to two different employee personnel files being associated with his student record. The complete failure of the institution's identity management systems led to egregious, recurring harm to his financial stability, including missed paychecks and double tuition charges. Although not raised by the participants during the group interviews, the research team was also deeply concerned about what names would be assigned to the participants' degrees and transcripts upon graduation.

> *It's a total fucking dumpster fire. And it's led to things like me getting overcharged. [...]. My tuition remission is late every term because they have a mix-up, even though it [his lived name] is my legal name. [...] There have been multiple times where I didn't get paid on time. I've been double charged for terms as if I was two people because there's two names associated with my account and they can't figure out why that is. Just nothing was easy about it. Nothing. Four years later, I just got an $8,000 bill in the mail because the tuition remission was for my deadname, not for my legal name.* -Farren

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Not all trans people change their names, but for the participants who have, these experiences of continuous deadnaming were psychologically harmful and financially destabilizing. The only participants who experienced a smooth transition regarding identity data at their new institutions were those who had completed legal identification updates prior to applying to graduate programs or who were using a variation of their legal name that was perceived as a nickname (e.g. a truncated version). We want to emphasize that government document updates are not legally possible, economically feasible, or safely accessible for many trans people depending on their local government policies, access to legal representation, ability to be present for court appearances, and personal safety factors (e.g. outness to family members). These barriers mean that many trans students rely on self-description to present their names and genders. Regardless of legal documents, trans people are the sole information authority of their own names, genders, and pronouns.

"Static Versus Active Support": Superficial Versus Substantive Trans Inclusivity

> *One of the topics that's been on my mind recently is like the concept of "static" versus "active" support. When you go and you look at a lab website or an LGBT Center website, that's static. That's a nice sign to see. But what really mattered to me was evidence of active support.* -Nat

A meaningful distinction for the participants was whether a department was "passively" inclusive (i.e. not overtly hostile) or "actively" supportive of trans people. The students were looking for departments that intentionally cultivated systems and communities that enable trans students to thrive. Many prospective departments expressed tolerance for trans people through a generalized commitment to diversity, but there were few examples of institutional work that genuinely addressed the needs of trans students. The approach of nominally welcoming all people without trans-specific considerations reinforced cisnormative expectations in graduate programs by assuming that the needs of trans students were the same as those of cisgender students. In the participants' words, these "static" or "passively supportive" climates often amounted to "wanting to look presentable" without implementing real change. When participants did receive active support, it was usually described as the actions of an individual mentor or an affinity group who made a difference in their lives, rather than formalized institutional efforts. The participants wanted their departments to "walk the walk" of being trans inclusive through trans-informed mentorship, workplace conditions, and departmental culture.

The general atmosphere that many of the participants described in their departments can best be illustrated in the following quote from Cameron, a nonbinary person. Although Cameron responded to a question about whether they had faced any clear discrimination towards their nonbinary identity in their chemistry department by saying "no," they conversely did not experience any affirming treatment either. The liminal experience of moving through a department that neither explicitly excluded nor actively included Cameron sent them a message

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that trans people are simply not a priority. The unspoken social contract of the department seemed to be that their transness was tolerable so long as it didn't require extra effort from faculty to accommodate. After being chronically misgendered, Cameron felt resigned to believing that the faculty members only "cared enough" about trans inclusion to avoid accusations of bigotry, compromising their trust in the department.

> *No, like there wasn't anything where it was like, "you're not going to be okay with this," but there also wasn't anything where it was like, "you will not misgender me." And I think that every professor that I've talked to so far in my department has at some point misgendered me. [...] I think if you ask them, they'd be like, "Yes I care," but they don't care enough to, you know, actually do it. Actually pay attention to the words that they're saying. [...] No one is aggressively bad. But also, no one here that I've met, none of the professors, are aggressively, you know, good either. -*Cameron

The students implicitly understood that trans inclusivity is a matter of *doing* rather than just *saying*. They were frustrated that although their institutions presented DEI values in mission statements, they observed little work to actualize these commitments. Some examples of the contradictions between institutional messaging and lived experiences raised by the participants included the following questions: If a department claims to include trans students, how can their health insurance benefits not offer coverage of transition-related care? How can nonbinary students participate on campus if there are no gender inclusive restrooms available? How can students seek government document updates if they cannot get absences approved for court appearances? How can a department help students navigate institutional systems if its faculty and staff are unaware of how to intervene? What happens if advisors refuse to use their students' lived names or pronouns? Grappling with these questions highlighted the gap between rhetoric and material conditions, leading the participants to conclude that their institutions never really intended to disrupt transphobia. Indigo explicitly named these feelings while talking about the lack of gender neutral restrooms in the chemistry buildings on campus, which she deemed contradictory to her department's stated commitment to DEI, saying that her department chair "wants to *appear like* he gives a shit, but [...] he just wants the status quo to remain exactly the way it is."

The participants' observations closely align with Sara Ahmed's landmark argument that higher education institutions engage in repetitively stating their commitments to DEI as the outcome itself, rather than as a promise to guide and accompany continuous practice.[60] Ahmed coined this type of rhetorical commitment to DEI as a "non-performative speech act," where *naming* takes the place of *doing* and ultimately fails to bring about what is named. Farren offered a similar critique of his chemistry department's DEI agenda after observing that his department made regular statements about how fostering a diverse group of scientists will improve the pursuit of science. Rather than this rhetoric being accompanied by real action to make the department friendlier to marginalized people, he noticed that the statements were simply used as evidence of a good climate itself. For Farren, the true goal seemed to be cultivating an image of an inclusive space, rather than meaningfully making the department a better place to work while trans.

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If you truly believe that your scientific community will be better and you will do better science with more diverse people, you won't hesitate to make sure that all of these things are inclusive and go out of your way to do the research to make sure that what you're doing is inclusive. I think that my department went from "not giving any fucks" to "wanting to look presentable" because of the way that the culture of universities is changing. More of [an attitude of] "I don't want to offend anybody." And I think that that's maybe another [first] step of, "Good. You're thinking that not everything fits everybody." But I think what would be even more meaningful is that if people actually bought into realizing that we're only going to solve the problems of the world if the representation of humanity is reflected in departments. -Farren

The participants also brought up instances where institutional DEI policy did not offer specific enough guidance to support trans students, leaving decisions up to the participants' supervisors. A major example was access to transition-related healthcare: even after carefully considering health insurance benefits and legal landscapes, participants still encountered roadblocks where chemistry departmental culture inhibited the students' ability to pursue transition-related care. As Nat pointed out, the time consuming nature of transition is not well understood by cis people, even those who consider themselves allies. Accessing gender affirming medical care and government document updates are long term processes that require doctors appointments, legal consultations, court appearances, and recovery time, often over the course of multiple years. Faculty who have high expectations of their graduate students' research productivity were less likely to approve students taking time off work for medical procedures, regardless of their ostensibly trans inclusive personal sentiments. In Nat's assessment, a university providing health insurance that covers transition-related care without ensuring graduate students could use medical leave to actually access that care was another example of a false commitment to trans inclusivity. She said "I need not just the resources to be able to transition, but I need to feel like I have the time to go and use them, otherwise it doesn't mean anything." Nat strategically sought out faculty members who would "actively" support her as her advisor, eventually choosing a PI who supported her physical and mental wellbeing.

I came out to him explicitly and I mentioned, you know, about coordinating time off if I ever wanted to have anything medical done. And he was like, "Oh, that's cool. I know all the appropriate channels for that. So if you want to take me off, you're totally welcome to." [...] A lot of it was me trying to almost justify myself and justify my transness in front of this person. And me being like "Hey, this is not going to be a burden on your lab. This is a positive thing for me. And even if I do have to be out, [...] maybe I can take up some computational work while I'm away from the lab." But you know, in the end he was just "No, it's fine." Good work-life balance person. -Nat

Nat realized in retrospect that when she approached her future advisor about these questions, she was discussing her medical needs as if they were a potential liability to her PI's research group. Fortunately, Nat's advisor interrupted this thought process and ameliorated her concerns, encouraging her to take time off for her health. Anna, who chose her graduate institution

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specifically to work with a PI she already trusted as her advocate, had a similar experience: her university and department did not have any proactive policies in place to address trans healthcare, but she was individually encouraged by her advisor to take ample time off to recover from surgeries. We applaud Nat and Anna's advisors for understanding that transition-related procedures should not be considered optional, unnecessary, or distractions from work, but rather essential medical care. However, both Nat and Anna described that "support felt more on an individual basis, rather than institutional one," and still described their overall departments as merely "passively supportive."

Clearly, the trans affirming actions of individual people made a huge difference for the participants, even through simple gestures like pointing out gender neutral restroom locations. This individual support is a key consideration in the mentorship of trans students throughout their graduate education. However, individual supervisors being solely responsible for supporting trans students' needs is untenable and inconsistent: some trans students will slip through the cracks. Indeed, many of the participants did not have any champions they could entrust for help while navigating "the social, the legal, and the medical bureaucracies" that shape trans life in the academy. The participants also noted that this mode of individualized help was offered because specific faculty or staff members knew (or inferred) them to be trans, making the participants concerned that the same guidance was not provided to the larger student cohort. That is, other students who do not disclose their trans identities or who are currently gender questioning would not be made aware of the same resources.

"I Am Full Up on Educating Other People": The Price of Advocacy

> *I really only feel like I am full up on educating other people and I'm very tired. It just feels like you're just the token trans person that they want [to advise] on everything. And even the things that don't even have to do with LGBTQ issues or the social culture of the department.* -Farren

When confronted with trans exclusionary educational environments, all of the participants (*n*=10) engaged in some level of self or community advocacy. This advocacy took various forms, from subtly validating trans identities within their immediate surroundings to openly demanding institutional change. It's crucial to recognize that any form of advocacy, whether at the micro or macro level, could potentially lead to consequences for students because it influences how departments and institutions perceive them. When students are positioned as instigators of change, the relationship dynamic between students and their universities shifts from being primarily focused on education and labor to being inherently political or even adversarial. Ahmed has described this shift, saying that those who point out oppressive conditions in their institutions become perceived as the problem themselves because they disrupt the cultivated image of their university.[61] While not explicitly discussed by the participants, the research team was also concerned about repercussions in the field for activist students who might be mischaracterized as disruptive by chemists with power over their future careers.

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Advocating for the trans community within their chemistry departments was a source of empowerment when the students were acting of their own volition. A common thread was that the participants were not just looking to protect themselves, but felt a sense of responsibility to improve trans visibility and the material working conditions in their departments for future trans students who would follow them. Many of the participants mentioned common practices to normalize trans existence in chemistry spaces, such as hanging pride flags in office/laboratory spaces, posting affirming flyers in gendered restrooms, including pronouns in online correspondence, and actively participating in prospective student recruitment events. Addressing these topics in a general sense was one way that participants who were not out on campus felt that they could shift the departmental culture without disclosing their trans identities, although we want to acknowledge that this type advocacy (i.e. for nonspecific others rather than for oneself) has still been associated with the negative psychological effects of trans identity covering in the workplace.[62] For example, Theo was not out as genderqueer in hir workplace and continued to use he/him pronouns on campus. However, sie found that addressing pronoun sharing in the abstract influenced hir department, saying "since I started putting my pronouns in emails, after I email professors, I've noticed that they start adding their pronouns to emails too." Jack had a similar approach using "little" acts to counter the cisnormative culture of his department in ways that have incremental impact.

> *I'm really aggressive about including my pronouns in places now. And so they're in my email signature. They're in my zoom stuff. When we had physical name tags, they were on my physical name tag. They're in all of those places. If you come to my office, I have little safe space stickers and like flags and stuff. [...] I've had enough conversations one-on-one with different professors at the university that they've all started adding stuff like pronouns to their signatures, so now the department chair has pronouns in his email signature. And like, little stuff like that has been just really how I end up pushing.* -Jack

However, some of the openly trans participants were also pressured to provide unpaid labor for their departments in the forms of serving on committees, providing LGBTQ+ training to their peers, representing the department on panels, and consulting on policies. For some who were reflecting back on many years in their graduate programs, the cumulative toll of their advocacy work was apparent to the research team, manifesting as burnout and disillusionment. Eris, a nonbinary transfemme, was currently in the process of interviewing with several graduate programs and had not yet committed to an institution. At her undergraduate institution, Eris had already been deeply involved in organizing campaigns related to trans inclusivity on campus. Now that they were moving into a graduate program, they were dreading the amount of labor they might need to provide regarding the same issues at a new institution. Eris was fully aware of the opportunity cost associated with advocacy work and felt resigned to the fact that it would make their progress towards graduation more difficult, even before entering her graduate program.

> *A lot of the stress that I have about grad school is not necessarily whether I'll feel included, but more about how much shit am I going to have to wade through to get*

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where I want to be. Rather than, how much of that work is already done for me. Because I've done this work [trans advocacy] before. But I don't necessarily want to do it again, if I can help myself. I will do it again. But how much of my time is going to be spent trying to advocate on behalf of me and my community to the administration? And trying to wade through the bureaucracy of academia? Just to make sure that trans people survive, both me and anyone else in the program behind me. How much wading through that bureaucracy am I going to have to do? How much unpaid labor am I going to have to do, in that regard? Rather than doing my job as a graduate student and trying to get the hell out. Because if I'm devoting 20 hours a week to trying to change the institutional processes that oppress us, that's 20 hours a week that I'm not in lab doing research or sleeping. -Eris

Based on the experiences of other participants, Eris's fears were not unfounded. Alex, a genderfluid transfemme in their first year of graduate school, also had previous experience advocating for gender inclusive restroom access in her undergraduate institution. Alex felt frustrated "going back to gendered bathrooms" in graduate school because the chemistry buildings had no gender inclusive restroom options, despite the fact that "there's a lot of trans nonbinary students in our department and the numbers are going up." For Alex, the lack of restroom availability "makes no sense" and they felt called to fight for change on behalf of current and future nonbinary students. Indigo, who was near the end of her graduate program, was also "pulled between a bathroom situation and writing my thesis" and felt compelled to "fight" the department chair on behalf of her trans peers. Despite the demands of her educational obligations, getting involved as an advocate in this situation felt obligatory due to her both her own conscience and the expectation from her peers that she would speak out.

Farren, who came out as a trans man during his graduate studies, took it upon himself to start educating others in his department about how to respect trans people through conversations, flyers, and training sessions. These acts were initially a source of empowerment for Farren who was coming into his gender identity and sharing willingly with his peers. However, once Farren had developed a reputation as an activist, he was inundated with people approaching him to ask questions about the trans experience. His status as the only out trans person in his department came with a high pressure to not only perform exhaustive emotional labor for his cisgender peers and mentors, but an expectation that he would speak for all trans people collectively on trans issues. Farren seeking to receive respect and dignity in his department eventually morphed his existence into a resource from which cisgender people could learn, demanding his continual patience and draining his time and cognitive resources away from his graduate studies. We are certain these types of interactions will sound familiar to people with other marginalized identities, where the oppressed are expected to act as objects of intellectual curiosity or as voices to console the feelings of their oppressors.

I had a graduate student who saw me in the hallway, and this is just maybe a month ago, saw me in the hallway and then proceeded to be like, "Hey. Back home, there was a restaurant that had a thing where they decided to say something very anti-trans. And my parents go to that restaurant. And I want to have a conversation with them about how

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that's not appropriate. What do you think I should say?" And I was [thinking] like, "I really am just trying to go run an NMR. Can you please just leave me alone?" But I obviously stood there for five minutes and explained to him and I looked at the Facebook page and the post and that sort of thing. And, I don't know, it just doesn't feel like I have the option to be like, "No, I'm not going to help you." -Farren

Farren also was tapped to volunteer on multiple departmental committees and policy groups, service that is typically performed by faculty members as part of their professional responsibilities rather than graduate students as unpaid volunteers. Beyond advising on LGBTQ+ topics, he was also asked to serve on unrelated committees (such as chemical safety) as a "diverse voice." Farren was frustrated because "I am a white, cis-passing, masculine person. I do not count as your diversity token." He also felt pressured to excel in these service appointments because he was perceived as the monolithic voice of the trans community, bestowing a high level of both expectation and scrutiny on his performance.

I think that I tend to overwork myself in sort of those volunteer positions because I'm also the tokenized trans person. And so then I do feel like I'm held to a higher standard. I mean, at least in terms of performing in a leadership role or performing in a volunteer role, that I definitely feel a lot of external and probably internal pressure to not perform badly because I'm out and visible and do advocacy work. -Farren

Numerous studies have extensively explored the impact of emotional and invisible labor on BIPOC scholars and cisgender women.[63–65] This body of literature highlights the disproportionate expectations placed on marginalized students and faculty to match the productivity and "excellence" of their privileged peers while also shouldering the additional burden of emotional and invisible labor. These studies frequently reveal outcomes such as burnout, disillusionment, and missed career opportunities. Despite the abundance of research in this area, our research team did not encounter similar studies specifically focusing on the experiences of trans students. However, the narratives shared by our participants resonated closely with the themes elucidated in existing research on BIPOC scholars and cisgender women.

Another thing that mirrored what has been reported in the literature about BIPOC students and faculty was how many participants were skeptical about the extractive use of their identities for the benefit of their department's reputation. Being counted as a "diversity token" rang hollow when there were no accompanying improvements in the trans exclusionary culture of the department. For example, Indigo was repeatedly asked to represent the chemistry department on panel discussions and to participate in graduate student recruitment. She said that she was "the tokenized out trans person in my department" and that the department thought of her as a "secret, hidden, S-rank [top rank] diversity choice" who could be used to "attract" prospective graduate students. For Indigo, using her existence as evidence of an inclusive department was frustrating. The high burden of time and emotional labor required for these events detracted from writing her dissertation and progressing towards graduation, and ultimately, speaking at these events did not improve her daily working conditions. These speaking engagements only

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benefited her department, rather than herself or the trans community. In the end, Indigo was simply exhausted.

> *Shit's hard. It's just hard. It's not easy. And people should just recognize that. And then recognize that I'm putting in more work for the same amount of productivity as your cis, white, female and male students.* -Indigo

Limitations

A critical consideration for the research team was developing this study from a place of trust and safety for the participants. As such, the call for study participation was shared through LGBTQ+ affinity group email lists, which then further circulated through word of mouth sharing. This mode of closed network sharing certainly left some voices out, particularly for potential participants who were not out or not already connected with LGBTQ+ chemistry communities. We maintain, however, that this does not invalidate the results of this study, as trust and safety are paramount to study queer communities. Our recruitment method centered on prior development of trust with participants and anonymity. Limited demographic data was collected on participants to minimize risks to the participants being identified, meaning that compounding factors to student experiences in graduate school (e.g. racial identity and socioeconomic status) were not analyzed. Our participant recruitment method focused on enrolled or enrolling graduate students, which inherently leaves out the stories and perspectives of trans chemists who ultimately did not pursue graduate studies or left the field entirely.

Conclusions

Since the completion of our group interviews, there has been a rapid intensification in trans-antagonistic rhetoric and politics across the United States and beyond. Several of the fears participants raised in the abstract (e.g. potential "bathroom laws") have since become a material reality with which trans people must contend. The framing of transness as a social problem is a reactionary response to the growing positive perceptions of trans identities, meaning public demonization of transness is motivated by the maintenance of whiteness, patriarchy, and cisheteronormativity.[66–68] Weaponization of trans identities as a tool in the present "culture war" narrative has already cascaded into US state legislation and degenerative education policy that targets trans people.[69] Recent legislation has serious, material impacts on trans people's healthcare autonomy, access to accurate government identification, entry to public accommodations (e.g. restrooms, locker rooms), right to privacy, freedom of information (e.g. book censorship in public schools and libraries), right to nondiscrimination, and freedom of speech (e.g. drag show bans).[45] The hostile political climate has also incentivized harassment of trans people in public spaces, fueling a state of constant vigilance for trans people.[70] Journalists reported in 2023 that students reconsidered college applications due to LGBTQ+ hostile state legislation.[71]

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Based on what we learned from interviewing students in this study, we believe the increasingly hostile political environment has already had far-reaching effects on the choices current trans students will make regarding attending graduate school, choosing a geographic location in which to live, and presenting their trans identities at their place of study. The implications for research, policy, and practice outlined below should be understood in context of the current reactionary era. Responding to this report with understanding and action is essential.

Implications for Research

The voices of trans people are left out of research when studies are not intentionally designed to include them. In research protocols, especially in survey instruments, recording data about participants' names and genders must be challenged in order to move away from binarist quantitative measures that make nonbinary people invisible. Researchers should be aware that inquiries about clear discrimination may fail to characterize the discouraging feeling of invisibility when trans people are in an environment that neither explicitly excludes them nor actively welcomes them. Researchers should also refrain from overemphasizing "coming out" stories, which are complex and situational for trans people, especially for nonbinary students who can never arrive at "being out."

Another major finding in this study was that although trans students' experiences with extractive emotional labor and tokenization in the academy have not received attention in the literature, they closely resembled reported experiences of BIPOC students and faculty. These results were surprising: even though BIPOC identities are often considered unconcealed and queer identities as concealed, the results of oppression manifested in similar ways. The students experienced tension between their trans identities and their STEM identities, which affected their decisions about sharing or covering their transness on campus. This challenging epistemological border crossing led to compartmentalization of identity, covering in the workplace, and acute experiences of isolation.

Additionally, recording trans experiences authentically depends on building trust; the co-creation of knowledge between trans researchers and trans participants allowed for nuanced community discussions to unfold. On many topics, there was more happening beneath the surface which was understood by the trans researchers and may not be as readily apparent to those outside the community. For example, when trans students discussed location, they were referring to many conditions ranging from legislative climate to critical mass of other trans people.

Implications for Policy

Participants were left adrift by a perceived need to separate their trans experience from their graduate school experience, which is detrimental to their ability to thrive in graduate school. This "don't ask, don't tell" culture was enforced before students even applied to graduate programs. Limited or wholly absent information about resources communicated to the students that trans people were not welcomed by prospective institutions. Poor transparency regarding the ultimate use of application materials, especially personal and diversity statements, put trans applicants in

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a position where they were asking if it is safe to be themselves before they even set foot on campus. Studies about trans people in the greater workforce have demonstrated reduced job and life satisfaction for trans people who feel uncomfortable presenting their full, authentic selves at work.[62] Without overstating the significance of "coming out," we want to stress that chemistry departments must work towards creating a climate where trans students feel they have the option to present their authentic selves in STEM spaces. Clarifying the intentions behind personal and diversity statements would help participants make an informed decision about how much personal information to disclose and in what contexts to discuss their trans identity. If trans students do disclose their trans identities in written applications, that information should be proactively used to prepare for an affirming welcome on campus.

Students in this study were outed and financially compromised by a lack of agency over their name and gender marker data, harms inflicted by cisnormative identity management systems throughout their universities. For trans graduate students, control over how their identifying data appear and how these data are disclosed to others is of utmost importance for self-determination in their academic careers. Institutions should take great care in the stewardship of these data and rebuild information systems that give power to individuals as the information authority over their own records. Academic departments, information technology offices, admissions offices, and university administrations must seriously consider not only the structure of how these data are stored, but how information systems can be rebuilt to address the changing needs of students. Furthermore, students must be able to give informed consent over how their identifying data are disclosed to others in their personal and academic circles to maintain agency and protect themselves from harm.

Material working conditions in STEM departments, such as access to gender inclusive restrooms and approval of medical leave from work, must be improved to meet trans students' needs. Because non-academic factors may be more important to trans students than academic factors when weighing decisions about their careers in chemistry, existing policies relevant to the trans experience (e.g. transition-related healthcare benefits) must be made plainly and publicly available in order to inform students' decisions. Departments should reassess gendered initiatives (e.g. scholarships) for broadening participation in STEM to explicitly communicate that trans and nonbinary people are eligible applicants. Where existing policy fails to address trans students' needs, intentionally designed interventions need to be enacted to protect the wellbeing of trans students, starting with some of the policy discrepancies raised in this article. Supporting trans graduate students cannot be left solely on the shoulders of individual advisors or supervisors; academic departments need to devote resources and collective effort towards trans affirming praxis. We want to stress that building a trans-inclusive department involves iterative assessment and improvement, rather than a checklist of best practices at one moment in time.

Trans students in this study reported being tapped multiple times to provide unpaid labor for the departments in the forms of panels, recruitment events, and departmental committee work. Departments must draw clear lines regarding the educational requirements of their programs and refrain from burdening marginalized students with extra work that is not expected of privileged peers. The students believed that this use of their identity was extractive, showcasing

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their transness to make the department look good while failing to create a trans-inclusive environment. Instead of attempting to cherry pick diverse faces for these kinds of events, what would happen if a department cast a broad net to all current students for these types of events? Would a department find that the only people willing to speak at these events, to attest to the department's strengths and general camaraderie, would be people from highly overlapping backgrounds? Or would the diverse body of students be able and willing to proverbially stand by the department and say that it is a truly supportive environment?

Implications for Practice

Dedicated mentorship that was responsive to trans needs was a major expectation of students in this study. Indeed, one participant chose her graduate program solely to work with a faculty member who would be her advocate. The participants actively looked for signals of trans affirmation from faculty and wanted to know that someone in power would be their champion. Educators should be aware that they cannot know which students are trans by looking at them and that trans students are pressured to cover their trans identities in STEM departments. Professors who consider themselves allies to trans folks should communicate their positions publicly, particularly in locations with hostile legislative climates. Regardless of departmental statements of support, active and accessible support structures were lacking for participants. Faculty members who mentor trans graduate students should be aware of the various policies at all levels (departmental, institutional, local, state, federal) that impact the lives of their students. Educators should also know the mechanisms by which students can access support structures (e.g. healthcare, name changes) so that they can help guide their students through the system and not leave trans students to navigate for themselves. Perhaps most importantly, faculty must ensure that trans support systems are tangibly implemented and honored by their departments and colleagues.

Many participants reported being in positions where their department’s tokenization of their identity demanded a significant amount of emotional labor, putting them in a position of perpetually guiding others on how to understand and respect their identity while juggling their research and educational obligations. Some students were even expected to serve as an educational resource for faculty and staff. Advisors should be aware of these demands on their trans students' time and cognitive resources and protect their mentees from becoming overextended. Faculty should devote their own time towards personal and departmental education efforts to ensure it is not the trans students themselves who are solely responsible for shifting departmental climate. Shifting STEM departmental culture to welcome trans students is an obligation of the faculty. It is crucial as educators that we hold one another accountable and interrupt transphobic rhetoric when it happens. When faculty are interacting with each other and with students, educators should speak up to correct deadnaming and misgendering and should challenge departmental norms that center cisnormativity.

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Project Administration: PVR (lead), MMN (supporting)
Conceptualization: IMB (equal), MMN (equal)
Methodology: PVR (lead)
Investigation: IMB (lead), MMN (supporting)
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Writing - reviewing & editing: PVR (equal), MMN (equal) IMB (supporting)

Competing Interests

Authors declare that they have no competing interests.

Supplementary Information

Semi-structured interview questions, exit survey instrument, analysis codebook, and further information about factors the participants weighed while comparing graduate programs are included in the Supplementary Information.

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