

# Examining the STEM Climate for Queer Students with Disabilities

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## Abstract

Increasing participation and success in science, technology, engineering, and math (STEM) fields continues to be a national imperative, with particular attention paid to eliminating barriers for women and underrepresented students of color. Some attention has been paid to the underrepresentation of students with disabilities in STEM fields, while few researchers have focused on the experiences of lesbian, gay, bisexual, transgender, and queer (LGBTQ) students in STEM. Literature about both students with disabilities and LGBTQ students suggest challenges and barriers that may prevent these groups from successfully persisting in STEM majors. This qualitative study examined the campus experiences of five queer students with disabilities in STEM fields at a predominantly white research university. Findings reveal that participants encountered male-centered, heteronormative STEM spaces, physical and social inaccessibility on campus, a lack of intersectional resources, and marginalization in and out of the classroom. We offer a holistic portrayal of students' higher education experiences and of their multiple identities, as students elaborated on their experiences and marginalization related not only to disability and LGBTQ identities, but also to gender, race, and ethnicity. The study offers one contribution to further exploration of the higher education experiences of students with multiple marginalized identities and presents ways that faculty and staff may seek to improve the classroom and overall campus environment for students.

*Keywords: disability, LGBTQ, intersectionality, STEM, campus climate*

Studies of science, technology, engineering, and math (STEM) learning environments have shown that they are less welcoming to students with minoritized identities than postsecondary learning environments as a whole (e.g., O'Brien et al., 2015; Stout et al., 2016). Most of this literature has focused either on the experiences of students of color or on the experiences of women students (e.g., Lord et al., 2009). Yet, the experiences of students with disabilities and lesbian, gay, bisexual, transgender, and queer (LGBTQ) students in STEM majors also point to experiences of marginalization, isolation, and misunderstanding (Linley et al., 2018). Students with disabilities are underrepresented in STEM fields (National Science Foundation, 2011) and strategies such as creating mentorship and coaching programs (Gregg et al., 2016; White & Massiha, 2015), implementing universal design in the classroom (Jenson et al., 2011), and allowing students to better identify their support needs (Dunn et al., 2012) may improve student experiences and outcomes. LGBTQ students may not feel

it is safe to disclose their gender identity and/or sexual orientation in STEM spaces (Linley et al., 2018), an experience shared by LGBTQ faculty and staff in STEM (Barres et al., 2017; Bilimoria & Stewart, 2009) that may create and enforce a culture of silence and invisibility around minoritized gender and sexual identities.

While there is cause for concern about the climate in STEM for students with disabilities and LGBTQ students, no published research on the intersections of these two populations —LGBTQ students with disabilities in STEM — was located, a gap we begin to fill with this study. The purpose of this study is to explore the experiences of self-identified queer students with disabilities as they navigate STEM majors and campus life at a predominantly white research university in the southern United States. The research question that guided this study is: How do queer students with disabilities majoring in STEM fields describe their collegiate experiences, both within and outside of STEM spaces? This question reflects that

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we explored students' perceptions of their experiences within their STEM majors and that we also find it important to contextualize these findings within students' broader collegiate experiences. The research question also reflects our holistic approach to exploring students' multiple identities; though disability and LGBTQ identities served as focal points of the study, students also shared their experiences related to gender, race, ethnicity, and other social identities and how they navigated compounding forms of marginalization.

### Literature Review

To situate the present study, we briefly review some of the research related to college students with disabilities in STEM and the few studies about LGBTQ students in STEM.

#### Students with Disabilities in STEM

Researchers have explored the experiences of students with disabilities in STEM fields relative to topics including faculty, coursework, and mentoring. Faculty members — who possess rigorous training in their field, but little training on student development and how to work with students with disabilities — can significantly influence the experience for students with disabilities in and outside the classroom. Thurston et al. (2017) found that faculty “may have stereotypes about the capacity of students with disabilities to do STEM work” (p. 55) and proposed strategies such as implementation of universal design for learning techniques, professional development, and faculty learning communities to help overcome such perceptions. Universal design “focuses on eliminating barriers through initial designs that consider the needs of diverse people, rather than overcoming barriers later through individual adaptation” (Rose et al., 2006, p. 136) More, while universal design for learning “embeds accessible pedagogy into...the means of representing information, the means for students' expressions of knowledge, and the means of engagement in the learning” (p. 136). A universal design approach to designing accessible learning experiences with a diverse group of learners in mind from the start may be understood in contrast to the idea of providing individual accommodations for participation on a case-by-case basis.

A mixed methods study examining the teaching pedagogy within STEM classroom at community colleges found that faculty may lack formal knowledge of pedagogy and time for professional development (Moriarty, 2007). The study illustrates that STEM faculty have the desire to be inclusive in their teach-

ing but struggle to identify obstacles and interventions that may affect student success. Examining the National Longitudinal Transition Study data, Lee (2011) found that students with disabilities chose a STEM major at higher rates in comparison to students without disabilities but received fewer forms of support within STEM classrooms. The study also revealed that in comparison to the male cohort, female students with disabilities enrolled in STEM at much lower rates. Wei et al. (2014) found students with autism in STEM majors at community colleges had higher rates of retention and success due to high levels of transitional support, the ability to live at home, and greater flexibility. Students were twice as likely to transfer to a four-year institution in comparison to students with autism in non-STEM majors (Wei et al., 2014).

Students with disabilities report a chilly academic climate, but faculty can implement strategies to help ameliorate these problems and enhance students' self-efficacy. Love et al. (2014) found STEM faculty have trouble identifying and defining the needs of students with non-physical disabilities regardless of whether students disclose their disabilities within their classroom. When students feel supported in the classroom, their academic self-efficacy may increase. Jenson et al. (2011) reported that students with disabilities in STEM majors are more invested in their learning and have higher rates of self-efficacy and retention when they have hands-on learning in universally designed classrooms where faculty members build rapport with students and address questions. By implementing universal design, students of all levels of ability are able to successfully thrive in the classroom. Dunn et al. (2012) found that students in STEM fields who understood their disabilities and their needs of support were better able to ask for accommodations within higher education. When students are able to identify detailed areas of support or accommodation, they have higher rates of retention and a more enriched academic experience.

Positive one-on-one mentoring and coaching relationships can serve as a protective factor for students with disabilities within higher education, including within STEM majors. The relationships can serve as safety nets and sources of empowerment in chilly climates. White and Massiha (2015) evaluated transitional and mentoring programs provided to students with disabilities within STEM academic programs at the University of Louisiana Lafayette. The researchers demonstrated that one-on-one mentorship in addition to targeted transitional support increases rates of first-year student retention for students with disabilities in a STEM major. Bellman et al. (2015) inves-

tigated the outcomes of academic success coaching for students with disabilities by coaches who have some knowledge of disabilities. In the evaluation of 60 students in over 300 one-on-one sessions, students reported learning new skills for academic success including note-taking, self-advocacy, and stress management. Other research has supported the use of electronic mentoring (e-mentoring) to achieve similar results of support. In a study with eight community college students, Gregg et al. (2016) found STEM students with a disability matched with an e-mentor received coaching on self-advocacy strategies, resulting in increased self-determination. In sum, the available research about students with disabilities in STEM has largely focused on barriers and challenges in coursework and how faculty may address these challenges; the research has focused comparatively less on student experiences in STEM classrooms and on campus.

### **LGBTQ Students in STEM**

To date, very little attention has been paid to how LGBTQ students experience STEM learning environments. However, the limited available evidence provides ample cause for concern. For example, studies have demonstrated that engineering schools reproduced heteronormativity and hegemonic masculinity (Cech & Waidzunas, 2011; de Pillis & de Pillis, 2008) and that biology classrooms are often unwelcoming to LGBTQ students (Cooper & Brownell, 2016).

In one of the most comprehensive studies to date, Linley et al. (2018) employed an ecological systems framework (Bronfenbrenner, 2005) to explore the experiences of 15 LGBTQ STEM majors within different institutional contexts (varying in size, public vs. private, religious vs. secular). While participants found community with out-of-class LGBTQ peers, their experiences in STEM-specific spaces were mixed, with “positive experiences ... primarily focused on specific interactions with STEM faculty [and] negative experiences ... primarily about specific interactions with co-workers, student peers, or perceptions of the STEM workforce” (Linley et al., 2018, p. 8). For instance, transgender students in the study reported that faculty used their correct names. Still, Linley et al. (2018) reported “students rarely described STEM faculty as LGBTQ allies” (p. 9) but as supportive individuals in general. The researchers called for additional research on LGBTQ students’ intersectional experiences in STEM majors.

On the faculty side, STEM faculty with minoritized sexual and/or gender identities reported feeling that they had to “pass” as cisgender and/or heterosexual in order to be successful in their fields (Barres et

al., 2017; Bilimoria & Stewart, 2009) and some faculty faced overt hostility (Bilimoria & Stewart, 2009). Such negative experiences might negatively impact faculty retention (Patridge et al., 2014). It is no surprise then that LGBTQ individuals in STEM fields report being less likely to disclose their sexual and/or gender identities to their students and colleagues than to family or friends and also reported feeling that their workplace was unsafe (Yoder & Mattheis, 2016). These findings were more pronounced for students than faculty, which likely contributes to inequitable STEM opportunity structures for LGBTQ students. Researchers who have studied LGBTQ people in STEM environments broadly (including faculty and the workforce beyond higher education) have outlined challenges in the climate for gender and sexuality, including hesitance of LGBTQ people to disclose their identities to others and a lack of role models and allies for LGBTQ students in the STEM fields. Published research does not address the intersections of these multiple marginalized identities as experienced by LGBTQ students with disabilities in STEM fields.

### **Methods**

This manuscript reports on findings from a subset of data drawn from a larger qualitative study about the identities and higher education experiences of 25 LGBTQ students with disabilities at a large, predominantly white research university in the South. Of these study participants, five majored in STEM fields, and during analysis for the larger study, significant differences in experiences of the academic and broader campus climate emerged between STEM and non-STEM majors, thus prompting the researchers to spotlight the experiences of the five students majoring in STEM.

The principles of constructivist grounded theory guided data collection and analysis for the original study (Charmaz, 2014). These principles included generating meaning inductively from data collected rather than being guided primarily by extant literature and using a constant comparative approach to analysis (Glaser & Strauss, 1967) that calls for generating possible patterns and themes early on in analysis and continuing to compare and refine these patterns as additional data is analyzed. Unlike more positivist research approaches, in constructivist grounded theory, “participants’ implicit meanings, experiential views ... are constructions of reality” that are subjective and guided by researchers’ subjective interpretations of how participants describe making meaning of their experiences (Charmaz, 2014, p. 17).

The study received IRB approval and all participants received information about the study's goals and procedures prior to being asked to sign a consent form. All participants were provided with information about relevant campus resources, including counseling services, should they wish to use them. Criteria for participation in the original study included self-identification with a disability and as LGBTQ and enrollment either as a graduate or undergraduate student. Participants were purposefully recruited primarily through electronic means (Jones et al., 2014), with email messages distributed through the campus LGBTQ center, disability services office, LGBTQ and disability student organizations, and academic units including disability studies and gender studies. We focus on the experiences of the five STEM majors in the sample (see Table 1): two engineering students and one student each in biology, computer science, and geology. Participants' disabilities included anxiety (three students), Asperger's or autism spectrum disorder (three), depression (three), ADHD (one), eating disorder (one), health problems/injuries (one), mental health problems (one), and PTSD (one). Because the five participants in this study used a variety of terms to describe their gender and sexuality, and because no participant identified as lesbian, we use the term "queer students with disabilities" to refer to participants in this study, taking up queer as an umbrella term to describe these diverse gender and sexual identities. To protect participant confidentiality, pseudonyms are used in place of participants' names.

Intensive, semi-structured interviews (Charmaz, 2014; Jones et al., 2014) functioned as the primary method of data collection. Interviews lasted 90 minutes on average and were audio-recorded, transcribed verbatim, verified with participants (member checking; Jones et al., 2014) and uploaded to Dedoose to facilitate data analysis. The interview protocol was designed to address how students conceptualized their multiple, intersecting social identities, with a focus on disability and LGBTQ identities, as well as students' campus experiences relative to their identities. Students were encouraged to speak to, and provide examples of, their individual experiences on campus and perceptions of navigating higher education relative to their unique identities. The interview protocol included a sequence of several sections with open-ended questions designed to elicit participants' experiences with:

- Life as a college student including college and major choice, experiences in the major, and campus involvement (e.g., "What are you now studying and how did you choose it?"

"Tell me about some campus resources you have used.").

- Social and cultural identities, relationship of multiple identities, and experiences of marginalization (e.g. "What are some of your social and cultural identities?" "Do you identify with disability and/or LGBTQ communities, and if so, how?" "Could you describe any prejudice or discrimination you have experienced?").
- Identification of allies and advice for campus leadership (e.g. "Who would you describe as allies in your life?" "What advice would you give to administrators and faculty members to improve the campus climate for people who share your identities?").

Because interview questions were open-ended and the study was designed to understand students' experiences in the context of the institution and their full experiences, students often brought up examples relevant to other identities including race, ethnicity, and gender, which is reflected in the findings; however, the researcher also probed to explore disability and LGBTQ identities in particular if a respondent did not address those identities in their responses. To answer the research question for this paper, we focus on students' experiences in STEM majors, further contextualized within their broader higher education experiences.

In constructivist grounded theory studies, researchers attempt to reach theoretical saturation (Charmaz, 2014), when significant new insights and/or themes relevant to the research question no longer emerge from additional data collection. By examining a subset of participant interview transcripts (i.e., the five students majoring in STEM fields) from the larger study that had already concluded, we did not reach saturation. The considerable diversity among our participants in terms of majors, experiences on campus, and gender, sexual, and other identities yielded unique insights and presents ample opportunities for future studies that can reach the point of saturation. We engage in data analysis and coding procedures guided by a constructivist grounded theory approach, as we describe below, and present in findings a thematic analysis of interview transcripts rather than developing an original theory specific to the experiences of LGBTQ students with disabilities in STEM.

Data analysis began with reading each participant transcript individually and writing analytic and reflective memos about the transcripts. Then, initial coding practices included line-by-line coding and in

vivo coding using participants' own words as codes (Charmaz, 2014). Subsequent coding included focused coding, which entailed identifying the most common and significant initial codes, grouping like codes, and beginning to identify the themes that are presented in this paper to answer the research question. During all phases of the analysis, the two researchers wrote memos about our impressions of the data and met frequently to compare insights and arrive at consensus, a strategy designed to enhance the credibility of our analysis. The researchers also reflected upon our subjectivities and relationships to the research topic to clarify our positionalities and potential biases. The first author conducted the original study based on his experiences directing an LGBTQ resource center on a college campus and a desire to better understand, support, and work with LGBTQ students with disabilities. He identifies as a white, cisgender, queer, middle-class man without a disability who is a first-generation college graduate and a faculty member in a higher education program. The second author joined the project after data was collected based on her interest in student development and her professional practice as a student affairs administrator. She identifies as a white, cisgender, middle-class female without a disability.

The researchers sought to employ Jones et al.'s (2014) guidelines for promoting trustworthiness of a qualitative study. Credibility was bolstered through member checking, the use of multiple researchers, feedback provided by two peer debriefers on this study, and providing thick description of participant examples in the findings. Because neither author presently has a disability, we were especially attuned to understanding the nuance of participants' experiences related to disability, and we engaged peer debriefers (two faculty members, including one who is a former disability resource center director and identifies as a person with disabilities) to review the study and offer feedback about our descriptions and conclusions. We sought to ensure dependability by documenting all steps of the research process, including data and collection and analysis, and sharing this documentation with our peer debriefers. Confirmability "requires the researcher to tie findings data and analysis" (Jones et al., 2014, p. 37), which we attempted to bolster by providing numerous participant examples and direct quotations within the findings as evidence of the themes we identified. Though this study was conducted in one institutional context, we hope the descriptions and implications we offer in this paper can provide some degree of transferability to readers' own contexts.

## Findings

The research question guiding this study is: How do queer students with disabilities majoring in STEM fields describe their collegiate experiences, both within and outside of STEM spaces? The findings section outlines students' experiences of stigma and marginalization in STEM spaces, male-centered and heteronormative STEM cultures, a physically and socially inaccessible campus, and a lack of intersectional resources that prompted some students to become advocates. While we begin this section with students' experiences directly related to their STEM majors, we also take a holistic view by exploring students' perceptions of their collegiate experience beyond STEM-specific spaces that undoubtedly inform their overall higher education trajectories.

### Isolation and Marginalization in STEM Spaces

Faculty helped shape how students viewed themselves in the classroom and within their broader academic experience. Students struggled to build and maintain relationships with faculty because they said their identities would be ignored or ostracized by faculty. Jordan reported he frequently needed assistance outside of the classroom to succeed within his courses. Initially, Jordan would reach out to his STEM faculty for office hours and supplemental learning, but struggled to find supportive faculty who would work with his learning needs:

It's a bit harder for me to go to office hours and talk with professors because the more competitive a place is, the more stigmatized obviously it is to be slower or stupid, to not be able to do things as quickly as the others. Sometimes, the professors, because they are so busy, they aren't willing to sit down. Not always, but a lot of them are not willing to sit down and help me through it. They say that's really simple, you should have gotten it, instead of helping me. It's always like I don't like saying anything when I don't understand anything because everybody else gets it and I don't.

After continual failed outreach to faculty, Jordan disengaged within the classroom and stopped engaging in out-of-classroom learning opportunities. He struggled to stay empowered to persist toward graduation in his major of choice.

Students sometimes felt marginalized by faculty and classmates. Veronica often felt isolated as a bisexual woman of color with disabilities majoring in geology:

It's important in the field of geosciences to have more than just the freaking white male heterosexual voice represented, which is, when you're looking at it, all of our geologic history, the freaking documentary that we were watching, was called "Men of Rock." I'm a woman. Where does that leave me? It feels like there's no space for me in that world, and sometimes we have to create that space.

Embedded in Veronica's reflections on her place in her major was an awareness that overrepresentation of heterosexual white men took place not just on campus and in her interpersonal interactions, but within her field as a whole. She identified that she did not see herself within the curriculum or welcomed in the classroom environment.

While Jordan and Veronica's experiences were negative, the other three participants in the study did not specifically refer to their faculty members as supportive or unsupportive, but did describe other challenges in the classroom and on campus detailed throughout the findings. Outside of the classroom, participants described navigating a STEM climate in their departments and colleges that often lacked diversity. Students often perceived they were the "only one" (the only queer or trans\* person, person with a disability, person of color, and/or woman) in spaces such as organizations and STEM resource offices. Regina reflected on the isolation of often being the "only one" in her department, as she was not aware of others who used disability accommodations. Part of the solution to this problem, as she saw it, was to focus on recruitment and retention of marginalized groups, including people with disabilities and queer people.

I think one big problem is that there's a really small minority of people in those types of populations in any given discipline. ... And I feel like if there were programs that specifically targeted people who aren't represented in higher education, so that there are more people in those departments, and then that would lead to the departments becoming more accommodating because those people would need the accommodations. So disabled people, queer people, people of color, anything like that, I think that would be helpful.

In Regina's view, recruitment would serve not only to bring in a more diverse student population, but could also improve the climate for students currently in the department or college by normalizing their presence and other aspects of academic life connect-

ed to their identities, such as receiving disability accommodations.

### **Male/Masculine-Oriented, Heteronormative STEM Cultures**

Across the board, participants described male-centered STEM cultures that promoted heteronormativity and hegemonic ideas of masculinity. While on the whole Hunter described his major's student organization as "probably one of the most inclusive and accepting places that I've ever been to," he lamented the "bro culture" of a scholarship program in computer science that he considered before attending the university, but ultimately decided not to pursue. He said that students in the program, "were a little more invested in, I guess, 'bro culture.' I guess that's never really been my thing. Coming out made me shy even farther away from that. ... We wouldn't have really had much in common." Hunter perceived the largely male group of students in the program to be conservative and hypermasculine, deciding that he would not fit in with such a group. Though alienated from such spaces due to gender and sexuality norms, Hunter perceived that being on the autism spectrum, and being introverted and independent, complemented his choice of major in computer science.

Women in the study, in particular, pointed out a lack of women in their disciplines among both students and faculty members. Veronica described feeling that she did not belong as a geology major, particularly as a feminine-presenting woman:

I can just see it in their eyes—they don't think I belong there. I hope every day that I will fight to not internalize that. ... If I continue to walk around and get stares from old white men that tell me that I don't belong, one day I may internally, or even vocally, express that and truly think, maybe while I'm taking a test, maybe while I'm considering applying to graduate school, or maybe even before that, when I'm consider applying to university, that I don't belong there.

Veronica doubted that she belonged on campus and in her geology major in particular. She contrasted the experience of unwelcoming stares with the validation she experienced interacting with one of the few female professors in her field: "I don't even think she knows that I idolize her." One solution, Veronica argued, was increased diversity education for faculty and staff, though she acknowledged that many might dismiss the importance of another training. "That attitude needs to change. It can't just be another sensitivity training, it can't be a waste of a faculty person's

day ... but it's important enough that it will affect a student's academic performance and how welcomed they feel in that classroom." Veronica thought additional diversity training was warranted because how faculty treat students can affect their sense of belonging and self-efficacy.

Students became involved in advocacy efforts to increase women's presence in STEM fields, among other types of diversity, in response to their experiences of marginalization. Regina described a negative experience during an engineering internship as an undergraduate. An older male professional at the internship site, having just met her, told her it was not too late to switch to a less difficult major:

I had completely changed careers, I was at the top of my class at the time, [and] it was not very good of an experience for me even though I know I didn't need this guy's approval. ... People like him are in charge of a lot of different industries and different companies. It's frustrating for me to know that that's what women have to go up against.

While this incident occurred prior to Regina's time at as a graduate student, it undoubtedly influenced her perceptions of the negative climate women often face in STEM fields. In response, Regina described participating on panels related to women and/or disability in STEM: "I do have a strong affiliation for increasing the female population in science and engineering, because I am female and I have to deal with all of the problems that women in engineering have to deal with." She also volunteered with the local children's museum that promoted science and viewed this as one avenue to interest underrepresented groups in science from an early age.

Despite involvement in advocacy efforts for underrepresented groups in STEM, Regina vacillated between saying her identities as queer and a woman "[don't] really come up at all," and acknowledging that she passed for other identities and did not often disclose her gender and sexual identities:

I'll disclose it if someone explicitly asks me, but otherwise, not really. Because one of the problems with being in engineering is, for the most part, it's a lot more conservative than social sciences and liberal arts where I'm used to. It's one of those things that I know it is fine, but I don't want to have to deal with people being jerks about it. I don't look anything other than straight, so I can pass. That's not really something that comes up very often.

Despite her assertion that gender and sexuality rarely come up, Regina also pointed that the engineering climate is conservative and that she often chooses not to disclose her identities.

### **Physical and Social Inaccessibility On Campus**

Beyond the classroom and other STEM spaces on campus, students noted a lack of accessibility, broadly conceived. Participants including Regina and Courtney had disabilities and health problems that often functioned to limit their mobility on campus and, in turn, affected how they engaged (or did not engage) with university resources. Regina described difficulty navigating older buildings in various states of disrepair:

It's really hard to find ... the entrances to get in [some buildings] if I'm having trouble with my muscle strength. ... Where do I find the door with the power assist button? They're not always labeled, so it's hard to get around. This construction [throughout campus] doesn't make it any easier.

Regina grew frustrated that accessibility on campus varied widely from one building to the next and that she did not always have a sure path to enter and navigate campus with ease. She described the graduate student lounge being tucked away in a basement that was difficult to reach. Because of her fluctuating mobility needs, she was not able to access resources such as the student lounge, where she might have solidified or made new social connections.

In addition to physical inaccessibility, participants also described a social climate that was often inaccessible as well. Students talked about the university as large and overwhelming. Regina said that it's "alienating how big [the university] is." She went on to describe added difficulty meeting others as a graduate student:

I feel like the university is designed for undergrads, but grad students make up a huge portion of the population, but there's not a lot of resources for them. I feel like for the most part we're left to be on our own and fend for ourselves. Everybody makes friends within the department, but because of my unusual journey to the program, I'm older than everybody else, and so it's hard for me to relate to them on the level that I need to. That's one thing that I've struggled with.

In the daily hustle and bustle of the large campus, another student, Courtney, discussed seeking out spaces where she could be alone and recharge, even if

only for a few minutes, such as a gender-inclusive restroom where she could collect herself. Students, such as Courtney, reported that even though the university was large and well resourced, they felt there were few places they could be alone for a few minutes. Courtney also sought to engage university-wide resources such as the counseling center, where she began seeing a therapist. However, she said that her need for long-term treatment resulted in her being referred to community-based resources due to a cap on the number of appointments a student can make at the counseling center, a policy that frustrated her.

Participants expressed discomfort with the dominant culture of the university, which they viewed as fueled by athletics, alcohol, and predominantly white fraternities and sororities. Hunter recalled being harassed while walking hand-in-hand with his boyfriend in a student neighborhood adjacent to campus and said that fraternity members' homophobia tended to emerge while they were drinking and partying, leading him to avoid the area when possible. Staff sometimes perpetuated an exclusionary climate. Jordan recalled an incident in the campus LGBTQ center when he spoke to a staff member so he could try "to find ways to connect my [engineering] major to helping underserved people. [The staff member] said, 'You're obviously in the wrong major.'" While Jordan desired to find a way to connect his engineering major to his passion for social justice, he felt dismissed by the staff member he sought out.

### **Lack of Intersectional STEM Resources and Becoming Advocates**

Though participants engaged with some targeted resources such as programming for women and people of color in STEM, they noted that these resources were focused on singular aspects of social identities and often lacked an intersectional focus. This lack of intersectionality played itself out in students' interaction with student affairs staff and peers. One participant, Veronica, described diversity as an "afterthought" in the sciences: "There's not a space there to kind of express these identities. If there could be like a multi-identity group for science majors in general—maybe I just haven't just found it because the university is kind of big and sometimes it's hard to find things." She reflected on feeling as though she was forced to choose between different identities when she sought to engage the college's resources and organizations.

Jordan, who identified as trans, used male pronouns, and occasionally described himself as a girl, became involved with the women in engineering program during his first year. His involvement included

volunteering to conduct outreach events for girls in elementary and middle school, but as the only Hispanic-identified and Spanish-speaking participant in the program, he felt overburdened by requests to lead events in Spanish: "I can't be the only Hispanic girl in engineering as a whole ... I can't be the only Spanish speaker there." Staff also sometimes asked Jordan to be the intermediary between women in engineering and a Hispanic engineers group, which made him feel uncomfortable and further tokenized. Jordan's experience with the Hispanic engineering group was not much better, as he felt excluded by racially insensitive jokes.

Jordan labeled the women in engineering program as "not intersectional at all. It only pretty much serves the white and Asian girls. I feel very much left out by them. ... I don't feel comfortable with them at all, but I still have to use it." Jordan shared a time when one of the program staff members questioned his disability diagnosis when he was seeking support upon identifying with Asperger's: "She sat down with me and said, 'You don't look like you have Asperger's.' The whole time she was just saying, 'Maybe you don't have it anymore. Are you sure? Have you been diagnosed yet?'" Such questioning and objectification left Jordan feeling worse than when he initially sought out the staff member. Negative experiences with multiple STEM spaces, including classes, diversity resources, and student organizations, left Jordan feeling distressed and lonely:

I'm almost always very uncomfortable here because it's a white majority. ... In engineering, it's very, very unwelcoming where every day I feel, "you don't deserve to be here, you shouldn't be here." ... I'm one of the very few Hispanic girls in engineering. Then when you add autism, I am very much alone. Every day, I see it, just looking around my peers and looking at my professors and the way that my professors treat me compared to the rest of my classmates. It's always just a very lonely experience.

Jordan described the intense toll that marginalization within the engineering context exacted upon him. Jordan's negative experiences in his major (in and out of class) reached the point that he eventually left engineering for a liberal arts major. He described feeling validated by his courses in liberal arts rather than experiencing panic attacks as he did in engineering courses: "I feel like if I did go into liberal arts ... I would feel like I dodged a bullet. I would be fine with it."



In response to negative experiences on campus (both in and out of STEM-specific spaces) and a lack of adequate resources, students discussed their efforts to become involved in non-STEM spaces, involvement which often included leadership and advocacy for diversity and equity issues. In this way, involvement functioned as a way for students to have a better experience on campus by connecting with like-minded others to build community. For those who became advocates, their work also functioned to pave the way for others and hopefully improve the university climate in both STEM and non-STEM spaces.

Participants became involved in a range of activities outside of their academic majors, including the LGBTQ center (Hunter), a queer people of color organization (Jordan), a bisexual student organization (Courtney), and becoming a resident assistant and orientation advisor (Veronica). Courtney founded a bisexual student organization after realizing that few resources targeted toward bisexual students existed on campus.

I've always been the kind of person that really enjoys helping people and advocating for people. I think that that's a passion of mine, to learn ways to help people. ... I feel like [we need] more resources specifically geared toward bisexual and pansexual students. Also, just more visibility, because that's another thing that's a big deal to people in the bisexual community, even amongst each other, is visibility, the lack of visibility. People tend to think that they're just aren't that many people who are bisexual out there because we don't stand up and wave our flag.

The experience of founding the organization allowed her to connect with others and channel her energy on campus toward improving the climate for herself and others. It also connected with her disability identity, as Courtney placed an emphasis on the group discussing mental health issues as part of its agenda.

## **Discussion**

Queer students with disabilities in STEM majors described a chilly climate around disability, gender identity, and sexual orientation — the initial focal points of this study — but also relative to race, ethnicity, and gender, a testament to the multiple identities students held and their holistic experiences on campus. This chilly climate was enacted within STEM spaces (classrooms and organizations) as well as in broader campus spaces, largely confirming evidence from prior research on students with disabilities (e.g.,

Lee, 2011; Moriarty, 2007) and LGBTQ students in STEM (e.g., Linley et al., 2018). While the students in the study did not attribute all of the obstacles they faced to disability or LGBTQ identities or other forms of marginalization, this study offers one contribution toward understanding students' holistic experiences on campus that undoubtedly influences their academic experiences and success.

Several students described their STEM faculty members as dismissive and unwilling to work to support students individually; other participants were neutral on this point and did not describe faculty as either supportive or unsupportive. Faculty are extensively trained in their content areas, but preparation to teach within a college classroom rarely includes training on how to work with marginalized students and students who use disability accommodations. Participants stated that when they were dismissed by faculty members when trying to reach out for accommodation or build rapport, it lowered the likelihood they would reach out to other faculty members in the future, thus affirming the importance of further training for faculty. Scholars have posited that faculty may hold negative stereotypes of students with disabilities relative to their ability to study in STEM fields and that training and implementation of universal design may be able to help change those perceptions (Thurston et al., 2017) and help faculty members become more inclusive (Moriarty, 2007). In particular, increased faculty training about providing classroom accommodations for students with disabilities (Love, 2014) could improve the climate in STEM, as student accommodations were not always taken seriously or were seen as rigid guidelines beyond which faculty would not provide support.

Beyond experiences with faculty members, students reported feeling isolated and tokenized within STEM spaces as a frustrating and exhausting experience. Students characterized STEM spaces as hypermasculine, male-centered, and heteronormative, a finding in line with prior research (Cech & Waidzunas, 2011; de Pillis & de Pillis, 2008; Hughes, 2017). Further, while one student cited the presence of a female faculty member as a role model, participants did not name any out queer or trans\* faculty members in STEM fields. If faculty do not identify as queer or trans\* or do identify with the population but do not disclose their identities or pass as cisgender and/or heterosexual, there is a missed opportunity to provide role models and mentoring based on shared identity that could improve the STEM climate (Barres et al., 2017; Bilimoria & Stewart, 2009).

Lastly, this study's findings affirm the need for far greater attention to multiple marginalized iden-

tities that students experience within STEM. While all students in this study experienced marginalization based on at least two identities (i.e., disability, gender identity, and/or sexual orientation), students also reported instances of harassment and invisibility based on race and ethnicity. This can create a compounded experience of marginalization that isolates students. Students pointed out that curricula and course content, including textbooks and documentaries, often rendered the contributions of people with disabilities, LGBTQ people, and women in STEM as invisible. Further, programs such as a women in engineering group that may have been created to increase inclusion may actually serve to further marginalize students if their focus is not intersectional and does not account for differential experiences based on sexual orientation and race. One result of these marginalizing experiences is that students (and faculty) may feel unwilling to disclose their disabilities and/or queer identities, thus preventing opportunities for visibility, inclusion, role modeling, and mentorship.

### **Limitations and Future Research**

As with all qualitative research, this study is not designed to generalize findings to a larger population, though we hope our description and analysis of participants' experiences offers transferable insights that readers can apply in their own contexts. This study reports on the experiences of five queer students with disabilities at a predominantly white research university in the Southern United States. Thus, an exploration of these topics in different institutional contexts (community colleges, regional comprehensive universities, liberal arts colleges, minority serving institutions) and regional settings is warranted. In addition, the participants represent a handful of disciplines within STEM (biology, computer science, engineering, and geology), leaving gaps for future research and better understanding of discipline-specific experiences. Future work could explore experiences that vary by specific disabilities, as this study primarily included students with autism spectrum disorders, psychological disabilities, and health problems, as well as specific LGBTQ identities not captured in this study. Despite these limitations, this study offers one of the first empirical examinations students living at the intersections of queer identities and disabilities in STEM fields and hopefully offers one contribution to continued attention to equity and diversity within STEM and areas for further inquiry and action.

### **Implications for Practice**

In analysis of the findings, the data suggest that there is work needed to improve the recruitment and retention of queer students and students with disabilities in STEM fields. Previous research and the findings report students feeling tokenized and isolated and experiencing a chilly campus climate. Thus, the primary implications for practice can be broken down into three areas: inclusive classrooms and curricula, recruitment and retention, and accessibility.

Previous research focused heavily on the classroom experience created by STEM faculty. Students in this study reported problematic classroom structure and curriculum. Faculty members should consider creating classroom structure based on universal design, which meets the needs of students by striving to create equity and use varied teaching and learning methods within the classroom. Beyond classroom structure, STEM faculty should create and assess their curriculum to ensure expert contributions come from a wide array of identities. By making the curriculum more inclusive, students will be able to engage in the content when seeing themselves reflected within it. Before implementing any classroom or curriculum changes, faculty and staff should participate in inclusion and equity training related to student identities including students with disabilities and LGBTQ students. Previous research and students within the study report distant and undeveloped faculty relationships, further isolating marginalized students within the classroom. Faculty need to become aware of the different type of student identities showing up within their classroom, how to support the success of all students, including different forms of accommodation and how to build relationships with students from diverse backgrounds.

Students reported feeling tokenized and isolated on campus with few resources provided to create community and a sense of belonging. Previous research found that when students with disabilities in STEM are provided a one-on-one connection to a mentor or faculty member to process their experiences with the goal of success, students perform better in and out of the classroom. Having a mentor or a coach to talk about academic success, accommodation, and transition would have a positive effect in the sense of belonging. This coaching in previous studies has been done online and in person, but regardless of modality, it is important that the mentor is trained to work with students with disabilities and can offer success strategies. These mentors can decrease the tokenization a student may feel but also assist in the recruitment and retention of a diverse student body. By strategically

putting resources toward training of faculty, a universally designed curriculum, and a welcoming campus climate, current students will thrive while potentially attracting more students who share their identities.

### Conclusion

In line with national imperatives to increase access to and success in STEM fields, researchers have begun exploring the experiences of students with varying disabilities in STEM learning environments. Less work has examined the experiences of lesbian, gay, bisexual, transgender, and queer students in STEM fields. Students who experience marginalization on campus based on both disability and LGBTQ identities may experience isolation, tokenization, and an overall chilly climate in the classroom and on campus, insights largely borne out in this qualitative study of five queer students with disabilities at a predominantly white research university, some of whom also navigated multiple, compounding forms of marginalization based on gender, race, and/or ethnicity. The findings of this study suggest that researchers and practitioners should devote greater attention to intersectionality within STEM student populations and can improve the climate by focusing on creating inclusive classrooms and curricula, improving recruitment and retention, and creating greater accessibility through the use of universal design.

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**Table 1***Participants*

Pseudonym	Major	Classification	Pronouns	Self-identified disabilities <sup>a</sup>	Self-identified LGBTQ identities	Self-identified race/ethnicity
Courtney	Biology	Undergraduate	she/her	Anxiety, depression, health problems, injuries	Bisexual	White
Hunter	Computer science	Undergraduate	he/him	Asperger's	Gay	White
Jordan	Engineering (transferred out)	Undergraduate	he/him	ADHD, anxiety, Asperger's, depression	Demisexual, queer, trans	Person of color, Mexican, Chinese
Regina	Engineering	Graduate	she/her	ASD, health problems, injuries, mental health	Queer	White
Veronica	Geology	Undergraduate	she/her	Anxiety, depression, eating disorder, PTSD	Bisexual	Mexican American

*Note.* <sup>a</sup>ADHD = attention-deficit/hyperactivity disorder; ASD = autism spectrum disorder; PTSD = post-traumatic stress disorder