

WIP: Trans-forming the Spaces of Engineering

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Dr. Clancy is motivated by their passion for and experiences with equity-minded teaching and holistic mentorship of students as people and professionals. She particularly enjoys intertwining engineering technical practices and social implications to prepare students to become socially responsible engineers. She seeks to reimagine who can be an engineer, what engineering is, and the impact engineering has on society for a more equitable world.

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Trans-forming the Spaces of Engineering

Abstract

This paper examines the spaces in which undergraduate transgender and gender nonconforming (TGNC) engineers feel comfortable expressing themselves or being their most authentic selves. Queer students in Science, Technology, Engineering, and Mathematics (STEM) often face a “chilly” environment due to issues like under-representation and a dominant masculine culture [1].

With a rise in TGNC students entering higher education [2], there is a need for educators and staff to prioritize their needs and create safe spaces. Preliminary work shows that TGNC engineers find comfort in physical and virtual spaces, with a majority of our participants having a deep connection to artistic spaces and forms of expression. The results of this analysis have implications of expanding knowledge on safe spaces and TGNC joy, as well as improving visibility of TGNC individuals' needs in higher education.

Introduction

Engineering culture has been described as heteronormative, masculine, and chilly for LGBTQIA+ folks [3], [4], [5], [6], where research has primarily focused on this climate and cisgender, LGB+ monoliths of the queer community [7]. Engineering students, staff, and faculty alike have had to compartmentalize their LGBTQIA+ and engineering identities within engineering or larger STEM spaces, change or conform their physical appearance and monitor their behavior to come off as cisgender and/or straight through passing, and other techniques to reduce unwanted attention, harassment, or violence [4], [8], [9]. These survival mechanisms have prevailed LGBTQIA+ communities for decades, not just in engineering, and have been reported to impact physical and mental wellbeing and desire to fully engage in engineering [3], [7]. While the growing research on LGBTQIA+ engineering experiences has been foundational to the field, as described by Yang and colleagues [10], the work thus far “...often miss[es] the ways in which LGBTQ+ engineering students actively and dynamically resist these oppressive forces as they go through their engineering lives, seeking to create space and build communities for themselves....”

This work has a purposeful focus on transgender and gender non-conforming (TGNC) individuals, as literature has identified the gap in studies of this population within the LGBTQIA+ community [7] and due to ongoing targeting of this community in larger sociopolitical contexts [11], [12]. According to the UCLA Williams Institute, 3.3% of the U.S. youth population and 0.8% of the U.S. adult population identify as TGNC, with 2.4% between the ages 18-24 [13]. This is an extremely small yet vulnerable part of the U.S. population

becoming increasingly hypervisible due to targeted legislation and news coverage. Over 150 anti-transgender bills in 2021 were under consideration across the U.S. and have exponentially grown to over 1000 bills considered in 2025, and over 560 bills in the first three weeks of 2026 [12]. Due to these reasons, our research team made a purposeful decision, despite collecting interviews with members of the LGBTQ+ communities, to only examine data from our TGNC participants to address a research gap and center trans joy, resistance, and community.

Background

In this paper we discuss spaces, meaning physical locations, virtual spaces or communities, or communities of people where culture and identity are negotiated [14]. Within higher education, LGBTQIA+ undergraduate student spaces have included the classroom, online spaces, and college life [15], [16], [17]. However, there is limited literature about LGBTQIA+ engineering spaces in particular [10], thus we will build on literature about climate or campus climate. Spaces or climate in institutions, campuses, departments, and/or classrooms, is sometimes seen in STEM disciplines as a “social” issue, less important than technical mastery and innovation [1], and force an apolitical narrative of engineering [18], [19]. Yet, climate can have negative effects on well-being, interest, retention, belonging, and persistence within disciplines, departments and programs [1], [20]. In a study of over 1,700 engineering students, LGBTQIA+ engineering students were found to be significantly more likely to experience marginalization, feel their work is less respected, and report more anxiety, stress, and exhaustion than their straight, cisgender peers [5].

Many studies have reported a chilly, hostile, or even violent campus climate for LGBT or TGNC students [1], [7], [20], [21] due to subtle or more explicit behaviors towards students’ sexual orientation or gender identity [7]. Overall, students enrolled in programs such as art or the social sciences reported a better campus climate than those in other majors, especially business and STEM subjects [21]. Within STEM workplaces or institutions, those who feel the need to hide their identities have reduced performance and decreased well-being [20]. Involvement in LGBTQIA+ centers or related groups also had more positive perceptions of campus climate [21], yet some researchers note transgender students' perspectives are lost within larger LGBTQ data sets and at times LGBTQIA+ centers have more focus on LGBTQ students due to lack of training or education [21].

Research on community building shows that queer engineering students build communities of support, or groups of people that queer engineers surround themselves with that legitimize their identities and experiences in engineering and can create techniques of resistance to challenge dominant narratives and oppressive institutions [4]. LGBTQIA+ students have leveraged their own peer networks, both inside and outside of engineering, to create community, a sense of belonging, and affirm their place within engineering [22], particularly TGNC students who have to navigate overwhelmingly gender-dichotomous, cisgender environments in higher education

[23]. As said by Yang et al. [10], “Within engineering education, queering engineering challenges us to view LGBTQ+ engineering students not as a monolithic group to be served with ‘LGBTQ+-specific’ resources, but as a body of unique individuals bringing their experiences to engineering and engineering culture within the context of their LGBTQ+ and other identities to learn and become successful engineers.” Driven by asset-based research theory and methodology from LGBTQIA+ studies and queer theory [24], [25], [26], our work aims to understand what are the types of spaces TGNC engineers interact with and benefits of these spaces such as but not limited to joy, self-confidence, resistance, and other positive impacts identified by our analysis of participants’ experiences.

Our investigation into various spaces TGNC engineers engage in was driven by two research questions:

RQ1) What are the types of spaces that TGNC engineers interact with?

RQ2) What benefits do these spaces provide for TGNC engineers?

Methods

Positionalities of the Researchers

We, the research team, came to this work from a variety of backgrounds, experiences, and identities - both privileged and marginalized; apparent and hidden - to critically examine how our knowledge production, analysis, and examination of this work [27].

The first author is a white, queer, transgender man who is an undergraduate engineering student. He first came to this topic through his work in his advisor’s research lab. When offered an opportunity to combine both his queer identities and engineering identity into this work, he felt compelled to participate. In his undergraduate engineering program he has experienced several instances of homophobia and/or transphobia from peers, which further sparked the need for this paper.

The second author is a white, queer, nonbinary neurodivergent woman, a tenure track engineering professor, a qualitative human subjects and design researcher, and an equity-minded teacher. In their experiences as an undergraduate engineering student, she felt her queer and engineering identities were separate or could not co-exist, even in spaces for other marginalized folks, due to straight, male-dominated, cisgender engineering culture. Being out in graduate school and exploring engineering education research, she was motivated to dive into LGBTQIA+ and queer theory literature, developing larger research project ideas and knowledge in these areas that this work came out of now as a faculty member. With the third author, we hired our first author as a research assistant to co-create this work together and support financially and professionally trans engineering student research experiences. Further, they value being in solidarity across marginalized groups, elevating their voices, and creating more equitable spaces

and experiences in engineering. Through teaching, activism, and research, she seeks to reimagine who can be an engineer, what engineering can be, and create a more inclusive engineering culture and society.

The third author, a white, straight, cis-female tenure track professor, came to this work through the high number of LGBTQIA+ students within her interview populations and students in her lab. In response to what she perceived as a growing anti-LGBTQIA+ and anti-trans sentiment nationally, she felt called to utilize her position of power to financially and structurally build a research program with the second author. She considers her role on this project to empower and support the first and second authors in their research agenda, provide mentorship, and learn about LGBTQIA+ experiences to create institution systems to better support these students.

Data Collection and Analysis

This study garnered participants from three higher education institutions across the United States, where the researchers had connections to recruit students. Institution A is a large, public research university in the Northeast, Institution B is a small, private liberal arts college in the South Central region, and Institution C is a small, private liberal arts college in the Mid-Atlantic. All three institutions offer an undergraduate engineering program.

We created a prescreening survey to distribute to queer undergraduate engineering students to learn more about the queer identities that they hold. Students were found through a number of methods, such as participation in LGBTQIA+ clubs on campus or prior involvement in previous research projects with the authors. Based on the results from the prescreening survey, 10 students were invited to participate in a semi-structured interview to learn more about their personal experiences as queer undergraduate engineers. Out of the 10 interview participants, 6 identified as TGNC and had other identities they discussed as well (Table 1).

Table 1: TGNC Participant Demographics and Institutions

Pseudonym	Pronouns	Sexuality	Gender Identity	Other Identities	Institution
Link	Any pronouns	Queer	Nonbinary, queer	Activist/political affiliation, disabled/chronic conditions, gamer, job outside of school, maker, neurodivergent	C
Mabon	Any pronouns	Bisexual, queer	Transgender, nonbinary, genderqueer	Disabled/chronic conditions, maker, neurodivergent	A

Milo	Any pronouns	Lesbian, queer, questioning, asexual, unsure	Nonbinary, genderqueer, queer, agender	N/A	A
Ralph	They/them	Questioning	Nonbinary, agender	Artist, first-generation college student, job outside of school, neurodivergent	B
Rollercoaster	She/her & it/is	Lesbian	Transgender woman	Gamer, neurodivergent	B
Zach	He/him	Pansexual	Transgender man	Artist, gamer, job outside of school, musician, strong family ties	B

Each student was sent a link to a Zoom room to participate in an approximate 90-minute semistructured interview. We created an interview protocol that focused on the participants' engineering identity and queer identity, specifically asking questions about both of those identities as well as the connection between the two. The interviews were conducted by the first and second authors, and were transcribed afterwards. To conserve anonymity, each participant chose a pseudonym, and all identifiable information was removed from the transcripts. Additionally, the raw interview data was stored in a two-factor authentication protected OneDrive folder that only the authors have access to.

Initially, for the data analysis, all 10 interviews were considered. The first and second authors read through the transcriptions, and we began doing initial coding. This involved several broad themes that related to their queer identities. For instance, some of the original themes were: being queer is political, being queer is creative, being queer is going against the norm, etc. One of these themes was: in community and queer spaces. This theme, in addition to the lack of literature on the TGNC engineering experience, shifted the focus to the need for safe spaces for TGNC engineers. A thematic analysis was utilized by analyzing the six participants' thoughts, experiences, and opinions shared during the interview process, which were then sorted into different categories of safe spaces. The first author created and selected the six categories of safe spaces based on common occurrences and themes found within the interview transcripts. The results presented below are from the semi-structured interviews conducted from June to

September 2025. Table 2 below shows the safe spaces, their definitions, and examples from the transcribed interviews:

Table 2: Safe Spaces and Definitions

Spaces	Definition	Examples from Interviews
Online spaces	Environments on the internet where people can share information, interact with others, and engage in activities	Queer YouTubers, queer-friendly Discords/chatrooms
Workplaces	A location where someone works/does their job	Scenic design shop, fast food restaurant
Pride/queer events	A gathering, party, or activity typically designed by and for the queer community	Drag shows, local pride parades or events
Creative spaces	Environments where people individually or collaboratively express themselves, or watch others express themselves	Art festivals, concert venues
Groups of people	Supportive or comfortable environments made possible by the people that make up the space, either permanent or temporary	Friend groups, partners
Engineering spaces	Environments targeted towards engineering	Makerspaces, classrooms

Results

The results from our thematic analysis, shown in Tables 4-9, represent the six participants' thoughts, experiences, and opinions shared during the interview process that were then categorized into different safe spaces identified by the first author. Table 3 represents which participants occupy which safe spaces. All participants are undergraduates who major in some engineering discipline and identify as TGNC. For this paper, safe spaces are defined as spaces (physical, online, groups of individuals, etc.) in which the TGNC undergrads feel comfortable being themselves.

Table 3: Spaces Participants Inhabit

Spaces	Participants
Online spaces	Mabon, Milo, Ralph, Rollercoaster
Workplaces	Link, Ralph, Zach
Pride/queer events	Link, Rollercoaster, Zach
Creative spaces	Link, Mabon, Ralph, Rollercoaster, Zach
Engineering spaces	Link, Mabon, Milo, Rollercoaster
Groups of people	Link, Mabon, Ralph, Zach

Online Spaces

Table 4: Online Spaces Quotes

Mabon	"honestly...I would say more in online spaces I'm in, you know, quite a few of those [queer-friendly Discords], and I definitely enjoy just getting to talk to different people and, like, hear their experiences and everything."
Ralph	"So I think the most I participate personally, because family doesn't know, is like I will watch like queer creators. I'd watch queer YouTubers. I'm there for my friends when they want to talk about things. I tease my friends lovingly, like, I think that's like the extent simply because, like, I can't just go out and do it because my parents have Life360 [family tracking app] and my parents are the definition of paranoid."

TGNC engineers participate in online spaces, or environments on the internet where people can share information, interact with others, and engage in activities. Our participants interacted with online spaces as a way to consume queer content and chat with peers. For example, Ralph watches queer content creators on YouTube rather than attending in-person events since they are not out to their parents. For Ralph, online spaces serve as a place where they can escape their non-accepting parents and feel in community by watching queer creators and chatting with friends. Similarly, Mabon enjoys their time online. For instance, Mabon enjoys chatting online in queer-friendly chatrooms by utilizing Discord. Both Ralph and Mabon enjoy the social interaction that stems from online interaction. Online spaces serve as safe spaces by giving TGNC individuals the opportunity to chat with peers or other parts of the queer community in addition to providing information and a sense of community to those who cannot be out at home.

Table 5: Workplaces Quotes

Link	“...I've spent much of the last three years in our theater program and in our theater department..., and I when I describe my work in the scene design shop to people, like, the interactions [are] the most queer, toxically masculine space I've ever been in there. It's very interesting, because of the 11 people on staff, there are two cisgender people and one heterosexual person. ... despite engaging in joking toxic masculinity. It is a very open and accepting space. ... beyond that, if any, if, as we have had people in the past who have come [into the space] and have been very non accepting and that space, like, I think, in a way, because of the jokingly toxic masculine environment. We don't put up with that s*** and like at all, and we that my work is, I think... one of the more militant spaces when it comes to enforcing the acceptance of queer people. Because in in shop, if you like, if you hate someone for who they are, you are you have different beliefs. That's fine. You just cannot. ... That is like that space is full of Queer people, and it is. It's a space built by queer people for queer people.”
Ralph	“I don't really do much outside of school except for that job, yeah, but my job is very nice. It's very welcoming. We have several like, trans people on our team, and then we also, we have a lesbian couple who are engaged, who are trying to figure out if they just want to have courthouse or not. So yeah, I was very lucky to find very open and welcoming team.”

Several participants found their workplaces, or a location where someone works, to be a safe space for their transness. Link works at their school's scenic design shop. Within the shop, Link has several queer peers. They describe the shop: “It is a very open and accepting space... I think one of the more militant spaces when it comes to enforcing the acceptance of queer people. Because in shop, if you hate someone for who they are ... You just cannot. ... That is like that space is full of Queer people ... It's a space built by queer people for queer people.” Within the design shop, the staff is comprised of mainly queer individuals. Link describes the shop as “toxically masculine” in a joking way, which is a stark contrast to the genuine toxically masculine culture in engineering. A majority queer staff along with the “militant” push for acceptance makes Link feel accepted as well as giving him positive social interactions. Ralph also finds their workplace to be a safe place, stating that having out trans and lesbian coworkers makes the environment feel “very nice” and “very welcoming.” Similar to Link, having queer coworkers makes Ralph feel welcomed and accepted in their place of work.

Pride/Queer Events

Table 6: Pride/Queer Events Quotes

Mabon	“probably just that, like various queer events and stuff where, you know, surrounded by other people who are also ... physically non conforming. I would say, like at events with other queer people... you know, we're, we're all enjoying the same things, especially art, like festivals are some of my favorites. You know, we're like, complimenting each other and just talking about, like, what's been going on, looking at all the different art and everything. It's nice to be able to, like, support other people and just really feel part of the community.”
Zach	“specific places, probably, like I said, like the LGBTQ+ nights, definitely when they do like the drag queen shows [which are] amazing. Sometimes they just do like arts and crafts stuff, just going to those things, just to talk to people, is amazing. Everyone is usually super comfortable to be themselves in those areas.”

The TGNC participants were also prevalent at pride events and overall queer focused events. These events can be defined as a gathering, party, or activity typically designed by and for the queer community. For instance, Mabon speaks on her experience with enjoying queer focused events. They spoke about enjoying spaces where they notice other “physically non conforming” people and feeling positively when they feel like “part of the community.” These events provide Mabon with a sense of acceptance and community. Zach shared some of his opinions with drag shows and other “LGBTQ+ nights.” A benefit of such events includes comfort and the opportunity for people “to be themselves in those areas.” Similar to Mabon, Zach enjoys the sense of acceptance and comfortability that events such as drag shows give him.

Creative Spaces

Table 7: Creative Spaces Quotes

Zach	“I've definitely had a couple moments where I've just like, sat back and realized, like, oh. I am, you know, a queer person. I'm a trans person, and, like, I'm doing this. Like, wow. Like, this is great. But, like, definitely, there's, there's a specific recent moment where I went to this benefit show, and the show was for my friend's top surgery. There, they recently had top surgery, and they didn't have a lot of money to, you know, get the surgery and do whatnot. So me and my
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	my other friend, who's also trans, we were like, All right, we can make this great, great coffee shop, like 10am show till 3pm wake the whole neighborhood up with some music. We'll get people in. They'll get coffee and and whatnot. So we found this cafe. My friend found the cafe in [city] because they're, they're, they know everything out there. So I just let them do it, and I brought my guitar. And, yeah, the cafe was super sweet about it. They actually gave all of the money from the coffees they served that day to us as well for the surgery. They were, they were very sweet.”
Link	“Yeah, I again, it was a concert specifically of a [home state] based goth band named [band 2]. They were playing at a venue very close by. I was there with my partner seeing them, and they have a song called Seven safe spaces, which is about making safe spaces for people no matter your identity, no matter your like, your gender identity, your sexuality, your race, your age, anything like that. There are, it's that song specifically is very much a song about acceptance and about making safe spaces and making those safe spaces known and open. And beyond that, there are a lot of lyrics and that song that hit very close with me. So like that, that that show and that song specifically was, I think, place that I felt the most accepted by myself and by the 100 plus people around me, because everyone was being weird, and that was okay.”

The majority of the participants found comfort in creative spaces. These spaces typically focus on either individually or collaboratively expressing oneself or watching others express themselves, whether it ranges from improv club to attending concerts. It is important to note that all participants generally have positive feelings toward the creative spaces. For instance, Link enjoys goth concert events; the band that wrote “seven safe spaces” in addition to fellow concertgoers, makes them feel both self-acceptance and outward acceptance. Zach and his band were able to perform at a local coffee shop to raise funds for their top surgery. Top surgery is an operation that often alleviates gender dysphoria for transgender men or nonbinary individuals. This experience left Zach feeling like “I am, you know, a queer person. I'm a trans person, and, like, I'm doing this. Like, wow. Like, this is great.”

Groups of People

Table 8: Groups of People Quotes

Mabon	“Wasn't until I started becoming friends with who I had now called my best friend, and they are very, very openly queer, and we just started hanging out a lot ...they gave me motivation to, like, express those parts of myself more um, and again, made me feel like I wouldn't be I wouldn't be judged for, like, trying new things and like wearing different clothes and like expressing myself. And after that, it just sort of snowballed from there. And I like, I realized that I can be myself without people like ... judging me all the time...I realized, like, hey, I really enjoyed, like, wearing fun outfits and just, you know, standing out, I guess. ... I met my partner that also helped a lot. They're a non binary trans man, and they, they sort of also started, like realizing that around the same time as me, so that also just, you know, sort of, sort of went through, went through our journeys, like, side by side”
Link	“I feel my most queer self when I am surrounded by other queer people, but not, not specifically, not only other queer people, I feel my most queer self again, like one of the reasons that I keep using goth shows as an example is because there are many cishet people who go to goth shows. I see myself. I view myself most as queer when I am able to be left alone without having to worry about what someone else is thinking. Whenever I am surrounded by queer people and non queer people who aren't, who don't care, who don't, who don't care about the relationships of other people who don't try to impose their view on someone else. One of the reasons that I like, again, concerts have been my big example, but also parties that are open to queer people or that like are queer centric, though ... I also feel the most accepted, because, again, people aren't worried about what if a gay person shows up, or what it like. People are just generally accepting. So I feel the most queer when I'm able to be queer without feeling judged or pressured by other people around me.”

Another safe space is groups of people. Groups of people is more broad than the other categories and can include friends, family, and peers. For example, Mabon speaks about her best friend and their partner who have both helped them on their journey with gender expression. Mabon shared that their “very, very queer” best friend gave them motivation to express themselves by “wearing fun outfits and... standing out.” Feeling that she won’t be judged by others allowed them to feel more secure in their gender expression. Additionally, Mabon’s partner also identifies as TGNC and helped Mabon as they “went through our journeys ... side by side.” An impact from this safe

space includes feelings of acceptance and gender euphoria for Mabon. Link also finds feelings of acceptance and community among groups of people. They share that venues like goth shows typically allow them to be surrounded by other queer people and allies which makes them feel like their “most queer self.” They feel accepted in these spaces due to a lack of judgment or pressure from the people around them. Link specifically mentions non-queer individuals making up these spaces which highlights that a safe space does not have to be queer-focused or made up of entirely queer individuals in order to give TGNC engineers a sense of acceptance.

Engineering Spaces

Table 9: Engineering Spaces Quotes

Rollercoaster	“Yeah, that's definitely something I've tried to talk about. Like, especially in SWE like, something that we do at each meeting is high, lows and whoas, and, like [friend name] ...has [talked about] current events regarding... Trans and Queer People.”
Milo	“So like I said, the [Institution A] improv club and oSTEM, which is like a group for queer students studying engineering, but technically, people of any identity and from any major could come ...it's open to people who might not be out yet or just want to go with their friends, or aren't in engineering but have an interest in engineering. So far, that's just been like more social events than projects, and actually it's sort of dying last semester, we had very little interest because we didn't advertise ourselves well. So I'm hoping we'll be able to get that a stronger presence next semester.”

Some participants found comfort in engineering spaces, or locations specifically targeted towards engineering students such as classrooms, makerspaces, and student organizations. Rollercoaster shared some club activities from SWE (Society of Women Engineers). She says each week SWE ends with “high, lows, and whoas” where club members share highlights since the last meeting. Rollercoaster says that one of her friends has talked about trans and queer people during this time. By talking about queer and trans people at meetings, she feels a greater level of acceptance than what can be considered a traditionally cisgender women-focused space. Milo participated in oSTEM, a club and national organization specifically for queer students in STEM. They found that oSTEM gave individuals who aren’t out an environment to hang out with other engineers who belong to the LGBTQIA+ community. Milo wants to continue oSTEM meetings as they provide a sense of community and overlap between queer identity and engineering identity.

It is important to note that both SWE and oSTEM are student organizations that cater to minorities in engineering, with oSTEM specifically existing for LGBTQIA+ individuals in

STEM. Therefore, perhaps it is not incidental that the participants found greater levels of acceptance and a sense of community in these clubs. For comparison, Link describes an engineering space in Institution C as “okay to be queer in these spaces ... we belong here.” They add that they believe their role as a queer engineer is to be “an advocate to engineers for queer people.” Although they feel safe in this environment, they also take on the responsibility of educating peers on queer identities which is significantly different than their behaviors in the design shop or concert venues.

Discussion

The spaces that TGNC engineers interact with can be divided into six categories: online spaces, workplaces, pride/queer events, creative spaces, groups of people, and engineering spaces. TGNC students can struggle with a lack of community in engineering spaces that they instead find within online spaces [7]. From the results, most of the participants found more comfort in spaces outside of engineering rather than within engineering. Most of the participants (Milo, Ralph, Rollercoaster, Mabon, and Zach) reported that they tend to keep their queer identities and engineering identities separate, a common finding in the literature [3], [4], [5], [8], [28], [29]. This does not negate the fact that several participants feel safe in engineering spaces; it is clear that participants are more comfortable being themselves in other spaces. One example would be the contrast in how Link speaks about the makerspace on campus vs. the concert venues they attend.

There are several impacts that safe spaces have on TGNC engineers. A few beneficial impacts include a sense of belonging/community, acceptance, and gender affirmation. Engineering is a predominantly cisheteronormative masculine field that leaves little space for social or political conversation within the classroom [18]. With current events such as an increase in anti-trans legislation [30], [31], being unable or uncomfortable to discuss TGNC identities creates a level of disconnect and compartmentalization that a number of the participants reference in the interviews. Rollercoaster, Mabon, and Milo found a way to feel comfortable in engineering spaces through participation in SWE and oSTEM, both of which combine engineering identity and LGBTQIA+ identity.

Some limitations to this study include the small number of participants and that most of the participants are white. In addition to there only being six participants, only one round of interviews was conducted. Therefore, our participants may not represent the entirety of the TGNC community or experience. If we continue this work, it may be beneficial to recruit new participants and conduct another round of interviews.

The results of this analysis have implications for challenging cisheteronormative culture in engineering spaces. Given that 2.4% of youth aged 18-24 in the U.S. identify as TGNC [13], we

suspect even less of that population majors in engineering, although no current data exists to confirm this assumption. This small subset of the TGNC population should be uplifted, protected, and respected within engineering spaces. One of the simplest and most validating actions faculty and students can take is to use proper pronouns, chosen names, and advocate for TGNC students, staff, and faculty not in the room; this is especially important with colleagues, peers, and people in higher positions of power. Engineering faculty can learn about engineering/STEM clubs and organizations that support queer students, staff, and faculty on campus and nationally, such as oSTEM (which is free for anyone to join). Organizations and centers on campus and in nearby communities that have LGBTQIA+ resources (like women's centers, LGBTQIA+ centers, or counseling services) can be added to syllabi and all classroom materials that discuss professional organizations and student support services, especially as they often provide financial and structural resources to meet TGNC needs. Faculty can also use their voice or vote to support these organizations financially and structurally on campus. As resources, such as public health records, being censored and gender affirming care becoming increasingly outlawed within the United States particularly for trans youth, the push for research on and tangible, visible advocacy and support of TGNC populations is of utmost importance.

Conclusions

Given the rise in hostility, erasure, and discrimination against TGNC populations within the U.S., we believe these asset-based interviews provide valuable information and perspectives on the undergraduate TGNC engineering experience to build community and persistence. The six categories of safe spaces identified within this paper provide TGNC engineers with several benefits; namely feelings of comfort and acceptance, a sense of community, and feelings of gender affirmation and/or gender euphoria. The safe spaces and benefits that they provide are a welcome and necessary addition to increase both safety and visibility of TGNC students within an otherwise predominantly heterosexual/cisgender field of study.

References

- [1] C. Brinkworth, "From chilly climate to warm reception : experiences and good practices for supporting LGBTQ students in STEM," M.A., Claremont Graduate University, Claremont, CA, 2016. doi: 10.5642/cguetd/97.
- [2] C. Thompson, A. N. Gentry, K. Douglas, F. Bahr, and J. Martin, "Leveraging Networks: Nonbinary STEM graduate students and the power of identity-specific social capital," presented at the American Society of Engineering Education Annual Conference, 2025.
- [3] E. A. Cech and T. J. Waidzunas, "Navigating the heteronormativity of engineering: The experiences of lesbian, gay, and bisexual students," *Eng. Stud.*, vol. 3, no. 1, pp. 1–24, Apr. 2011, doi: 10.1080/19378629.2010.545065.
- [4] B. E. Hughes, "'Managing by not managing': How gay engineering students manage sexual orientation identity," *J. Coll. Stud. Dev.*, vol. 58, no. 3, pp. 385–401, 2017, doi: 10.1353/csd.2017.0029.

- [5] E. A. Cech and W. R. Rothwell, "LGBTQ inequality in engineering education," *J. Eng. Educ.*, vol. 107, no. 4, pp. 583–610, 2018, doi: 10.1002/jee.20239.
- [6] K. Yoshino, *Covering: The hidden assault on our civil rights*. New York: Penguin Random House, 2006.
- [7] M. Jennings, R. Roscoe, N. Kellam, and S. Jayasuriya, "A Review of the State of LGBTQIA+ Student Research in STEM and Engineering Education," in *2020 ASEE Virtual Annual Conference Content Access Proceedings*, Virtual On line: ASEE Conferences, Jun. 2020, p. 34045. doi: 10.18260/1-2--34045.
- [8] D. Bilimoria and A. J. Stewart, "'Don't Ask, Don't Tell': The Academic Climate for Lesbian, Gay, Bisexual, and Transgender Faculty in Science and Engineering," *NWSA J.*, vol. 21, no. 2, pp. 85–103, Jun. 2009, doi: 10.1353/ff.2009.a316151.
- [9] K. M. Cooper, S. E. Brownell, and C. Gormally, "Coming out to the class: Identifying factors that influence college biology instructor decisions about revealing their lgbq identities in class," *J. Women Minor. Sci. Eng.*, vol. 25, no. 3, pp. 261–282, 2019, doi: 10.1615/JWomenMinorScienEng.2019026085.
- [10] J. A. Yang, M. K. Sherard, C. Julien, and M. Borrego, "RESISTANCE AND COMMUNITY-BUILDING IN LGBTQ+ ENGINEERING STUDENTS," *J. Women Minor. Sci. Eng.*, vol. 27, no. 4, pp. 1–33, 2021, doi: 10.1615/JWomenMinorScienEng.2021035089.
- [11] "Mapping Attacks on LGBTQ Rights in U.S. State Legislatures in 2026," American Civil Liberties Union. Accessed: Jan. 21, 2026. [Online]. Available: <https://www.aclu.org/legislative-attacks-on-lgbtq-rights-2026>
- [12] "2026 Anti-Trans Bills: Trans Legislation Tracker." Accessed: Jan. 21, 2026. [Online]. Available: <https://translegislation.com/>
- [13] J. L. Herman and A. R. Flores, "How Many Adults and Youth Identify as Transgender in the United States?," UCLA Williams Institute, Los Angeles, CA, Aug. 2025. [Online]. Available: <https://williamsinstitute.law.ucla.edu/publications/trans-adults-united-states/>
- [14] H. Bhabha and J. Rutherford, "Interview with Homi Bahabha: the third space," *Identity: Community, culture, difference*, pp. 207–221, 1990.
- [15] R. A. Miller, "'Sometimes You Feel Invisible': Performing Queer/Disabled in the University Classroom," *Educ. Forum*, vol. 79, no. 4, pp. 377–393, Oct. 2015, doi: 10.1080/00131725.2015.1068417.
- [16] R. A. Miller, "'My Voice Is Definitely Strongest in Online Communities': Students Using Social Media for Queer and Disability Identity-Making," *J. Coll. Stud. Dev.*, vol. 58, no. 4, pp. 509–525, 2017, doi: 10.1353/csd.2017.0040.
- [17] R. A. Miller, "Toward Intersectional Identity Perspectives on Disability and LGBTQ Identities in Higher Education," *J. Coll. Stud. Dev.*, vol. 59, no. 3, pp. 327–346, 2018, doi: 10.1353/csd.2018.0030.
- [18] E. A. Cech, "The (Mis)Framing of Social Justice: Why Ideologies of Depoliticization and Meritocracy Hinder Engineers' Ability to Think About Social Injustices," in *Engineering Education for Social Justice*, vol. 10, J. Lucena, Ed., in Philosophy of Engineering and Technology, vol. 10. , Dordrecht: Springer Netherlands, 2013, pp. 67–84. doi: 10.1007/978-94-007-6350-0_4.
- [19] D. Riley, *Engineering and social justice*. Morgan & Claypool, 2008.
- [20] E. P. Tingey, "A Scoping Review on the Experiences of Queer and Trans Students in STEM." Utah State University, All Graduate Theses and Dissertations, 2024. [Online]. Available: <https://digitalcommons.usu.edu/etd2023/323>

- [21] J. C. Garvey, S. Viray, K. Stango, C. Estep, and J. Jaeger, "Emergence of Third Spaces: Exploring Trans Students' Campus Climate Perceptions Within Collegiate Environments," *Sociol. Educ.*, vol. 92, no. 3, pp. 229–246, Jul. 2019, doi: 10.1177/0038040719839100.
- [22] J. Linley, K. Renn, and M. Woodford, "Examining the Ecological Systems of LGBTQ STEM Majors," *J. Women Minor. Sci. Eng.*, vol. 24, Jan. 2018, doi: 10.1615/JWomenMinorScienEng.2017018836.
- [23] Z. Nicolazzo, E. N. Pitcher, K. A. Renn, and M. Woodford, "An exploration of trans* kinship as a strategy for student success," *Int. J. Qual. Stud. Educ.*, vol. 30, no. 3, pp. 305–319, Mar. 2017, doi: 10.1080/09518398.2016.1254300.
- [24] P. Dilley, "Queer theory: Under construction," *Int. J. Qual. Stud. Educ.*, vol. 12, no. 5, pp. 457–472, Oct. 1999, doi: 10.1080/095183999235890.
- [25] S. Seidman, Ed., "Deconstructing queer theory or the under-theorization of the social and ethical," in *Social postmodernism: beyond identity politics*, in Cambridge cultural social studies. , Cambridge ; New York: Cambridge University Press, 1995, pp. 116–141.
- [26] S. M. Pennell, "Queer Theory/Pedagogy and Social Justice Education," in *Handbook on Promoting Social Justice in Education*, R. Papa, Ed., Cham: Springer International Publishing, 2020, pp. 2291–2311. doi: 10.1007/978-3-030-14625-2_103.
- [27] S. Secules *et al.*, "Positionality practices and dimensions of impact on equity research: A collaborative inquiry and call to the community," *J. Eng. Educ.*, vol. 110, no. 1, pp. 19–43, Jan. 2021, doi: 10.1002/jee.20377.
- [28] A. Butterfield, "Being Queer Taught Me How to Teach," in *Queering STEM culture in US higher education: Navigating experiences of exclusion in the academy*, 1st ed., K. Cross, S. Farrell, and B. Hughes, Eds., Routledge, 2022, pp. 152–168.
- [29] E. A. Cech, "The veiling of queerness: Depoliticization and the experiences of LGBT engineers," presented at the 2013 ASEE Annual Conference & Exposition, Jun. 2013, p. 23.1243.1-23.1243.8. Accessed: Jan. 27, 2023. [Online]. Available: <https://peer.asee.org/the-veiling-of-queerness-depoliticization-and-the-experiences-of-lgbt-engineers>
- [30] "Mapping Attacks on LGBTQ Rights in U.S. State Legislatures in 2026." 2026. Accessed: Apr. 02, 2026. [Online]. Available: <https://www.aclu.org/legislative-attacks-on-lgbtq-rights-2026>
- [31] E. Greytak, "The Impacts of Anti-Trans Laws and Policies: Evidence from Empirical Research," American Civil Liberties Union, New York, NY, ACLU Research Brief, 2024. Accessed: Apr. 02, 2026. [Online]. Available: <https://assets.aclu.org/live/uploads/2024/08/Impact-AntiTrans-Law-Research-Brief-FINAL.pdf>