

Exploring Transgender and Gender Nonconforming Engineering Undergraduate Experiences through Autoethnography

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Abstract

Undergraduate programs in engineering are demanding, time consuming, and inherently social endeavors for young adults. Strong social support networks and communities which foster success are frequently found to increase student retention and perseverance through their engineering degree programs. Students with marginalized identities in higher education are met with additional workloads – managing their social identity, negotiating stereotypes, and finding belonging. Existing research shows that a student’s experience in higher education is particularly shaped by gender interactions. This has been shown to be particularly true in engineering, whose gender demographics and professional culture is described as hegemonically masculine. Research on gender in engineering has typically framed gender within a rigid, essentialized cisgender binary. Current literature is lacking detail on the processes used by gender diverse students in the transgender and gender nonconforming (TGNC) community as they navigate the gendered engineering field. We wish to highlight the experiences that undergraduate engineering students have had in relation to their social support and perceptions of gender as it relates to engineering culture within their undergraduate programs. Two students participated in autoethnography as a method of data collection to meet this objective. Collaborative autoethnographic methods position the students as coauthors and coresearchers to ensure the validity of analysis alongside the project’s primary investigators. Using a resiliency framework and critical autoethnographic analysis, the primary focus is on the ways these students have formed support systems and their perception of the social landscape in engineering. Through exploring how students persevere through their programs we may uncover points of intervention to strengthen these support systems.

Introduction

The 2018 STEM Inclusion Study reported that lesbian, gay, bisexual, transgender, and queer (LGBTQ+) individuals perceive having their ability devalued and given less respect than that of their peers, and experience a chilly, discriminatory climate [1]. This study added to the growing body of literature which show LGBTQ+ individuals are navigating a chilly to hostile climate in science, technology engineering, and mathematics (STEM) which results in a diminished sense of belonging in their field [2-5]. Student experiences of discrimination on the basis of gender and race also lead to lower trust in their department and greater disidentification with their programs [6]. A sense of belonging – which can be described as comradery, positive relationships, and identification with peers – is a critical component to persistence in engineering education [7-9].

Studies which seek to describe a universal LGBTQ+ experience may overlook experiences surrounding gender which are specific to the transgender and gender nonconforming

(TGNC) population. Lesbian, gay, and bisexual identities primarily revolve around sexuality and not necessarily gender expression, presentation, and identity. This may risk conflating TGNC gender identities and LGBQ sexual identities as synonymous in experience, despite distinct differences in experience on college campuses [10]. One form of harassment particularly directed towards TGNC individuals is known as “gender bashing” which targets individuals whose gender expressions and identities stray from dominant norms expected of their bodies [10-13]. Additionally, TGNC individuals experience discrimination and exclusion not only from cisgender straight individuals, but from cisgender individuals within the LGBQ+ community as well [10, 11]. These factors result in a need for research focused specifically on the TGNC community in engineering – their experiences, support systems, and pathways to success.

According to the 2015 U.S. National Trans Survey, 24% of people perceived as transgender on college campuses were verbally, physically, or sexually assaulted, and 16% left higher education due to the level of harassment they experienced [14]. These statistics for the overall population are further divided across racial lines, with TGNC individuals of color experiencing greater marginalization. TGNC students who perceive a negative or discriminatory campus climate report decreased measures of student success as measured by performance and retention [15]. The years of higher education are of particular note in TGNC research as nearly half of the US trans population comes out or begins transitioning between the ages of 18 and 24 [14]. This itself is a process with additional social and material support needs which can overshadow the demands of the classroom.

Resiliency and social support

Resiliency refers to the processes used to overcome challenging situations and adapt to the demands of life, with particular attention on the unique strategies employed by marginalized groups [16, 17]. Transgender and gender nonconforming students are often written about through deficit framing which define their lives in terms of their trauma or perceived academic failure [13, 18]. In contrast, resilience is “reflected by achievement in career development, happiness, relationships, and physical well-being in the presence of risk factors” [19]. A focus on enrollment retention alone overshadows the complex and creative strategies that TGNC students make on a daily basis across every facet of their lives in order to succeed on campus [13, 18].

One of the strategies employed by TGNC students is the formation of social support networks [13, 20]. Transgender and gender nonconforming students frequently form supportive communities as a resiliency strategy during their undergraduate programs. Sometimes described as “kinship networks,” these networks of close mutually supportive relationships exist on and off campus, as well as online [13, 21]. “Kinship networks,” as described by Z Nicolazzo [13], are communities of deep interpersonal relation which provide three primary roles: 1) recognizing and honoring gender identities and expressions, 2) providing a refuge from the cultural realities of gender binary discourse and compulsory heterogenderism on campus, and 3) acting as a potential site for participants to use to resist systematic trans oppression. Regular interaction with peers of a similar identity fosters belonging among underrepresented communities in engineering

and STEM, which underscores the important role such groups have in higher education [22-24]. These supportive social spaces for underrepresented groups are often informal due to lack of institutional support yet serve to maintain a positive learning climate and promote the group's validation of their common experiences [6, 13, 23, 25]. TGNC college students are 13% more likely to spend time with others socially and spend 12% more time online compared to the national average, underscoring the relevance of such social support networks in their lives [26]. Similar informal networks, such as those formed by women of color in STEM described by Maria Ong, exist in a variety of forms [23]. They may be conceptual, ideological, or physical spaces on and off campus but all together function "as havens from isolation and microaggressions."

Collaborative autoethnography

Autoethnography is social and cultural analysis performed through personal narrative [27]. They are self-written detailed and descriptive writings of personal experience that are "reflected upon, analyzed, and interpreted within their broader sociological context" [28]. If ethnography can be described as an observation and interpretation of the "other" then autoethnography becomes an observation and interpretation of oneself and one's perception of their social surroundings. It is a method engaged in both qualitative reflexive self-analysis and a commitment to theoretical scientific social analysis [29]. Autoethnographers choose a topic on which to focus with a method of writing grounded in factual real-world interactions, quotations, experiences, and emotive responses as best remembered and documented. The theoretical analysis is conducted on the written data upon completion which can include a variety of textual and narrative interpretations.

Collaborative autoethnographic method uses multiple autoethnographies from individuals of similar social locations or social experiences to triangulate upon common shared experiences while allowing for diversity of experience [30]. Multiple coauthors of similar social location also assist in the interpretation for cultural and social meaning. In this study, two coauthors of this paper were also the research participants in the autoethnographic data collection. This method has been applied in higher education studies to research underrepresented populations such as female psychology student leaders, drug abuse counselors, foreign-born faculty of color, and black trans/nonbinary students [30-32, 20].

Feminist and critical autoethnographic methods can inform analytical approaches. These situate the individual as existing within an inherently political social landscape whose knowledge "emerges from political understandings of one's social positioning as well as experiences of the cultural freedoms and constraints one encounters" [32]. Feminist autoethnographic interpretation reformulates the narrative interpretation to include social systems such as gender. Such work recognizes the influence that identity has upon lived experience and implicates societal systems of marginalization in the data interpretation [31, 34]. Critical autoethnography centers the confluence of multiple identities (i.e. race, gender, class, sexuality, disability, etc) to acknowledge the intersections of difference and oppression [33] and the impact this has upon

lived experience [27]. Together, critical and feminist autoethnographic analyses recognize how identities and experiences provide insight into dominant social power structures.

Prior engineering education research has applied similar narrative methods to investigate the social experiences of students and faculty. In a narrative analysis of a socio-economically disadvantaged woman of color in engineering, Cynthia Floor et. al. argues that underrepresented students are “the very people we need to attract and retain in engineering” and thus individual narrative-based research allows us to “listen to these hidden and experientially diverse people one story at a time” [35]. Drawing from feminist standpoint theory, Alice Pawley argues that analyzing narratives is a novel method for uncovering gendered, social landscapes in an engineering institution [36]. She writes that “we can understand institutions, and thus develop theories about the ways in which they are gendered and raced, only through the lived experiences of individuals within those institutions.”

Method

This research is qualitative with a primary objective of revealing the specific experiences of TGNC students in engineering undergraduate education. Two undergraduate engineering students were prompted to write autoethnographies on their experiences in engineering education. These two autoethnographic written narratives serve as the primary data for analysis. The autoethnographies were thematically coded in two collaborative phases with the undergraduate students to identify salient commonalities in experience. A resiliency framework was used as a lens of data interpretation to target systems of support and community instead of a focus on identifying marginalizations. Details of the methodology follows.

Sample selection

The autoethnographers are two women in the TGNC undergraduate engineering population at Oregon State University who were recruited through informal communication with the research team. Ava Butler is a 2nd year student in mechanical engineering (ME) and Naya Pelzi is a 3rd year student in computer science (CS). The students were offered the opportunity to engage in autoethnography as a method of analyzing their perception of engineering culture and support systems, and the students agreed to become coresearchers and coauthors. The students identify as white, transgender, and queer women. The study was conducted in an engineering college at a large public research university in the Pacific Northwest region of the United States. A total of 7,748 undergraduate engineering students are enrolled at the Oregon State University college of engineering. In the general population 0.6% of adults identify as within the TGNC population [37]. At Oregon State University’s college of engineering 20.5% of the undergraduate engineering student population identify as women. If representation of TGNC individuals were at parity with broader society then we then estimate approximately 9-10 women may identify as within the TGNC population at our institution. The population of TGNC students in engineering undergraduate programs can be expected to be similarly small at any given institution. The

limited number of students available to sample from limits the application of methodologies which rely on statistically significant sample sizes. Small sample sizes for collaborative autoethnographic methods are also typical to preserve the salience of individual stories and provide a targeted reflection by the coauthors [31].

Autoethnographic writing and analysis

To begin, the participants (autoethnographers) were given excerpts from the books “Autoethnography as Method” by Heewon Chang [28], “Critical Autoethnography: Intersecting cultural identities in everyday life” edited by Robin M. Boylorn and Mark P. Orbe [27], and several articles which used written narrative as the subject of analysis [30-32, 38, 39]. This provided the participants with tools and frameworks from which to begin their autoethnographic process. The autoethnographers obtained these materials, read and reviewed them, and then met with the researchers to debrief on the writing process.

Autoethnographic investigations begin with a central topic or theme of exploration [28]. The autoethnographers were prompted to write about their experiences in engineering education as it related to social support inside and outside the classroom and their perceptions of gender and engineering broadly. The autoethnographies included their experiences as related to both TGNC life and engineering education, and includes pre-college perceptions of engineering and gender that later informed their college experiences. The autoethnographers were additionally informed and prompted to write with a particular focus on their resiliency, success, and how they navigate their academic program.

The autoethnographies were written over the course of thirteen weeks. During week seven of the writing process, the research team met to review drafts of the autoethnographies to explore emerging themes, notable events, and commonalities between the two participants. The search for cultural themes and reoccurring topics is the primary method of autoethnographic analysis [27, 28]. These indicators “explain how your life experiences are culturally, not just personally, meaningful” and can be compared to others in society [28]. Experiences which were found most relevant to engineering and gender were expanded upon and explored in the final autoethnographic data. The final autoethnographic data set comprised of 9 pages of text by Ava and 10 pages of text by Naya.

The researchers collaborated with the autoethnographers in the final analysis of the autoethnographies through thematic coding in ATLAS.ti. The autoethnographers clarified concepts and the meanings of quotations in order for their experiences to be accurately interpreted and portrayed. Excerpts were coded by their cultural and experiential themes. Quotations and excerpts within each theme were read, reviewed, and placed into context collaboratively through conversations between the research team. Throughout the analysis, memos and notes of verbal conversations between the researchers and the participants were kept to record findings to ensure validity of the final analysis.

Results & Discussion

Three common themes were identified between the autoethnographies: engineering and trans culture as separate or incompatible; the relevance of online and virtual spaces; and support systems existing primarily outside engineering contexts. There was an additional resiliency strategy from Naya's autoethnography which the research team found important to analyze and present in this paper. These are presented with specific quotations from the autoethnographies to provide context alongside the collaborative analysis. Pseudonyms were used in quotations instead of identifiable information.

Theme 1. Engineering and trans culture as separate

Both students describe an engineering culture which is geared towards a dominant paradigm of men (e.g. straight, cisgender, hegemonic masculinity). They began to perceive this dynamic in engineering even prior to entering undergraduate education. During high school Ava participated in an engineering course and a robotics club. Her experiences were positive due to her close relationship with another queer individual and a love for robotics, despite marginalizations:

Girls made up less than $\frac{1}{3}$ of the team, and I understood why. The environment was often uncomfortably sexual and dismissive of their opinions. On the team, the only other queer person was a senior named Jani. The team was aggressively homophobic, and Jani & I got mocked pretty constantly. Nevertheless, we continued through the year, and fielded our robot at competition. I enjoyed the experience greatly, and despite the team's flaws, I really loved what we were doing. (Document 1, paragraph 21)

These experiences primed her expectations of what undergraduate engineering culture might eventually be like in college. Her love of engineering propelled her to enroll as a mechanical engineering major once she graduated high school. During her first year Ava began to transition and present her gender in and out of the classroom. She immediately met similar exclusionary social dynamics once again in college:

Most of my classmates & group members seemed perplexed by my gender identity, and talking about it seemed to make them uncomfortable. Luckily, most of them treated me with some degree of respect. Several refused to use my pronouns, and made jokes about my identity. This didn't bother me a whole lot, since I had dealt with a lot worse through high school. However, it did make group projects exceptionally awkward. I felt as though I was always an outsider within the group, and that the other participants were only there because they had to be. (Document 1, paragraph 30)

Group projects are an integral component of engineering education programs which necessitates working relationships between peers. This group nature brings students of differing identities together, meeting frequently outside of classroom hours or instructor monitored interactions. The students identified group projects, laboratory work, and classroom interactions as a particular hurdle towards engineering peers being a part of their social support networks. This seems to mirror literature which describes a gendered engineering student dynamic where women experience negative interactions and diminished project roles in team-based settings [40, 41]. The additional layer of being transgender women complicates the ability to draw clear parallels to existing studies on women in engineering, which often have not explored the nuance of transgender status or gender nonconformity in their analysis. Perceptions of diminishment stemming from her trans status continued into her summer research appointment between the 1st and 2nd year:

I can't help but feel that my isolation within the lab was a result of my transness. Another moment when I felt my gender deeply and painfully was when I had to fabricate my project in the shop. I felt incredibly condescended to by some of employees. They treated me as if I was incapable of using the most rudimentary tools, even though I'd spent years doing work with them. It made the fabrication process really unpleasant for me.

(Document 1, paragraph 39)

Naya found that hiding her LGBTQ+ identity became a part of her strategy to find belonging and acceptance in engineering spaces. Stereotyping and minority myths propel underrepresented groups in engineering to put significant effort into “proving” their intelligence to peers, faculty, and others while simultaneously trying to downplay parts of their lives which may “prove” these stereotypes true [42-44]. In what can be considered part of this downplaying, LGBTQ+ individuals in engineering are found to “closet” their identity at a rate that is higher than other STEM fields [4]. Naya noted that other TGNC engineering students had hidden or diminished their trans identity as a resiliency strategy in their program:

We would later learn that Suzu is nonbinary and prefers “they/them” pronouns. Despite this, they lived their life closeted to avoid unnecessary trouble within the culture of engineering. They truly did love the field, taking part in extracurricular activities related to engineering in addition to their studies. In order to reconcile their non-normative gender with the very normative atmosphere of their chosen field, they elected to remain private with it, living their daily life as a woman ... this itself can lead to harassment, but they elected to take that over what they would be otherwise subjected to. (Document 6, paragraph 3)

After these interactions Naya began to perceive that queer and trans people such as herself are a part of an identity group with ties to political advocacy for rights and recognition, which is a

culture she perceived as absent within engineering student culture. She noted this disconnect when debating social issues with male engineering students:

The three of us would continue to have similar debates about social issues as the term progressed, with eventually both Suzu and myself coming out to the group as indeterminate non-cis. This also changed the debate dynamic somewhat by further aligning the two of us against the cultural norm. Two queer people arguing against toxic masculinity and in favor of programs to improve the lives of those who are underprivileged in the field are not exactly standard issue. (Document 6, paragraph 8)

Throughout both autoethnographies the students detailed the inherently political ties the transgender community has to the broader social landscape, particularly in the contemporary moment. Trans rights have become a national political conversation. Just in 2018 major news stories have ranged from the leaked White House memo on redefining gender for Health and Human Services, a Supreme Court decision on Title IX interpretation for transgender students, and what the Human Rights campaign has described a “national epidemic” of fatal violence against the transgender community [45-47]. For many TGNC individuals their very existence has become framed within political rhetoric and advocacy. This is reflected in the political behaviors of many TGNC college students. Transgender students in higher education are more likely to discuss politics and share political opinions than the average college student [26]. Additionally, transgender students (70% of sample) claim a liberal or far left political identity compared to the national student average (34%). The culture of engineering is different in its relationship to the political realm. Engineering has a depoliticized, meritocratic culture which is disengaged from public welfare or social justice concerns [48]. This hegemonic and depoliticized ideology can be represented by both men and women in engineering. A study by Carroll Seron et. al. found women in engineering education were not connecting their personal experiences of gender marginalization to greater political or social structures, but instead interpreted them through meritocratic ideology and individualism [38]. Engineering is also considered one of the most politically conservative academic disciplines in higher education [49]. One study found liberal-left views to be the far less prevalent in engineering faculty (23%) when compared to social sciences (59%) or humanities (54%) [50]. This relationship to the socio-political has led engineers to be characterized as “idealistically obeying the behests of society” [51]. TGNC undergraduate engineering students may exist in a liminal cultural space, with contemporary TGNC student culture holding political ideologies of advocacy against their systemic marginalization which is incompatible with meritocracy and depoliticized ideologies.

Theme 2. Internet and Virtual Spaces

The online social landscape of the internet offers space for the LGBTQ+ community, and in particular the TGNC community, to construct affirming spaces for their identity where they may

not exist in person [13, 52]. The internet offers a space where a community that is rather small in any given town or college major can join together. As mentioned earlier, TGNC college students spend 12% more time online compared to the national average, which situates the internet as a particularly relevant structure in their lives [26]. At the same time, dominant paradigm online spaces surrounding science and technology exist as male dominated social spaces which often proliferate sexist sentiments towards women and discrimination against LGBTQ+ individuals [53]. These two virtual spaces were navigated by the participants as they searched for their own place as queer TGNC women in engineering. Some internet and virtual spaces were found to be sources of affirmation, respite, and support during their undergraduate engineering programs. Other spaces were sources of “deciphering” dominant undergraduate engineering student culture.

From a young age, Ava found that the internet was an important avenue to understand gender and sexuality outside of the formal school environment. She noted that it played a pivotal role in understanding herself, her gender, and her sexuality. This laid a foundation for the internet to serve as a source of LGBTQ+ community knowledge and connection into adulthood. Naya wrote at length about how online interactions shaped her perceptions of STEM culture. During high school when Naya was at the age of preparing for college applications and admissions she perceived a connection between what she describes as “science and fact” ideology in engineering and political cultures which purported misogyny and transphobia in dominant paradigm online STEM spaces. She witnessed individuals online using “science and fact” to justify the invalidation of “nonnormative sexualities and genders.” The following passage takes place while she was online and considering college programs:

I saw engineering as the home of these concepts, so when I encountered the same terms being associated with the far right ... I began to associate the two. This was reinforced when I found that many of the people attached to that ideology were themselves engineers. My definition of engineering had now grown to include a mindset and [far right] ideology. (Document 3, Paragraph 6)

It is worth noting that online spaces are varied, vast, and diverse in their formulations. The authors do not wish to assert that all online spaces with engineers promote a “far right” ideology which she described as aligned with contemporary anti-trans political movements. However, this is the culture of engineering that she witnessed: an online justification for discrimination against women and transgender individuals on the basis of “scientific fact” by engineers on forums. In conversations analyzing the placement of these life events, Naya described how these events informed her future conceptualization of engineering undergraduate culture. Despite classmates in her undergraduate program not using the same words that she read online, these ideologies and perceptions became what she *presumed* others would privately believe:

My awareness of how those people tend to feel about women, trans people, and especially nonbinary people led to a little bit of fear pervading my life. Even among those who were not overtly sexist, there seemed to be a common thread of still being sexist, just inadvertently. (Document 5, paragraph 11)

These messages from an online internet STEM forum were internalized by Naya creating an internal barrier towards her coming out as trans in engineering contexts. Other online spaces simultaneously presented a social landscape which nurtured and fostered her TGNC identity. In her undergraduate program, the discovery of alternate online spaces provided her with social support and affirmation of identity when this did not exist in her physical social spaces or previous online spaces.

Naya further described how an interconnected online social sphere of social justice and transgender communities “introduced (her) to the lives of trans people as people rather than hate-spawned caricatures.” She additionally perceived a stronger relationship with social justice culture and TGNC culture with the two communities sharing similar politics, humor, ethos, and members as opposed to broader online STEM culture (i.e. more trans people inside of social justice culture than trans people inside of engineering culture). These virtual spaces provided a means toward a self-understanding of her own trans identity and the formation of supportive online group-chats with other TGNC young adults which she still maintains. These group chats became an informal social support space during her undergraduate program which existed outside of the institution. It provided affirmation for her identity where it was not present on campus.

The first year on campus for Ava included numerous incidents of engineering peers not using the correct pronouns for her and directing gendered invalidation towards her. The internet and virtual spaces became a place for respite and finding community:

The cruelty of my peers caused me to become deeply and painfully introverted. I shrunk away from any sort of social obligation, and became a denizen of the internet. I spent most of my free time locked away in my room, reading or cruising online forums. (Document 1, paragraph 15)

Online spaces which centered on her political identity and gender identity became ways to feel included while she continued to form in-person support networks which would be validating in similar ways. Her day-to-day interactions during the first term of her 1st year were dominated by cisgender students on campus and in engineering classrooms leaving the internet as an important social support space.

Theme 3. Support Inside/Outside Class

The communities which sustain and foster day to day life for the two students are predominantly outside of engineering contexts (e.g. engineering student groups or engineering classmates). At the start of college while feeling isolated from engineering peers, Ava began to search outside of her program for alternate social spaces:

I joined a bunch of clubs in the first week, and continued going to them throughout the year. I also started going to local punk shows, and hosting a show on the college's radio station. (Document 1, paragraph 31)

Having friends in the trans and/or punk community became important. These peers “spoke the same cultural language” as Ava. Being surrounded by these individuals became her primary social network which sustained her academic pursuits. She began to get involved with the local Democratic Socialists of America and met other trans activists in town through this group. They shared a common interest of working towards social justice and change, and she continued to make friends outside of engineering this way. Previous studies have found LGBTQ+ STEM students becoming involved in advocacy groups and other political groups on and off campus as a way to foster supportive community [54].

She eventually met other trans students through these avenues. However, in the following excerpt, she experienced interpersonal rejection from a transgender engineering student named Esther who she met outside of class. The hyper-specificity of their social locations (i.e. there are very few trans engineering students to meet on campus) made this rejection particularly hurtful:

I told Esther I was a mechanical engineering major, and she asked me a little bit about my classes, and I responded. After a moment, she responded, “This is boring, I don't want to talk to you anymore.” I was really devastated by this, and I walked home sobbing. It crushed me that someone, who seemed so cool and interesting, would like me so little. I was really shaken by it, and felt rejected like never before. We were both members of a very small community, and I wish we could've had a relationship. (Document 1, paragraph 35)

This portion of the autoethnography reflected that it should not be assumed that just because someone is transgender, or even a transgender engineer, that they will form supportive community together. These students' TGNC lives intersect with other identities – such as race, class, sexuality, disability, political ideology, and religion. The researchers believe that this passage underscores the particularity of TGNC student support systems. These support systems are not all TGNC individuals, nor all engineering students, and certainly not all TGNC engineering students. The social support networks of transgender undergraduate students are

described in research as heterogeneous – consisting of trusted individuals outside the community and diverse members from within the community [13, 21].

Naya also found community during college by reaching outside of engineering towards more politically involved groups. The on-campus LGBTQ+ cultural center is where she first “encounter(s) people who are visibly not cis for the first time.” The campus LGBTQ+ cultural center, which hosts programming and events centered around LGBTQ+ inclusion and advocacy, became a place to meet other TGNC individuals who were safe to ‘come out’ to while her peers were not perceived as safe. As she progressed further in her program, Naya found that her hearing disability was often just as salient when seeking resiliency strategies and forming social support networks. Disability and LGBTQ+ identities are described as socially overlapping, interactive, parallel, and/or oppositional [55]. For Naya this was present in her forming of specific supportive networks which both affirmed her trans identity and accommodated her hearing disability. Both participants noted that their social support networks were heterogenous. This heterogeneity affirmed their multiple social locations and included very few engineering students. When writing about her communities of support in her undergraduate engineering program Naya noted that hers have “never really been within engineering” but also not from any particular source. A mix of romantic partners, parents, and the local trans support group were cited as important communities for Naya.

Additional Resiliency Strategy of Importance

The previous themes were found to be common in both autoethnographies. There is an additional resiliency strategy salient in Naya’s autoethnography that the researchers found important to communicate. Support systems that foster educational resiliency can extend to a student’s success strategies more broadly in their life. In the case of Naya, finding success, happiness, and affirmation as a transgender individual eventually lead her to leave her undergraduate engineering program. There was a consistent narrative theme present in Naya’s autoethnography of wrestling with the decision to stay or leave engineering. Her autoethnography alludes to a general feeling of distrust and fearfulness of her cisgender male peers. She began to feel distress over the disconnect with her life as a transgender individual and life as an engineering student, in part due to the perceived widening of cultural differences. She felt as if she had two losing choices – to come out to her engineering peers, or to remain closeted:

The fact of the matter is that I was not willing to live another year closeted but I didn’t have the ability to live as a woman yet. This meant that I would have to come out to my project group without actually living it. Given what I’ve already seen of the culture of the students in the college of engineering, I was legitimately concerned that I would be able to complete capstone without making enemies of my own group. I was scared. I was feeling physically ill at the thought of taking capstone. (Document 4, paragraph 9)

Naya wrote that her experiences both online and in-person with engineering culture lead her to perceive that coming out as trans would be met with negativity or discrimination by her peers. It was weighing on her “ability to accomplish work and succeed.” She eventually took a term off from her computer science program. The autoethnography described near universal positive impacts of this decision:

I have been taking a break from school. I have been spending time around other trans and miscellaneous queer people rather than around engineering students. At first it was something of a culture shock to suddenly be exclusively around people who validate me but now that it’s become the norm, I find myself missing my old life less and less by the day... There are still stressful events and my life as a trans person is not necessarily easy, but the background radiation anxiety has been cut dramatically. (Document 4, paragraph 1)

Culture is created and maintained socially. It is constructed through countless interpersonal interactions. For her, being surrounded by and integrated into a culture where the interpersonal interactions are validating was a culture conducive to her success in life. The culture of engineering did not feature interactions that included this validation. The choice of leaving an engineering undergraduate program can be considered resiliency in the broader social context of Naya’s life. She specifically defined this experience in her autoethnography with the term “retreat as resilience”:

In short, (retreat as resilience) means the use of accepting failure in one aspect of life in order to facilitate success in the rest of life. Had I remained headstrong and continued pursuing my engineering degree in spite of my misgivings and anxieties, I would have inevitably pushed myself to some kind of breaking point. By accepting that I needed to remove myself from engineering, I was able to foster a life which is much more conducive to my success in the rest of my life. I had been convinced that in order to remain resilient, I needed to power through my distress and complete my computer science degree. I had compartmentalized my life and was unable to see the bigger picture. (Document 4, paragraph 6)

This autoethnography presents a powerful narrative for engineering educators. If engineering programs are not inclusive of students like her, she suggests that it may not be in the student’s best interest to stay in a program. It is a way of reframing the phenomenon of underrepresented students changing majors or changing careers away from engineering – for individuals like Naya it can be considered a success and a positive change. Naya had written in her autoethnography that there exists “a phenomenon of so many trans people dropping out of engineering in favor of something in liberal arts or social sciences.” This phenomenon appears to be present in literature which puts forth that humanities and liberal arts “disciplinary micro-climates” in higher

education are more inclusive to LGBTQ+ students than STEM [54]. A recent study by Bryce Hughes found LGBTQ+ students to be 7% less likely to be retained in STEM undergraduate programs versus switching to a non-STEM program [56]. For a student in Nicolazzo's research [18], leaving a women's studies classroom or leaving the LGBTQ+ campus center made them feel out of place. The student in this paper ended up changing major due to what Nicolazzo describes as her previous major not having "figurative or literal" space for trans students to be themselves. Social and interpersonal factors are primary reasons for program attrition of underrepresented student groups in STEM [23]. For Naya leaving engineering resulted in positive changes on her overall quality of life.

Conclusion

Underrepresented students such as women of color and LGBTQ+ students in STEM often keep two separate worlds – STEM peers and those with whom they socialize and create support networks [15, 21, 57]. This separation of worlds and was found to be reflected in both autoethnographies throughout every theme. Similar to the social support systems of other underrepresented groups in STEM, the networks of social support for TGNC students are multifaceted and complex. These heterogeneous social support groups provide respite and resolve outside of an engineering student culture which is perceived as not welcoming towards their gender status. To nurture and maintain TGNC students we may wish to explore the liminal spaces which have been identified between trans culture and engineering culture. This liminal space appears between two cultures far apart in terms of inclusive language, acceptance of trans people, and engagement with the political sphere that can dominate TGNC lives. Trans students in engineering may walk between two different worlds – one where they are affirmed and supported, and one which they are met with discrimination or misgendering. Fostering inclusivity and retaining students may require investigation into these liminal spaces which exist on campus, online, and ideologically. We believe these narratives provide crucial insight to a gender expansive understanding of belonging, equity, and inclusion in engineering undergraduate programs.

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