2023 Annual Conference & Exposition
Baltimore Convention Center, MD | June 25 - 28, 2023
The Harbor of Engineering Education for 130 Years
ASEE
Paper ID #37397

Modeled Professionalism, Identity Concealment, and Silence: The Role of Heteronormativity in Shaping Climate for LGBTQ+ Engineering Undergraduates

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Modeled Professionalism, Identity Concealment, and Silence: The Role of Heteronormativity in Shaping Climate for LGBTQ+ STEM Undergraduates

Prior studies have demonstrated that STEM students with LGBTQ+ identities feel marginalized in STEM spaces and refer to the climate as chilly and heteronormative. One salient theme in prior literature is social technical dualism, which is the separation of technical and social aspects of STEM that typically excludes social aspects from STEM education experiences. The mechanisms that perpetuate social-technical dualism, and therefore a heteronormative STEM culture, are not yet well understood. The purpose of this analysis was to understand how social technical dualism is perpetuated or maintained in undergraduate STEM spaces through the experiences of LGBTQ+ STEM students at a large research-intensive institution in the southwest. We conducted focus groups (n=3) and individual interviews (n=3) with these characteristics and thematically coded the interview transcripts. We found three main themes pertaining to the perpetuation of the social-technical dualism in STEM: modeled professionalism, silence, and identity concealment. In modeled professionalism, we explore how heteronormative professionalism is modeled by professors, teaching assistants, and faculty researchers. These are referred to as dominant figures in STEM, or figures who play a large role in shaping how LGBTQ+ students view STEM values. Dominant figures in STEM typically reinforce the chilly, heteronormative culture of STEM by showing how straightness is a key aspect of professionalism in STEM. However, our findings also show that dominant figures have the ability to drastically change LGBTQ+ students' perspective of professionalism. We also explore how LGBTQ+ students face a culture of silence in STEM environments, unable or unwilling to give voice to their discomfort. LGBTQ+ students experience a lack of solidarity from their peers, contributing to a silent, chilly experience in STEM classrooms and lab environments. Our third theme, identity concealment, investigates how students conceal their LGBTQ+ identities as a mechanism for survival in STEM. A lack of LGBTQ+ dominant figures in STEM, a culture of silence, and reinforcement that straightness is a professional requirement in STEM has perpetuated a cycle of identity concealment, where students without visible LGBTQ+ role models in their field feel less comfortable in their ability to safely come out in STEM spaces. On the other hand, some participants expressed that having an out mentor has encouraged them to persevere in their field and resist heteronormative professionalism in STEM environments. Our findings suggest that representation in dominant figures in STEM is one way to disrupt the culture of silence in STEM. Understanding the mechanisms that perpetuate social-technical dualism in STEM is paramount to creating inclusive, safe environments for LGBTQ+ students in STEM. We suggest ways in which dominant figures in STEM, such as professors, teaching assistants, and faculty researchers can disrupt the chilly, heteronormative culture of STEM by modeling inclusive classroom and lab practices. Additionally, we offer insights on how students negotiate their identity visibility in a chilly, heteronormative, and silent culture.

Introduction

Despite efforts to increase diversity and inclusion on college and university campuses, Science, Technology, Engineering, and Mathematics (STEM) programs continue to be largely cisgender, male, heterosexual, and white [1]–[3]This continued lack of diversity is largely due to the heteronormative, racist, and sexist culture that serves to make STEM spaces inhospitable for

marginalized students, and results in high levels of attrition for these groups [1], [4]. In order to address this, we must first understand the factors that drive this culture and the experiences of marginalized students in engineering. In the past these efforts have largely focused on women and those with minoritized racial identities, only in the last decade has there been a research focus on LGBTQ+ individuals in STEM[5], [6].

Studies on LGBTQ+ undergraduate students in STEM have demonstrated a uniquely chilly climate rife with microaggressions, hypermasculine competitiveness, assumptions of heterosexuality, and overt homophobia[5], [7]–[9]. These experiences lead to a myriad of academic, health, and wellness issues for students and exert a pressure for students to pass as cisgendered and heterosexual or conform to the heterosexual environment to survive in STEM [5], [10], [11]. This issue is further exacerbated by the frequently studied false dichotomy of social-technical dualism in STEM, where many STEM professionals disregard and devalue social and political issues in favor of technical knowledge and experiences[12]. This Social-Technical dichotomy leaves LGBTQ+ individuals silenced and marginalized since gender and sexuality issues—along with myriad other social issues—are seen as entirely irrelevant to the STEM environment and curriculum [7], [13].

Faced with this climate, students must resolve their LGBTQ+ identity with a STEM professional identity that is implicitly and explicitly tied to heteronormativity. This resolution is a crucial but complicated and difficult process of identity work. Previous research has demonstrated the ways in which building a STEM professional identity reinforces one's interest, performance, and persistence within STEM fields[14]–[17]. Therefore, it is important to understand the ways in which STEM professionalism is communicated to students as undergraduates and how these norms serve to reinforce the cycles that lead to LGBTQ+ student attrition in STEM. This understanding may help to develop ways to break the attrition cycle.

In this work we seek to address the following research question: How do LGBTQ+-identifying undergraduate students perceive and respond to heteronormative notions of professionalism in STEM at this large research-intensive university in the southwest?

Terminology Used

In this work we use the acronym LGBTQ+ (standing for Lesbian, Gay, Bisexual, Transgender, Queer, and + for all other identities not explicitly included) and "queer" interchangeably as umbrella terms for any individual with a marginalized gender identity or sexual orientation. We acknowledge the history of the term "queer" as a slur that might be uncomfortable to some readers, but we chose to use to contribute to the reclamation of the term.

We use the term "Social-Technical Dualism" to refer to the perceived irrelevance and devaluation of social issues in favor of the technical work in science and engineering. This false dichotomy has been explored in many contexts within STEM, notably in the ways in which stereotypically feminine and masculine ideals are equated to social and technical competency respectively[3], [18]. This framework has also been used to understand the ways in which queer

people specifically interact with science and engineering as they must navigate both stereotypical gender norms and also how these norms map to certain values in STEM[5].

To discuss the overarching experiences and expectations within STEM we use the terms "culture" and "climate". Here the term "culture" is referring to the overarching social norms, expectations, and behaviors that defines what it means to be a STEM professional and "climate" is similarly used to describe how individual students interact with or perceive these norms. Many past studies have worked to analyze and understand the social norms of STEM and how they serve to benefit cisgender white men over those with marginalized identities [19]–[21]. More recently, as studies have begun to focus specifically on LGBTQ+ individuals in STEM, qualitative studies have demonstrated the ways students perceive and interact with this culture, describing a climate that is harsh and unwelcoming to them[5], [6], [8].

Author Positionality

The authors of the work represent a broad range of identities and experiences which they draw from and consequently impacts this work. The majority of the authors identify as members of the LGTBQ+ community, and include a gay white cisgender man, an Asian queer cisgender woman, a white bisexual genderqueer person, a white queer nonbinary man, and a white heterosexual cisgender woman. The researchers also represent undergraduate student, graduate student, and faculty roles in a variety of engineering and/or engineering education fields. This work is deeply rooted in the experiences of oppression and marginalization of the LGBTQ+ authors in STEM and seeks to find ways to undermine the systems of oppression that have caused harm to them and others.

Methods

This research used focus groups and individual interviews to explore the experiences of LGBTQ+ STEM undergraduate students at a large R1 university in the U. S. southwest. Data collection occurred in Fall of 2020. Interview and focus group recruitment was achieved using a call that was sent to out to all graduate and undergraduate students through program coordinators in each department of the engineering and natural sciences programs. Interested students were directed to complete a screening survey. Additionally, the call and survey link were distributed through Slack channels of STEM student organizations based on LGBTQ+ identity, and was posted on the virtual bulletin board of the campus LGBTQ+ center. Students were also encouraged to share the survey with friends or through other student organizations in which they participated. The survey collected student demographic information, and interview preferences, such as whether the student was comfortable with a focus group, and if the student preferred a video-based or anonymous messaging platform for an interview. This flexibility and option for anonymity was intended to encourage participation from students who may not be comfortable being out to researchers or peers in a focus group setting.

Students were then sent a follow up email to sign up for an interview and/or focus group time as scheduled by the researchers. The semi-structured interviews and focus groups were all conducted virtually using Zoom and video and audio recorded for analysis. One focus group

consisting of three participants and three individual interviews were collected with undergraduate students. Table 1 summarizes the students interviewed for this study.

Table 1: Summary of Participants

Pseudonym	**Major**	**Year**	**Identities**	**Pronouns**
Charlie	Biology	4th	gay	he/him
Logan	Mechanical Engineering	2nd	aromantic/asexual	she/her
Bailey	Computer Science	4th	queer	she/her
Cameron	Civil Engineering	3rd	bisexual	she/her
Jaiden	Mechanical Engineering	3rd	trans non-binary, bisexual	they/them
Taylor	Math, Sociology	2nd	lesbian	no preference

Data analysis proceeded through three phases. First, members of the research team individually transcribed all of the recorded interviews and focus groups utilizing a simplified Jeffersonian Transcription System and then open-coded each of the transcripts [22]. Second, the research team met to discuss themes identified from individual work. The team consolidated the codes into a codebook, combining similar codes and grouping them by similar theme, and then returned to the transcripts and recoded them using our standardized codebook. Finally, the research team met and developed broader themes based on the recoding process, and selected those most relevant to the research question.

Results

Through the coding process many themes emerged around student responses to the climate of STEM as well as STEM professionalism at this institution. In this paper, we focus on the modeling of heteronormative professionalism in STEM, the ways students conform to these notions of professionalism, and finally, the burgeoning ways in which queer identity is being incorporated into notions of professionalism in STEM spaces. These themes were chosen as they provide an understanding of the ways heteronormative professionalism can be constructed, experienced, and, in some cases, subverted at this institution.

Dominant Figures in Engineering Model Heteronormative Professionalism

A prominent theme that emerged in the data was that queerness is seen as existing in opposition to the values and norms of STEM. Students described an environment where queerness is silenced and stifled in STEM spaces on campus, reinforcing the notion that STEM professionalism is synonymous with heterosexuality. The heteronormative notion of professionalism is modeled to students by dominant figures, which we define as an individual

with perceived power or authority in STEM spaces. These dominant figures can include professors, administrators, teaching assistant and even other students in leadership roles. While dominant figures may not be actively discriminatory towards queer students, they convey an expectation of heterosexuality through a culture of silence, exclusionary class materials, and a lack of action.

Many students described a culture that perpetuated silence about queerness. Bailey describes her experience with a culture of silence in the Computer Science department:

> *"In the CS department … it's kind of just like a silent thing and people like I don't know if people openly judge because I haven't like heard anything"*

While Bailey acknowledges that she has not experienced any explicit acts of discrimination, she describes a culture where queerness is not talked about and homophobic microaggressions are left unchallenged. Bailey makes it clear that "professionally you don't talk about those things," emphasizing how the perceived culture of silence and lack of action taken towards addressing casual homophobia from dominant figures influences the heteronormative nature of STEM professionalism. Similarly, Jaiden expressed, "I don't think I've ever seen an engineering professor specify their pronouns or ask people to specify their pronouns uh which is just a little off putting". This further signifies the invisibility of queer identities and the assumptions about the gender expressions and identities of students in the room.

Dominant figures also model that this culture of silence is only about queer identities; there is no such requirement for discussions involving straightness. Cameron discusses her experience with this difference:

> *"We don't talk about personal lives or if you do talk about your personal life it's only if you have a wife or kids or uh wife and kids uh like it's just the traditional stories that you hear about like oh I took my wife out to dinner last night and you know we had to hire a babysitter for our kids and it was a hassle you know just normative stories that you hear like that but like you can't say the same thing or like if you have (.) you know um like if I'm a woman and I have my like a lesbian partner or anything along those lines like you just can't say that because it's not like normative in our cultural standards it's not like fitting the traditional world that is civil engineering or engineering in general"*

Cameron's experience highlights that the only acceptable personal conversations in the STEM environments she inhabits center around a heterosexual masculine normative identity. Discussions of identity that don't align with this normative identity are viewed as disruptive and unprofessional, forcing queer students to remain silent about their queer identity if they wish to maintain a professional STEM identity.

Another means in which dominant figures model heteronormative professionalism is through presenting course content in a manner that explicitly excludes queer identities. Bailey describes one such instance in her computer science class:

"just this past like lecture that I had in like data (.) database or like data queries that like oh um (.) select a person based on like gender equals male or like gender equals female and like saying how there's only two genders"

Through the use of exclusionary examples like these, dominant figures model that identities that exist outside the normative heterosexual engineering identity are not just ignored, but actively excluded. The assumption of heterosexuality is built into the material itself, communicating to students that straightness is foundational to an engineering identity.

Faculty members were not the only ones who modeled professionalism as dominant figures; heterosexual professional norms were also modeled by students in other STEM spaces. Charlie describes an incident working in a lab:

"In one of the labs I was in actually two of the men were actually quite sexist in this lab I remember they told right after one of the grad students had just left early so she could go pick up her two kids from daycare they made comments about how she um was not very dedicated to research … the fact that like if they talk about her like that when she's gone how do they talk about me when I'm gone"

Here the two men equate STEM professionalism to a heteronormative notion of masculinity. While Charlie is not directly targeted by these comments, he is left unsure of the perceptions of himself in comparison to this notion of professionalism put forth by two graduate students. Some students also saw a heteronormative notion of professionalism modeled by their undergraduate peers. Cameron specifically mentions being a part of the American Society of Civil Engineers and describes queerness as something that "wouldn't be talked about" in "a professional organization".

Overall, many students described the opposition of queerness and STEM professionalism in a broad sense, noting the lack of acceptance or feeling of belonging in these spaces. Charlie described the STEM environment as "A wasteland of straight" and Taylor similarly summarized her perceptions of STEM being one where "you focus on research you focus on academia you focus on like numbers and science and stuff and so I just don't feel like that's a space that's necessarily open for me". These perceptions ultimately serve to situate a student's queer identity as irrelevant, or even oppositional, to their identity as a STEM professional making it difficult to rectify the two.

Student Conformity to STEM Professionalism

In response to heteronormative professionalism, queer students have adapted to surviving through conformity. This is congruent with many past studies which describe queer students compartmentalizing their LGBTQ+ identity or choosing to conform or hide within STEM spaces [5], [6], [23]. In this study, we found that these students adapted to the chilliness of STEM environments in the same ways, opting to emulate the heteronormative notions of professionalism by suppressing their queer identities.

One way this conformity manifested was in declining to speak up when experiencing microaggressions or other discriminatory acts. When talking about the computer science department, Bailey mentioned "there are times when like professors make jokes in class that are kind of inappropriate but at the same time like nobody points it out" This sentiment was similarly expressed by Jaiden:

> *"I were like a cis guy I would feel more comfortable about speaking out and be - you know maybe directly to the professor, but as of right now I don't feel uhm you know incredibly safe making myself like vulnerable I just feel like you know maybe people would laugh at me or the like professor would just disregard me"*

While Jaiden describes their hesitation in speaking up as rooted in concern for their personal safety, for others it is a matter of feeling unvalued in STEM spaces. Taylor expresses that, in cis, straight, male dominated STEM spaces, "it's just a matter of ... fitting in … I don't feel comfortable expressing my opinions in this space. That is, you know, like not representative of myself."

Students also chose to conceal their queer identity in LGBTQ+ spaces. For instance, Cameron mentions being willing to discuss their identity if asked, but that they "don't always just walk into a room and announce like 'hey I'm bisexual'". For Logan, this identity concealment has allowed them to avoid discrimination and backlash: "I'm not very like open I guess with my identity so I've never really seen that put against me." These students ultimately choose to remain silent or hidden within STEM spaces, conforming as best as they can to the expectations of heterosexuality in their fields. These tactics, while effective in avoiding scrutiny, highlight how the climate alienates LGBTQ+ people to the extent that they are uncomfortable existing in a way that is oppositional to the status quo.

Burgeoning Queer Professionalism in STEM

Even though students largely chose to conform to the heteronormative expectations of STEM, we also saw examples of ways in which queer notions of professionalism were emerging for some students.

One example of this was the impact of visible queer dominant figures on students, who provided an example of what being a queer STEM professional can be. Cameron describes an experience meeting a queer faculty member that inspired her to join the professional organization in her field:

> *"One of these uh one of the Women Engineering groups that I was in -one of the meetings a civil engineering professor came in and she is actually the ASCE practitioner -faculty advisor and she was like -she started off just like I'm gay, and she's like this is my wife, this is my son."*

Jaiden describes a similar experience after meeting with queer engineering graduate students: "I can be you know a grad student within engineering uh, and be queer, like other people have done it before me". Here both participants were able to see people who held

identities as professionals in STEM while simultaneously asserting their queer identity, thus challenge the expectation that success in engineering is tied to heterosexuality. These examples of queer dominant figures served to empower students, as Bailey states:

> *"it just feels more comfortable to see that like um people who identify similar as me is like actually doing pretty well in the academic field and they're able to speak their minds and uh and it's okay so that gives me that kind of courage*

In addition to seeing queered professionalism modeled by queer dominant figures, participants used student organizations as to foster their own queer professionalism in STEM. Cameron discusses how her role as an officer for a STEM professional organization enabled her to "promote trainings and promote workshops" and specifically mentioned promoting events hosted by the campus LGBTQ+ center and a queer identity organization on campus. In this leadership position Cameron mentions she has "a lot more opportunities to promote the things that I want to see". With this Cameron is challenging the status quo of heteronormativity and the expectations that social issues do not have a place in professional engineering discussions.

Jaiden and Bailey also have experiences as officers for student organizations, however both are officers for organizations centered around LGBTQ+ identities in STEM. Both describe similar goals of creating spaces to foster community among queer people in STEM, with Bailey describing "providing support for people in the community" as her organizations "main goal". Jaiden also describes ways in which their organization is actively working to challenge the status quo of engineering.

> *"Something we've been doing in [LGBTQ+ Organization] is trying to work with like [the dean] and just like the school of engineering to try and like put together like materials and resources together for like professors to use."*

Interestingly, despite being in leadership positions and working with administration to enact real change, these participants situated these spaces as oppositional to STEM professionalism. Cameron mentioned being able to be "open" and "crack jokes that you wouldn't crack in a professional setting" and Jaiden mentioned that the leadership team of the LGBTQ+ club "definitely don't meet these professional standards". Thus, these organizations offer a refuge from the heteronormative professional expectations in the rest of STEM.

Discussion

Our interviews demonstrated that the climate in STEM at this institution remains chilly and difficult for queer students to navigate, as their queer identity clashes with their perceptions of a heteronormative STEM professionalism. Thus, students must find a way to cope with the dissonance of these two identities. We can understand this process using the LGBTQ+ STEM Identity theory proposed Mattheis, De Arellano, and Yoder, who describe an interlocking and

three-pronged process of: "*Defining* a queer gender and/or sexual identity, *Forming* an identity as a STEM professional, and *Navigating* queer identities at work." p. 1860 [24]

Here, we focus predominantly on understanding the way dominant figures impact STEM identity formation at this institution and how students navigate their queer identities in these spaces.

Unsurprisingly, these students look to those in positions of power and authority in STEM to understand what it means to be a STEM professional. Here students are met with dominant figures that reinforce heterosexual ideals, and make STEM a place that is less hospitable for those that do not fit that mold. These notions of professionalism are conveyed implicitly and in a myriad of small ways, from a professor making jokes or writing problems that reinforce heteronormative notions to graduate students that make sexist comments in a lab setting. It is important to note that this messaging often does not come from a place of harm or malice, but rather emerges after a lifetime of existing within white, cisgender, heterosexual, male dominated spaces.

In response to this heteronormativity these students mainly choose to use covering and passing strategies that have been described extensively in the literature[5], [6], [23]. In this way students are able to build two separate identities, a professional STEM identity and a personal queer identity in which they connect with other LGBTQ+ often external to STEM.

However, through our interviews we are seeing an emerging and promising phenomenon, one in which students at this institution choose to create their own spaces that empower both their LGBTQ+ and their STEM identity together. Students are working to create their own organizations, serve in leadership positions, connect other students to resources, and even fight for institutional change. This serves to redefine what it means to be a STEM professional at this institution, and represent promising avenues for redefining STEM professionalism in a more inclusive, and more queer way.

It is important to note that not all of the students we interviewed were doing this work to such an extent. Taylor, Charlie, and Logan all remained using covering and passing strategies almost exclusively, and for different reasons. For example, Logan truly saw their identity as irrelevant to their STEM identity and felt no need to combine the two. Taylor and Charlie on the other hand relied heavily on liberal arts spaces as space to support their queer identities and kept those identities out of STEM. It is not entirely clear why students took different approaches to navigating their identities and whether or not they asserted queerness in STEM spaces. This is a key area for future research, as understanding this what drives this process can allow for us to empower more students to drive change in STEM spaces.

Another key implication for this work is the need of visible queer role models at this institution to challenge these expectations for students. We see that connecting with even one queer dominant figure can inspire students to persist and succeed in STEM and feel less alone overall. Interestingly, the students that were most active in queering STEM professionalism were also the ones that described the most salient experiences with queer dominant figures. Whether

this is a coincidence or a motivating factor for students remains uncertain, but it merits further study.

Limitations and Future Directions

This works serves to highlight the experiences of six undergraduate students at a large research-intensive university in the southwest. While we demonstrate key aspects of how these students understand and navigate the professional environment of STEM, our results have inherent limitations. While the relatively small sample size allows for a deeper exploration of groups that are typically silenced in larger data collections [25], it also limits the overall conclusions that can be made about the overall culture of engineering. Thus, more data is needed to understand how other students at this university, and at other universities, recognize and interact with notions of professionalism. Furthermore, more works needs to be done to understand how LGBTQ+ students at the intersection of other marginalized identities react to these same pressures. This group is historically underserved and understudied, and a more focused study would be needed to understand what differences, if any, exist in this population.

Conclusion

This work serves as a case study of the experiences od STEM majors at a large research-intensive university in the southwest. Here we saw many parallels to existing literature that describes a chilly and heteronormative environment for students. We show that at our institution this is driven, at least in part, by the way dominant figures model notions of professionalism and how students feel the need to hide or pass to persist in the environment. Most promisingly, the examples of queered professionalism demonstrate ways in which the dominant narrative of STEM can be challenged and students can find belonging. While this study is limited to one particular institution, we invite you to reflect on the ways heteronormative notions of professionalism may be manifesting at your institution, and how you could challenge those norms to create a more inclusive environment.

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