



Microaggression Experiences of Queer Science Students in Their Departments

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Abstract: This study explored how the feelings of comfort and safety of LGBTQ+ undergraduate science majors in their departments at a mid-size Midwestern university affected their academic success. The literature provides a number of studies about LGBTQ+ STEM faculty, campus and departmental climate studies for LGBTQ+ students, and microaggressions experienced by a variety of students and faculty from historically underrepresented groups. There is little literature directly connecting campus climate work to STEM departments' climates and the experiences of LGBTQ+ undergraduates. This study utilized a qualitative approach to explore the experiences of STEM majors who identified as LGBTQ+. A narrative approach to the research emphasized the voices of these marginalized students. Three participants participated in one interview per semester over two subsequent semesters for a total of six interviews, which were then coded using emergent themes. The most interesting findings were related to potential microaggressions experienced by the students, such as specific passive negative experiences or general negative feelings about expressing their identities. This study found that LGBTQ+ undergraduates in science departments may experience microaggressions because of their sexual orientation but may lack the language to describe these situations in detail or identify them as harmful. Thus, there is a need to examine and potentially improve science students' language tools to better identify and describe these experiences.

Keywords: *LGBTQ+; Undergraduate students; Queer in STEM; Microaggressions*

Introduction

Increasing enrollment and retaining students in science, technology, engineering, and mathematics (STEM) programs has become an increasingly important priority for the United States (Chen & Soldner, 2013). This is an issue because historical trends have shown that during the 2000s, enrollment and attrition rates in STEM programs were consistent at 28% of undergraduate students enrolling in STEM majors and an attrition rate of 48% for those same students, where 28% of the students who originally enrolled left for a non-STEM field (Chen & Soldner, 2013), and recent data suggest that attrition rates may be beginning to decline (Hughes, 2018; National Center for Science and Engineering Statistics, 2014).

One important group of students to gain or retain in STEM programs are students who are lesbian, bisexual, gay, transgender, queer/questioning, pansexual, asexual/aromantic/agender, nonbinary, genderfluid/genderqueer, or other minority gender or sexual identities (LGBTQ+). It is widely accepted that LGBTQ+ students are likely an underrepresented minority at colleges; LGBTQ+ individuals make up somewhere between 9.6% and 11.3% of all 19–24-year-olds in the United States (Green et al., 2019), and the college LGBTQ+ population is estimated at 3.5% (Hughes, 2018). Little has been done in STEM programs to encourage them to pursue degrees and careers in STEM fields (Stout & Wright, 2016; Vaccaro, 2012), such that 7% fewer LGBTQ+ students are retained in STEM programs compared to their heterosexual peers (Hughes, 2018).

LGBTQ+ students continue to face discrimination in both macro- and micro-aggressive forms, which leads many of these students to keep their identities secret (Bowling et al., 2020). This may negatively affect their health, academic careers, and development of a sense of belonging (di Bartolo, 2013; Garvey et al., 2015; Pitcher et al., 2016; Vaccaro, 2012). In particular, microaggressions, which are “brief and commonplace daily verbal, behavioral, and environmental indignities, whether intention or unintentional, that communicate hostile, derogatory, or negative racial, gender, sexual-orientation, and religious slights and insults to the target person or group” (Sue, 2010, p. 5), can lead to increased negative physical and mental health and academic outcomes (Roffee & Waling, 2016; Seelman et al., 2017; Woodford et al., 2012; Woodford, Han, et al., 2014; Woodford, Kulick, et al., 2014; Woodford, Chonody, et al., 2015; Woodford, Kulick, et al., 2015; Woodford, Kulick, et al., 2018; Woodford, Weber, et al., 2018).

Terminology

For the purpose of this study, comfort and safety are used as gauges of academic climate (Garvey et al., 2015). Within the body of work on campus climate discussed below, safety refers to both physical and emotional protection while also being encouraged to speak, learn, and grow, and comfort is thought of as feeling supported, understood, and accepted. Students who feel comfortable and safe in academic spaces are more likely to perform better (Garvey et al., 2015; Rania et al., 2014; Snapp et al., 2015; Theobald et al., 2017).

There are a number of other terms important to know in the context of this study, defined below with the assistance of the Trevor Project Resource Center (The

Trevor Project, n.d.). The identities used by the participants in this study are also defined in this section.

- For the purposes of this study, academic success is defined in this study as students passing their required program classes and retention in the program from one semester to the next.
- Diversity is focused on creating opportunities for marginalized students to be in spaces
- Inclusion involves putting in effort to keep students and make them feel welcome and part of the space
- Queer is a common academic umbrella term to refer to non-heterosexual, non-heteroromantic, and non-cisgender identities, and it is also used as an individual identity.
 - Non-heterosexual: Someone who does exclusively experience sexual attraction for those of other genders
 - Gay/Homosexual: Someone who experiences romantic and/or sexual attraction to only those of the same gender
 - Bisexual: Someone who experiences romantic and/or sexual attraction to those of the same and other genders
 - Non-heteroromantic: Someone who does not experience romantic attraction solely to those of other genders

- Non-cisgender: Someone who does not identify with the gender they were assigned at birth
- Heterosexism is the expectation that all individuals are heterosexual and the discrimination against those who are not.
- Heteronormativity is the normalization of heterosexuality at the expense of all other sexualities.
- Cisgenderism is the expectation that all individuals are cisgender and discrimination against those who are not cisgender.
 - Cisgender: Someone who identifies with the gender they were assigned at birth

Campus Climate

A major concern for queer students continues to be that of campus or departmental climate (di Bartolo, 2013; Garvey et al., 2015; Mulcahy et al., 2016; Pitcher et al., 2016; Stout & Wright, 2016; Vaccaro, 2012), which can be thought of as “the prevailing standards, behaviors, and attitudes of people on campus” (Vaccaro, 2012, p. 430). A negative campus climate has a detrimental effect on student retention, especially for minority students like LGBTQ+ students (Tetreault et al., 2013). It has been shown that positive campus climates for students of minority identities lead to increased academic success (Garvey et al., 2015; Ost, 2010; Pitcher et al., 2016; Vaccaro, 2012). A wide variety of existing studies have been conducted on campus climate for LGBTQ+ individuals, which demonstrate that inclusion issues persist for LGBTQ+ individuals in higher education (Bilimoria & Stewart, 2009; Blumenfeld, 2012; Forbes, 2020; Garvey et al., 2015; Patridge et al., 2014; Rankin, 2004; Sadika et al., 2020; Vaccaro,

2012; Woodford, Kulick, et al., 2015), but little recent research has been done about departments’ and academic programs’ approaches to LGBTQ+ issues (Renn, 2010, p. 138). Additionally, campus climate work seems to focus more on diversity, which is about creating opportunities for marginalized students to be in spaces, instead of inclusion, which involves putting in effort to keep students and make them feel welcome and part of the space (Couillard & Higbee, 2018; Yost & Gilmore, 2011). Lange et al. (2019) conducted another state of the field study to follow up Renn (2010) and, while they noted studies on LGBTQ+ individuals in higher education had increased since 2010, there are still many areas for further work, including searching for new ways to engage with LGBTQ+ students on campuses, actively promoting inclusivity for LGBTQ+ individuals across all campus spaces, and for researchers to utilize critical theories in research frameworks.

Some suggestions have been made for a variety of policies leaders in higher education could enact to help improve campus climates for LGBTQ+ students, such as expanding non-discrimination policies beyond academics and athletics, including gender and sexual orientations in institution policies, and making administrative progress toward supporting LGBTQ+ education and safe spaces (Renn, 2017). While no specific follow-up has yet been done on all the presented suggestions, some studies have examined factors that do have a positive influence on LGBTQ+ students’ perceptions of campus climate. For some students, being supported by on- and off-campus communities, both LGBTQ+-focused and general academic communities, has a positive impact on their perceptions of campus, as can having LGBTQ+ resources centers and LGBTQ+ events and content on

campus (Loren Hill et al., 2020). Having queer or queer-supportive mentors and intuitional support also improves the experiences of queer students on campuses (Graham, 2019).

Academic Success

The literature focusing on academic success is very broad and extensive. Based on previous research, it may be that academically successful students have some internal driving force, such as a love for learning, that motivates them to be successful (Fauria & Zellner, 2015), but it has also been noted that low grades in their major courses may lead some students to leave STEM (Ost, 2010). It has been demonstrated that positive mentor-mentee relationships may help with student success (Byars-Winston et al., 2015), and for queer students in particular, LGBTQ+ supportive policies, resource centers, and organizations are extremely beneficial to students' success (Pitcher et al., 2016). For science students in particular, it has been noted that developing a strong science identity is beneficial for their success in academic programs (Gonsalves et al., 2021; Le et al., 2019), especially for women, racial minority, and LGBTQ+ students (Ahlqvist et al., 2013; Chen et al., 2021; Eren, 2021; Rodriguez et al., 2017), and increased academic success leads to a positive and more developed science identity (Aschbacher et al., 2010).

Queer in Science

Many science and engineering departments have an implicit "don't ask/don't tell" policy regarding gender and sexual identities (Bilimoria & Stewart, 2009; Sadika et al., 2020). This policy reflects the expectation that science is an identity-neutral space, or a space where a person's identity seemingly has no

effect on the situation, but this neglects the normalization of heterosexuality and cisgender identities within science spaces (Friedensen et al., 2021; Yoder & Mattheis, 2016). Identity-neutral spaces represent a type of heterosexism and cisgenderism. The "don't ask/don't tell" policy contributes to a negative climate for LGBTQ+ faculty, which may result in poor career performance or even negative health consequences (Bilimoria & Stewart, 2009; Sadika et al., 2020), but a positive climate can mitigate some of the negative effects from such environments on LGBTQ+ individuals (Bilimoria & Stewart, 2009). LGBTQ+ individuals in non-academic STEM careers are more likely to be in positive work environments and to know what support they have from their employers regarding gender and sexual identities (Yoder & Mattheis, 2016). For LGBTQ+ individuals in all types of STEM environments, a sense of belonging is important for their success and retention in these fields (Mattheis et al., 2019). However, many LGBTQ+ individuals in STEM have never had to articulate their experiences as STEM professionals or students in conjunction with their LGBTQ+ identities, and they may struggle to identify or articulate their experiences in a significant way (Cooper & Brownell, 2016).

Recently, LGBTQ+ students have also described STEM cultures as being a "bro" or "dude" culture, or a culture where hypermasculinity and heteronormativity take precedence over other identities, based on historical trends of STEM being dominated by white, heterosexual, cisgender men (Miller et al., 2021). Many STEM disciplines--including engineering, geosciences, physics, mathematics, and chemistry--continue to have acceptance and inclusion issues (Ackerman et al.,

2012; Atherton et al., 2016; Cech & Waidzunas, 2011; Friedensen et al., 2021; Hughes, 2017; Linley et al., 2018; Olcott & Downen, 2020; Pecher, 2020; Stachl et al., 2019; Stout & Wright, 2016; Vaccaro et al., 2021; Voigt, 2020). On the other hand, students in more socially oriented STEM fields, such as biology and environmental studies, have started to perceive friendlier climates for LGBTQ+ individuals (Linley et al., 2018).

Microaggressions

Sue et al. (2007) used the concept of microaggressions to explain subtle racial discrimination. It has been expanded to include gender and sexual orientation, among other identities (Roffee & Waling, 2016; Sue et al., 2007; Woodford, Chonody, et al., 2015). For LGBTQ+ people, microaggressions may appear in the form of homophobia or other types of discrimination because of someone's specific sexuality or gender identity. These may include the "don't ask/don't tell" policies discussed in the section above (Bilimoria & Stewart, 2009; Sadika et al., 2020), the heterosexist and cisgenderist assumption that science represents an identity-neutral space (Yoder & Mattheis, 2016), or jokes that either imply or outright state the expected roles of men and women in relationships or workplaces (Sue, 2010). Everyday language can be another example, such as assuming coworkers, peers, or friends have a significant other of a different gender (i.e., using "boyfriend," "girlfriend," "wife," or "husband" instead of gender neutral "partner" or "spouse") (Sue, 2010). While these may not seem harmful, the accumulation of many of these small interactions every day over weeks, months, or years can cause significant mental distress or poor physical health (Lange et al., 2019; Sue, 2010; Woodford et al., 2012; Woodford, Han, et al., 2014; Woodford, Kulick,

et al., 2014; Woodford, Weber, et al., 2018), with negative experiences leading students to leave STEM programs (Hughes, 2018).

When looking at microaggressions, it may be important to see how identities intersect using the concept of intersectionality, originally described by Crenshaw (1991) to explain the experiences of Black women with pursuing legal hate crime cases. While it usually refers directly to the experiences of people of color who are not men, cisgender, or heterosexual, intersectionality can be thought of as a way to examine the intersection of all types of identities, including those individuals choose for themselves (e.g., science student). In an expanded idea of intersectionality, there are no neutral identities—being a man, being white, being heterosexual, and being cisgender are all identities that impact everyday experiences (Duran et al., 2020; McCann & Monaghan, 2020). Intersectionality has also been used to better understand microaggressions faced by individuals with differing but connected marginalized identities (Sadika et al., 2020). In queer communities, white gay cisgender men are generally prioritized, and these communities may disadvantage those who are transgender, people of color, or those of other sexualities (Sadika et al., 2020). Because of this, the types of microaggressions against an individual may change depending on whether they are inside or outside of the queer community (Roffee & Waling, 2016). Whatever the type, microaggressions may lead to individuals leaving their program of study or career, experiencing negative mental health outcomes, or experiencing physical illness (Seelman et al., 2017; Woodford, Weber, et al., 2018).

Research Question

While some work has been done looking at STEM LGBTQ+ faculty (Bilimoria & Stewart, 2009; Patridge et al., 2014; Vaccaro, 2012), little has been done in specific STEM fields and less has been done looking at queer STEM students, although some recent studies are starting to fill that gap (Cech & Waidzun, 2011; Friedensen et al., 2021; Miller et al., 2019; Stout & Wright, 2016; Vaccaro et al., 2021). Almost no work has been done on LGBTQ+ students in particular majors (Traxler et al., 2016) and little work has been done examining the relationship between feelings and experiences for LGBTQ+ STEM students. This study will address this gap by looking at academic success and feelings of comfort and safety of LGBTQ+ students in science majors. While queer STEM graduate students also face similar issues (di Bartolo, 2013), undergraduates were the focus of this study based on initial timeline and expected ease of recruitment. To better understand the experiences of undergraduate queer science majors, the study examined the question: How do feelings of comfort and safety of LGBTQ+ undergraduate science students in their departments affect their academic success?

Methodology

Researcher Positionality

The first author is a queer nonbinary woman (pronouns: she/they) who is heavily involved in the queer community and is a queer activist. She has a background in feminist scholarship and LGBTQ+ studies with a BA in Women's and Gender Studies with an LGBTQ and Sexuality Studies minor. They are also a former physics student, having earned a BS in Astrophysics and an MA in Physics. The first authors may have had identities in common with

participants, including a science background and being queer, and this was taken into account and utilized in different ways. During data collection, the similarities may have allowed her to create a sense of rapport between participants and interviewer, and it may have been a benefit when creating codes and themes during data analysis. However, they utilized caution, stopping to reflect on how their perspectives could potentially color their understandings of the participants' conversations. To help combat that, the first and second author communicated throughout the data analysis process.

The second author is a heterosexual, cisgender woman (pronouns: she/her) active in academic research and institutional efforts related to diversity, equity, and inclusion. She has a background in feminist and critical scholarship, including completion of a graduate certificate in Women's Studies during her doctoral work in chemical education. She has a BS degree in Chemistry and Biology with a minor in Psychology and MS and PhD degrees in Chemistry.

Theoretical Frameworks

This project is situated within two theoretical frameworks. The first is feminist standpoint theory, which is "a way of empowering oppressed groups, of valuing their experiences" (Harding, 2004, p. 2). It can be seen as both a methodology and an epistemology (Harding, 2004). In the context of this study, feminist standpoint theory was used to situate the stories of the participants at the very front of this study, using their words when creating narratives and codes and focusing on their experiences as part of a whole story.

Queer theory was also utilized to think critically about how the participants' queer identities intersected with

the research and in other aspects of data analysis. The concept of one, unified “queer theory” does not exist by the very nature of queer theory, because it is a way of knowledge-making that is inherently fluid and multifaceted (Browne & Nash, 2016; McCann & Monaghan, 2020; Schilt et al., 2018), and researchers bring instead bring a queer theoretical perspective to methods (Brim & Ghaziani, 2016). While this may be seen as a hindrance in some circumstances, it opens up unique avenues of exploration when considering the lived experiences of marginalized individuals. Queer theory recognizes that heterosexism and discrimination against queer people are systemic in society, which makes it necessary not to “condone heteronormative and cis-sexist male approaches as the only methods of inquiry” (Nadal, 2016, p. 301). It is a critical theory about the intersection of identity and power (Gunckel, 2009), which pushed the first author to consider her relationship with the participants as part of the data analysis. Queer theory provides scaffolding for analysis by encouraging the use of transgressive practices to look for deeper, unusual connections (Browne & Nash, 2016, p. 7). For example, it has been used in education research to reexamine “institutions and processes that limit possible identities, promote binary constructions, and naturalize heteronormativity” (Gunckel, 2009, p. 65), and to think critically about education both as it is and as it could be (Gunckel, 2009). Queer theory has been underutilized in research about the experiences and feelings of LGBTQ+ individuals in STEM fields (Jennings et al., 2020; Lange et al., 2019).

Within this study, queer theory was used as a lens to examine participants’ experiences outside of the expectation that heterosexuality is the “norm” and

other sexualities as deviant or “other” (Browne & Nash, 2016), normalizing their identities and situating their sexualities within more complex situations (McCann, 2016). It has been used as a way of meaning-making between the existing bodies of literature and the expressed perceptions and feelings of the participants.

Research Design

The research design originally utilized a solely narrative approach, but this was adapted to include a case study approach as well to reflect the small number of participants. A narrative case study approach allowed each participant’s experiences to be analyzed individually before looking for cross-case comparisons, and feminist standpoint theory was utilized when building each participant’s narrative. Feminist standpoint theory was the sole original framework in the study design, but when the literature was re-examined after the first round of analysis, queer theory was found to have a unique and helpful lens for additional analysis and in reframing the study as a narrative-case study mix.

This study served as an exploratory, pilot study to lay the groundwork prior to embarking on the process to create and defend a dissertation proposal. Because of this, the study was purposefully designed to recruit participants from only one university and an IRB modification to expand this was not sought to continue to meet the timeline of the first author’s graduate program.

Data Collection

The data collection process began after IRB approval, and the original plan was to recruit via a midsize Midwestern university’s physics department listserv

in early 2018. The target group was LGBTQ+ physics undergraduate students, who would be enrolled for two additional semesters at the start of the study. After a few months of unsuccessful recruitment, the collection plan was amended via IRB to extend recruitment to all science undergraduate majors and minors at the same university, which included the degree-granting departments of physics, chemistry, geosciences, and biological sciences. Recruitment emails were sent to these departments' undergraduate listservs in late 2018. A second adaption after this with IRB extended the recruitment timeline from 2018 to 2019 with a third round of recruitment emails sent to science major undergraduates through their departments' listservs. The second adaption led to the successful recruitment of participants.

Two interviews were conducted with each participant, one in the semester of recruitment, Spring 2019, and one in the following semester, Fall 2019; the second interview served as a follow-up to the first and was used to determine if the participant was still enrolled in the same major. The interviews were scheduled via email, and the first author met the participants at locations of their choosing on or near the university's campus. These locations were chosen by the participants to increase their comfort with the interview process and to give them more control over the process. One interview took place in a coffee shop off campus, while the rest took place in fairly private locations on campus, including a greenhouse, an empty lunch space, and the first author's office. All of the interviews were audio-recorded and then transcribed by the first author. The interview protocol examined topics such as experiences in classrooms, relationships with professors and peers, and personal reflection on identity and academic success and was

developed based on the literature and refined through a pilot process to improve wording and adjust the number of questions in the protocol. The interviews covered topics including perceptions of their progress through the program, interactions with peers and professors, and their feelings and opinions regarding their own sexual identities; the IRB-approved semi-structured interview protocol can be found in the Appendix.

Participants

The study ultimately ended up with three participants, which included one cisgender gay man with an engineering major and minors in physics and math, one cisgender bisexual woman with a biochemistry major, and one cisgender gay woman with a geology major. It is important to note that no gender nonconforming individuals participated in this study. All three participants were in their 20s, and no racial or ethnic information was collected from them.

Data Analysis and Trustworthiness

After transcription of the interviews by the first author, data analysis started with each participant's interviews being analyzed individually through the construction of narratives by the first author, summaries of which are presented below in Findings, and the interviews and narratives were analyzed as part of each participant's case by the first author. A case study format was utilized to allow for a more holistic focus on their voices and their individual stories, which could then be analyzed on a cross-case basis. Emergent coding was used so as not to bias the results initially, and the major codes in common across two or more participants included academic success, comfort, safety, negative experiences, passive experiences, and identity hiding. The common

emergent themes from each interview were used for deeper critical thinking about the case studies.

In qualitative work, trustworthiness is the answer to quantitative validity (Merriam & Tisdell, 2016). To verify the accuracy and trustworthiness of the data analysis, the authors regularly discussed the codes and subsequent analysis throughout the development of the narratives and cross-case comparisons. Member checking was used for each narrative, which means each participant reviewed their narrative and provided input on its truthfulness and accuracy. Finally, the literature was reviewed to verify consistency with this study's findings, and the authors discussed how the analysis of the data aligned with the literature.

Findings

Narrative Summaries

Zed (She/her). Zed, a bisexual cisgender woman, was a biochemistry major with minors in philosophy and biology. She was a junior during the first interview. Zed defined academic success in two parts, first in connection to her Honors College status and second as “feeling like I get the opportunities I need to be successful.” Zed was not out publicly at the time of the study, which means only a select number of people and not her department at large knew about her sexuality. Her experience with comfort in the department involved different faculty members, identifying the experiences as “...there are some people you trust and feel comfortable and there's people you don't.” However, she identified no individual experiences feeling unsafe on campus or in her department.

Liv (He/him). Liv is a gay cisgender man who majored in electrical engineering with minors in math and physics, and he was a third-year student during the first interview. He thought of academic success as

including grades, “but also there's the level of degree of which you feel you have learned.” Liv was publicly out and had no discomfort in sharing his identity with new individuals, and he felt very comfortable and safe in his department, noting he felt “pretty confident about being able to go and talk to a professor.” He noted one particular professor as being the embodiment of his comfort, who he described as “an amazing human being and she just, she doesn't care who you are...She's nice to everyone, she's welcoming, and there's lots of professors here that are like that.” He specifically brought up his background growing up in a lower socioeconomic status and in a conservative, religious community.

Ann (She/her). Ann is a gay cisgender woman and had a geology major with an earth science minor. She was also a junior during the first interview, who described academic success as “satisfaction in the amount of knowledge that you've gained.” Ann was publicly out and generally had no problem sharing her identity with new people. Within her department, she overall felt comfortable and safe, noting one particularly positive experience: “I had a really positive reaction to it when I shared my sexual identity while on a field study.” However, she had experienced some discomfort, saying “I don't know if uncomfortable is [the right word], uh, hesitant to approach [certain authority figures] perhaps.”

Academic Success, Safety, and Comfort

While all three participants did include grades in some way in their personal definitions of academic success, Ann and Liv both described academic success as related to how much knowledge they had gained, and Zed framed it in terms of setting up opportunities for future success. These definitions provided an interesting contrast to both the expected answer from

the literature (Ost, 2010)—success being related solely to grades and GPA—and to the study definition. All three participants considered themselves to generally be academically successful by their own metrics and met the study definition for academic success.

Zed in particular felt academically successful as the study progressed. Between the two interviews, she had the opportunity to complete an internship and attend a symposium to present research from her internship, where she had the feeling, “I kind of like to think I know what I’m talking about now.” This reflected a shift in her perception of her abilities in the study, as she originally felt underqualified for her position in her program.

Ann, Liv, and Zed expressed feeling safe in their departments and on campus, and none of them could identify an instance where they felt unsafe; Ann elaborated by saying, “Oh, most all day, every day, yeah. I feel pretty safe just about everywhere.” However, Ann did mention she had felt unsafe in off-campus spaces in the city the university is located in, although she did not provide details about a particular experience.

Related to safety, Zed did say she worried about support from the university in addressing any issues she could have faced in coming out to her roommates in an off-campus housing situation; she thought “I would be stood behind if something were to happen on campus, but I think that a lot of the repercussions I worry about [in my housing situation]...I don’t feel as if I would get university support in solving that problem.”

Zed felt less academically supported than either Liv or Ann, noting “a disconnect between the student

governments and the administration and individual departments.” Zed described her department as being less organized and full of miscommunications between students, faculty, and staff, whereas both Liv and Ann considered their departments to be “excellent” (Ann) and “absolutely” supportive (Liv). However, Ann did say she felt less supported by the university compared to her department, saying, “certain processes are more difficult than they need to be.”

In varying contexts and to different degrees, all three participants felt they could be themselves on campus, which is one way to explore feelings of comfort. Zed and Ann both gave qualifying answers, Zed saying “75% of the time” and Ann saying “most of the time,” when asked about being themselves, and Zed later added, “I don’t know whether my identity will ever get to be an actual part of myself.” Liv, on the other hand, felt as though he could be himself, and “I also feel like being with these people is also helping me grow and to be a better self.”

Microaggressions

Zed, Liv, and Ann all identified experiences that can be described as microaggressions throughout their interviews, but it seemed they lacked the language to truly express these experiences in detail. All three participants gave “I’m not sure” or “I don’t know” as responses when asked for more elaboration about their discomfort, which is consistent with the findings of Cooper & Brownell (2016). These potential microaggressions became the focus of analysis because of the subtle ways each participant talked about their experiences.

Ann noted she had had some passive negative experiences in her department, nothing she thought was significant enough to remember details about but which left a lingering feeling of unease. Microaggressions are brief interactions and usually unconsciously done (Sue, 2010), but making another person feel uncomfortable because of their identity is still a microaggression and may cause at the very least harm to a working relationship between students or between student and professor. Additionally, Liv thought of engineering as an identity-neutral space, where “teachers look at me as how well I’m performing as opposed to who I am.” As discussed in the introduction, this is a heterosexist microaggression where a student’s marginalized identity is erased in an education space, which may unintentionally other those who are not heterosexual. Zed felt “as if I need to work harder or be better in order to get to the same places,” a common feeling among queer students, and reflected a situation where Zed felt othered by her peers, even though they did not know of her sexual identity. This may represent a heterosexist environmental microaggression within her department spaces, a type of microaggression called a microinvalidation (Sue, 2010). Zed’s allusion above to feeling uncomfortable with some faculty in the department is another example of how environmental microaggressions may impact queer students and deter them from engaging in major spaces.

In particular, Ann and Zed both noted feeling it was necessary to conceal their identities in some instances, which may be a response to invisible heterosexism that promotes heteronormative culture and behaviors (Sue, 2010) and has been recorded within science spaces (Miller et al., 2021).

“Yeah, in some small cases, um yeah...Just because you never know how people are gonna react. If there’s any speculation that somebody might have a negative reaction, then I, it just doesn’t seem worth it, worth that sacrifice if it’s not gonna be like a prolonged interaction with that person.” -Ann

Zed worried about others’ reactions, saying “I don’t know how it [my life] would be affected if people knew, that’s probably one of the reasons I haven’t come out yet.” She also wondered if it would impact her future STEM career or her studies if she were out, which contributed to her not feeling comfortable being out. Zed, without being able to explicitly identify why, was concerned that being queer would hurt her future job prospects.

All three participants felt their sexual identity had nothing to do with their schoolwork, thinking of their STEM experiences as identity-neutral or indifferent and prioritized their science student identities over their sexualities. Both Ann and Liv very strongly identified with their majors, and this connection may have contributed to their feelings that their sexualities had nothing to do with their majors. Zed, not being out, said she hadn’t “ever felt it was [pause] pertinent, I guess.” Liv and Ann both considered their sexualities to have little to do with their future STEM careers, whereas Zed was concerned her identity may always need to be separate from her work, saying, “it’s hard to look at all these like opportunities and these like great things that are hap-happening and wonder if like it would be the same if I wasn’t straight passing?” She wondered if she would be treated the same way in her workplace as her heterosexual colleagues “if the

person that I was with happened to be not cis-straight male.”

Finally, Liv attributed some of his experiences to personal characteristics rather than environmental or interpersonal interactions, saying “my family has always been very accepting, uh but the culture I grew up in, it, ya know, that kinda defined who I was, it kind of like pushed me to be stronger as a human.” This may mean that Liv was forced to deal with discrimination from others in his community growing up, and now he attributes his ability to cope with homophobia and discrimination to those formative experiences. He may also be able to brush off or ignore subtle discrimination such as microaggressions because of these experiences.

Discussion and Implications

This study sought to understand how feelings of comfort and safety affected the academic success of queer science major undergraduates. Most notably, the three participants made no direct connections between their sexual identities and their academic success or persistence within their majors, which provided no insights in answer to the research question. Instead, microaggression experiences common in the literature came out in the interviews and narratives, and the queer theory framework allowed the authors to “queer” the research methods, or to think outside the bounds of traditional qualitative work and “to embrace multiplicity, misalignments, and silences” (Brim & Ghaziani, 2016, p. 17). This decision not to change the research question comes from queering the data analysis process and remaining transparent about the changes in the research study.

The participants each had slightly different conceptions of comfort, with Liv and Ann thinking

more about their ability to choose to be open about their sexualities. Zed instead considered it to be more comfortable in her department to remain closeted. When asked about the support being provided by their departments, all three participants brought up only academic support, which demonstrates a continued disconnect between the personal and academic spheres of their lives.

Through a queer theory lens, the subtle language used by the participants pointed in a different direction and even the silences suggested a different interpretation of the participants’ disconnect between sexuality and academic success (Brim & Ghaziani, 2016). Many of these silences occurred when participants were asked for more detail or to think in new ways about how their personal identities connected to their academic worlds, whereas all three participants became more talkative when asked about their academic programs or future career plans. A queer approach allowed the researchers to question why, exactly, the participants did not see any connection between an intrinsic part of themselves and their chosen field of study and future career, and to begin to seek out literature for new ways to examine that idea.

Disconnecting their identities from their academic and future careers could be denial of personal disadvantage, where the participants may recognize that discrimination against queer people happens in general but do not see themselves as being personally discriminated against (Crosby, 1984), or even system justification theory, where they think of the system as established and so it is unnecessary to involve identities not already in the space, such as sexuality (Jost & Hunyady, 2003). This appeared in Liv’s discussion of his personal strength against a

homophobic culture growing up, in Ann brushing off the uncomfortable passive experiences she had with classmates and professors, and in Zed's discomfort at the thought of coming out to classmates. It may even be that, by perceiving science as an identity-neutral space, the participants could be avoiding negative effects from recognizing the inequality in these spaces (Suppes et al., 2019). It is worth noting that only one of the participants was a man, and Liv described the fewest experiences that could be classified as microaggressions, which may be an example of male privilege within STEM spaces (Dancy et al., 2020). These potential approaches could be connected to the passive negative experiences Ann and Zed mentioned in their interviews. However, without further interviews or follow-up, it is impossible to say for certain.

An implication of this work comes back to the language used by participants. In exploring microaggression literature after analyzing Ann's description of minimal or passive negative experiences and Zed's concerns about her ability to be authentic in future biochemistry workplaces, it became apparent that these students may lack the knowledge to identify their experiences as harmful or the language to describe their experiences in meaningful ways, which reflects the experiences of queer biology students asked to describe their experiences in another study (Cooper & Brownell, 2016). Another possibility is desensitization to these experiences, which may be built up over a lifetime of seeing heterosexism in daily interactions from both heterosexual and non-heterosexual individuals (Dessel et al., 2017; Woodford et al., 2012; Woodford, Han, et al., 2014; Woodford, Kulick, et al., 2014), which may apply to what Liv described above about gaining personal

strength from the discrimination he experienced growing up. Microaggressions have become more commonly explored in queer research but remain underexplored for STEM queer students, and the language involved in understanding micro-aggressive experiences also seems to be under-explored.

Conclusion and Limitations

At their current university, the participants generally did not feel uncomfortable in their departments, and none of the participants identified feeling unsafe. They did not see their identities as impacting their coursework or success. They noted some negative passive experiences with others but were unable to elaborate further. Based on the literature, these experiences could likely be categorized as microaggressions, which is beginning to be more specifically and explicitly explored in queer research for queer students.

This research has a number of limitations, most notably the very small population. This means that any implications or conclusions reached might not be applicable beyond these particular students. There were also no gender nonconforming students, only students of sexual minorities, and no information about race or ethnicity was gathered about the participants. Additionally, the most interesting findings regarding microaggressions were not realized until long after both the interviews and the narrative member checking had been completed, so there was no ability to follow up with the participants about these findings. Another limitation may have been the emerging interview skills of the first author, as this project was one of their first formal interview-based studies.

This research identified a possible lack of language about or ability to identify subtle or passive experiences and the perception of identity-neutral spaces in STEM. From this, it may be beneficial to explore microaggression language with queer undergraduate STEM students in future work. In Western societies, heterosexism is the norm, and the expectation that all individuals will conform to a heterosexual worldview impacts every individual, including those who are not heterosexual. The

language to better identify how heterosexism impacts their lives may help empower queer science students to see how the accumulation of unidentified comments, behaviors, and attitudes that are hurtful may be affecting their academic careers, their personal choices, and their mental and physical health. Empowering these students with language may help researchers and educators better understand the problem and hopefully work to better address it.

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Appendix: Semi-Structured Interview Protocol

1. What is your year/status (freshman, sophomore, etc.)?
2. What is your major(s)?
3. How do you define academic success?
 1. What does it mean to you?
 2. When do you feel like you've done well?
4. How do you identify (gender/sexuality)? What are your preferred pronouns?
5. Is this information you consider to be public?
 1. Are you publicly "out", privately "out", or not out at all?
 2. Are you open about your identity with anyone? With select people?
 3. Do you feel comfortable sharing your identity?
6. Describe for me what it means to be you.
7. Tell me about your feelings regarding your major.
 1. How do you feel about your classes?
 2. How do you feel about your progress?
 3. How do you feel about your future?
8. Tell me about a time your identity impacted your major.
 1. In an advising session, a classroom, with a professor, with peers, etc.
9. Tell me about a time your identity impacted your classwork or homework.
10. Tell me about an experience when you felt safe/didn't feel safe in your department.
11. Tell me about a time you felt your identity came in to play with a class in your major.
12. Tell me about a time you felt you needed to keep your truth a secret.

13. Tell me how you feel about your major and department.
 1. Support
 2. Peers, advisors
 3. Homework, classwork, content, etc.
14. Tell me about a time you felt positive or negative about sharing your time in your classroom or major space.
15. Tell me what it's like to be you in your major.
 1. In your classroom
 2. In your homework group
16. Do you feel supported by the university?

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