Work in Progress: Building a Safe Queer Community in STEM—It Takes a Village to Support a Village

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Introduction

Recognizing the need to attract and retain talented individuals to Science, Technology, Engineering, and Mathematics (STEM) professions, the National Academies advocate that diversity in STEM must be a national priority [1]. To build a diverse workforce, educators within STEM disciplines must continue working to create inclusive environments to prevent historically underrepresented and underserved students from leaving the field. Additionally, previous research provides compelling evidence that diversity among students and faculty is crucially important to the intellectual and social development of all students, and failure to create an inclusive environment for minority students negatively affects both minority and majority students [2].

Research about the experiences of LGBTQ+ individuals in STEM disciplines is critical to improving the climate for LGBTQ+ in our classrooms, departments and professions. A 2011 exploratory study by Cech and Waidzunas found that opportunities for success among engineering students that identified as lesbian, gay, and bisexual (LGB) was hindered by engineering's heteronormative and chilly climate, with many LGB-identifying students facing both academic and social isolation [3]. In a later study, Cech and Rothwell found that, in comparison to their non-LGBTQ peers, LGBTQ engineering students face more marginalization and devaluation in their programs, which in turn partially contributes to more negative health and wellness issues for these individuals [4]. The heteronormative/cis-normative culture in engineering and STEM also frequently imposes "passing" (acting with the goal of being perceived as heterosexual) and "covering" (revealing certain aspects of your identity with the goal of being perceived as non-LGBTQ+ in certain settings) demands on both students and faculty. With regard to faculty, when comparing academic climate and career consequences among LGBTQ faculty in various fields, Partridge, Barthelemy, and Rankin found that those in STEM fields reported the highest level of discomfort on campus, in departments, and in classrooms; those who faced discomfort were more than twice as likely to consider leaving their institution [5].

This project builds on the success of a previous exploratory phase [title deleted to maintain the integrity of the review process] and aims to support engineering departments' efforts to create LGBTQ+-inclusive environments. While our project focuses primarily on engineering, organic synergies with other fields have expanded our community to include members from other STEM disciplines. Our research focuses on understanding how Community of Practice (COP) characteristics develop among STEM faculty who work to increase LGBTQ+ inclusion; how STEM faculty as part of the virtual community of practice (VCP) develop a change agent identity; and what strategies are effective in reshaping norms and creating LGBTQ+-inclusive STEM departments. Our overarching research question is: *How does a Virtual Community of Practice of STEM faculty develop from a group committed to improving the culture for the LGBTQ+ community?* This paper presents preliminary results, focusing on one emergent theme from a sample of 16 individual interviews: characterization of the virtual community as a

supportive and affirming space to negotiate identity development and bolster advocacy confidence.

Theoretical Framework and Research Questions

Our research study is grounded in the conceptual framework for Communities of Practice (COP) [6-8] and leadership readiness [9,10]. Communities of Practice have three core characteristics: the domain, the community, and the practice [8]. Members have a shared domain of interest and a commitment to that domain; in this project, the domain is promoting LGBTQ+ equality in engineering. COP members learn from each other through social participation in the community; they engage in learning, knowledge sharing and taking action. Members of a community of practice must be practitioners [8]. Over time, they develop shared resources that support their practice: in this project, advocating for LGBTQ+ inclusion at their home institutions or in other professional contexts [8].

Kezar, et al. [10] proposed a model for successful faculty participation in campus advocacy that includes both individual and institutional characteristics. Previous research by Cunningham, et al. [9] suggests that self-efficacy mediates individuals' readiness to engage in organizational change efforts. Cech, et. al. [3, 4] found an absence of institutional-level initiatives and expectations for LGBTQ inclusion, despite deans' recognition of LGBTQ inequality within their college. In this project, members have joined the virtual community of practice (VCP) with an interest and commitment to the stated domain of promoting LGBTQ+ equality in engineering. Through their engagement with the VCP, they have become practitioners or change agents for LGBTQ+ inclusion in their home institutions and in other professional contexts. This project examines the process of transformation from sharing a common domain to becoming a practitioner or change agent, including how community members integrate their change agent identity into their professional identity. The study of members' experiences aims to illuminate the process through which individuals gain the skills and confidence required to promote inclusion, and how the VCP supported their participation in campus advocacy.

The initiatives of the community of practice are guided by the inclusion model proposed by Winters [11], in which building an LGBTQ+-inclusive environment in engineering departments is considered both a macro and a micro organizational change effort. The VCP is further guided by an institutional change model that considers the stages of institutionalizing a practice (e.g. LGBTQ+ inclusion) [12]. This portion of the study seeks to understand the experiences of the VCP members that directly influence individual (micro) behavior, and to raise awareness for the need for institutional (macro) change. The preliminary results presented are part of the Interpretive Phenomenological Analysis (IPA) approach we followed (described below); our two guiding research questions (RQs) are:

1. How do participants describe their experience in the VCP?
2. What themes emerge from participants' descriptions of their experiences and activities within the VCP?

Method

To answer our overarching research question, we designed a qualitative Interpretive Phenomenological Analysis (IPA) study based on in-depth individual interviews. The IPA methodology allows researchers to consider two levels of analysis: (1) individual experiences and perceptions, and (2) group-level collective experience and engagement. These qualitative techniques avoid essentializing a single identity dimension or experience of the participants. Interpretive Phenomenological Analysis (IPA) is an established approach to qualitative data analysis [13] and has been used in previous LGBTQ research to understand the way gay men think about sex and sexuality [14]. Based in both hermeneutics and phenomenology, IPA emphasizes the role of interpretation of the experience of a phenomenon by participant, researcher, and reader; the role of the researcher is to establish themes based on their interpretation of participant experiences. IPA samples are often relatively small, and findings are not intended to be broadly generalizable. Rather, IPA heeds the particular/individual while forming connections or themes across participants. In this way, findings from IPA studies provide foundational evidence for how a phenomenon is experienced by a relatively homogenous sample. We selected IPA as the strategy of inquiry because it emphasized clarifying the phenomenon by shedding light on the experiences as they are lived by an embodied socio-historical situated person [15]. That is to say, the goal of IPA is to capture particular experiences as experienced by a particular group [13]. In this case, we wanted to capture the lived experience of the VCP members within their own individual and collective sociopolitical perspective.

Because the three authors are also members of the Virtual Community of Practice, the following paragraphs explore our positionalities in relation to this study, to the community members that were interviewed, and the broader research context.

Positionality

Author 1: My interest and concern about this research topic is relevant to me both personally and professionally. I am Black, female, same-sex loving, engineering professor with strong beliefs around spirituality. I am a first generation PhD in my family and raised in a racially and economically segregated large city in the Midwest. My research agenda is to broaden participation in engineering. My previous research investigated the experiences of multiple marginalized groups including women of color and members of the LGBTQ spectrum. I typically take an intersectional approach to identity in research and I am passionate about giving voice to those often overlooked in the business of educating engineers in the U.S.

Author 2: In my personal life and professional life I strive to be an LGBTQ+ ally. I am a cisgender, heterosexual woman and an engineering professor. I was raised in a middle-class town in the northeastern United States, the only child of parents with college degrees. My understanding of LGBTQ+ issues was influenced deeply by a 32-yearlong close friendship with a gay man. As an attorney who provided pro-bono legal services to LGBTQ+ asylum seekers, he inspired me to bring together my personal interest in LGBTQ+ advocacy with my professional interest in engineering education and institutional change. For the last several years, my work has focused on increasing the participation of students with marginalized identities through micro and macro level change efforts.

Author 3: I am a Hispanic, cisgender female; an engineer by training, and educator at heart. I consider myself a diversity and inclusion practitioner, and LGBTQ+ ally. I started my career as engineering faculty; however, I have been outside of academia over a decade. I was raised in a lower middle-class, Catholic home outside the U.S—albeit, I no longer practice a specific faith. In my home country, conversations about race, class, gender identity, and sexual orientation were not part of the national discourse. Moving to the U.S. broaden my understanding of these topics and helped me to recognize my own privilege in some areas, and my disadvantages in others. The awareness of these (new) identity facets and a shared concern to address issues around marginalization led me to integrate my interest in the areas of educational development, and professional communities, with the diversity, equity, and inclusion space.

Participants

Research participants are members of the VCP who self-identify as professionals working in academic departments and who are actively engaged in activities to promote LGBTQ+ inclusion Because of the primary scope of the project, only members currently working in engineering departments were eligible to participate. The established relationship of the community simplified the recruiting procedure. Existing VCP members were invited to take the initial screening survey through the community mailing list. Additionally, during the regularly scheduled VCP meetings, members were notified of the opportunity to participate in the research study. The VCP is the target population for the study, as the group previously existed, and the investigation occurs within the natural context of the community interactions. The unit of analysis is the members of the VCP. The phenomenon of interest is participation in a VCP that is engaged in activities to improve LGBTQ+ inclusion in engineering. The final sample of 16 participants were not offered compensation for participation and represented all ranks (e.g. tenure-track, non-tenure track, and academic professionals) across several departments.

Data Collection

After consulting with IPA experts to establish face validation, we piloted the interview protocol with three experienced qualitative researchers. The semi-structured in-depth interviews were conducted online, as the study participants are distributed across the country. The data collection included demographic information and responses to semi-structured interview prompts. We collected demographic data (e.g., age, gender identity, race, department, academic position or title) to characterize the participant pool, and only considered during analytical interpretation when relevant to an emergent theme. The interview protocol was intentionally semi-structured to provide flexibility in capturing each participant's perception of their experience and how the experience affected their identity. Sample interview questions include: "How did you first get involved in the VCP?" and "How has the VCP changed your views of improving inclusivity for LGBTQ+ students and professionals in engineering?" The interviews lasted 60-90 minutes. The objective of the interviews was to gather contextual information on each participant's experience in the VCP and how they made sense of these experiences. Participants had the option to have the interview video recorded or audio-only recorded. In both cases, the audio files were transcribed verbatim.

Data Analysis

The VCP member interviews were analyzed using the IPA analysis procedure outlined by Smith [13]. The IPA analysis has three primary steps: (1) read interview transcripts multiple times and make notes about interesting or significant aspects of the account; (2) translate the notes into emerging themes; (3) identify connections between emerging themes and clusters of themes [11]. After the data was processed by a third-party transcription service, each transcription was reviewed for quality by listening to audio recordings while reading the transcript. Next, the transcripts were cleaned to remove all identifying information. IPA suggests that the researcher should first listen to the transcript multiple times to familiarize themselves with the voices of single participants. After listening and reading a transcript 2-3 times, segments of the transcripts were labelled with descriptive, linguistic, and conceptual comments on the data. To differentiate the three types, each comment type was coded. Labelled coded comments where then grouped into themes and the themes were further designated as superordinate or a minor. Throughout the process, Author 1 used detailed audit trail to bracket her views on the topic during the coding process and maintained focus on the interviewees' experience. All coding procedures occurred within the MaxQDA qualitative data management software. Note: some comments or quotes are left in plurality to avoid gender identification of the participants.

Results

The preliminary results presented in this paper focus on a single emergent theme: the characterization of the virtual community as a supportive and affirming space to negotiate identity development and to bolster advocacy confidence. Generally, the VCP was described as supportive and allowing each member to cultivate a sense of belonging that is rarely experienced in other professional activities:

> *"Well, I was surprised to see it, first and foremost, because I know there hasn't been a lot of – at least, **very visible work** that I have seen, around LGBTQ students in STEM, particularly engineering. So for me to see it, I was surprised. I was very pleasantly surprised, and I was very appreciative of the enthusiastic welcome that I got, when I was emailing about joining the group."*

> *"[The VCP has] provided a kinship that I never really felt in engineering. I don't really know how else to explain it but I'm very fond of many of the members of this group, even though we haven't spent much time physically together. I feel like I have a support network of topics that I never discussed with any of my colleagues for the first 25 years of my career"*

> *"We were doing these things [meetings] in this Adobe Connect thingy, I just really- I really liked that because I heard a bunch of people's voices. And it was like, real people have the same problems as me, and are aware of the same things as me, and want to talk about them. And so, I think each of us, and especially for the folks, who are in the places where maybe it isn't so supportive, or maybe they don't have a lot of community. Having that be like,*

oh, I know this week, I'm going to get an hour and a half where I get to talk to people who actually care about stuff that I care about. Which is really supportive and helped me get through feeling like I wasn't supported"

Several participants described the importance of having a voice within the VCP and having a space to unpack experiences or developing identities around the LGBTQ+ spectrum. One member stated that "[the VCP] it's this great supportive space where I feel like I'm a whole person". Multiple members mentioned the importance of the VCP helping them fully integrate their multiple identities into their job as an educator:

"The group helps me bring my 'whole' self to the workplace."

"I always show up as a white person in every meeting. I always show up as an able-bodied person in every meeting. I always show up as a trans person in that [VCP] meeting. I always show up as a woman in every meeting, although the way that gets read depends on whether people see me as a man in a dress or a trans woman… I can get up and I can, I can give a nice lecture, but I'm really at my best when I'm going back and forth with students in multiple meetings. And I'm, I'm getting something from them about what they're understanding and then that helps me come at whatever they're struggling with a second time and I really engage in a back and forth with my students that way over time."

The participants spoke in detail about how the group supported their identity development as an educator and as a professional (e.g. engineering identity) in addition to seeking opportunities to combine their advocacy work with their academic work:

"To be a part of the group, I'm appreciative of the community. It's very supportive, and I've been able to join the meetings that are put forth. I am always excited to see the advocacy work that's happening and the training and the workshops that are put on, and communication with people who are willing to be a part of that. It's all things that I personally want to be involved with, and I'm glad that I see it there [within the VCP]."

"So, basically Oliver Sacks had just passed away and he was a fairly famous neuroscientist. No one made mention of the fact that he was gay and I forget which term they used for him. I kind of bemoaned that on Facebook and then, one of my colleagues from [university], she [VCP leader] came in and offered me a position in the, the LVCP to kind of explore, you know, concepts of LGBTQ identity within STEM. And, I personally have been trying to engage in that space personally just as another way to, kind of, I guess, like, develop myself a little more and maybe hopefully, get a deeper appreciation of what it means to be an engineer."

"I'm not doing it all the time per se, but I've been able to integrate this [VCP and Safe Zone] content into a lot of my work."

Based on the relationships established during VCP activities, members appreciated the diversity of thought and perspective that makes the group unique and powerful. Participants described changing or updating perspectives on LGBTQ+ issues based on group participation; they also talked about increased confidence when interacting with colleagues or administrators while advocating for the LGBTQ+ community:

"It [being in the VCP], it certainly changed my, this has broadened my understanding of LGBTQ in STEM. It's broadened my understanding of the experiences, experiences that people have who are LGBTQ in STEM. I've gained new skills and new insights without a doubt although, my somewhat radical, queer, lefty, you know, pro-trans, all of that stuff, all of it [being in the VCP] did was just bolster all that. It just magnifies it, every time somebody told a story about some derogatory or discriminatory experience"

"I think if anything it's [being a VCP member] given me a better snapshot of what other people's experiences are like. Because you know, we're a reasonably inclusive place and I'm still aware of how, you know, how much people are marginalized and like to realize how good we have it, I think has been useful, sad, eye opening."

"I've learned some techniques for communication facilitator training, and it's helped me talk with administration and with people who are in other departments and other programs and curriculums and kind of help them engage where they're at. It has been a big motivator and a driving force, at least from the facilitator training, to bring about training on our campus, here, in areas not of LGBTQ, but also in other areas of diversity and inclusion. Some specific needs on campus, I think it's been – I think it's all been helpful and very useful for me. I've been able to use it."

"I think where we're going, in terms of – in terms of giving people in education, staff and faculty, the administrators, tools and language with which to discuss these things with people who are not aware, or in other institutions that don't prioritize it, like we do. I think that's – that – that's continually more and more important, I think.

Discussion

This project addresses the critical need to diversify the engineering and STEM workforce by promoting the inclusion of LGBTQ+ students and faculty. The project supports the continuation of a virtual community of practice that has been successful in the sharing of knowledge, development of resources, and nationwide dissemination of effective approaches for promoting LGBTQ+ inclusion in a culture that is resistant to change. The project will generate innovative practices for individual and institutional capacity for building LGBTQ+-inclusive classrooms and workplaces. Overall, through our analysis of the VCP member interviews we were able to answer our research question. **The participants described their experience in the VCP as a supportive community of practice that provides a safe space to negotiate identity development and bolster advocacy confidence.**

Community-safe dialogue and relationships allows members to share information where LGBTQ+ allies can learn how to provide space for marginalized voices. The distributed STEM faculty were able to build relationships through community interactions to learn from each other, support identity development, and build confidence to share their whole selves with the engineering community. Furthermore, the VCP is important to its members because it has helped them fully integrate their multiple identities into their work. The group supports members' identity development, which enhanced their ability to be supportive of LGBTQ+ students.

The current study has a few limitations that can be addressed in future work. First, the current paper only reports a fraction of the emergent themes. Second, the VCP members interviewed for the project were self-selected and may not be reflective of STEM faculty not participating in the VCP. In addition, the linguistic and conceptual analysis is not presented here as the interpretation is ongoing and will be deepened in future rounds of analysis. Finally, due to research staff limitations iterator reliability has not been performed at this time.

Future work of the group will translate the research findings into practice through the iterative refinement of the community's advocacy and education efforts including the Safe Zone workshops. To increase access, Safe Zone training will be offered to engineering departments on college campuses, online via webinars, and through an asynchronous online courses. The impact will extend beyond the boundaries of engineering to STEM more broadly, as the VCP will include members from STEM fields and webinars will be disseminated to STEM professional societies online and at professional conferences. Creating a professional culture in which individual differences are valued and embraced will enhance student learning, increase productivity and fuel innovation.

Conclusion

The VCP operates on the three principles of a community of practice; *the domain, the community, and the practice*. In this paper, we explore VCP members' experiences related to the *domain* of LGBTQ+ equality in STEM. We report findings from interviews with members of a virtual community of practice (VCP) to promote LGBTQ+ equality in engineering and STEM. VCP members characterized the community as supportive and effective at promoting an inclusive environment for the LGBTQ+ community in engineering and STEM, allowing members a safe space to develop and integrate social and professional identities and to bolster confidence in their advocacy skills.

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