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”What if I just do what I have a pull for?” Negotiating the Borderlands of Queer and Engineering Epistemologies

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Introduction

Prior research about the experiences of LGBTQ+ engineering students has focused on the cultural aspects of the discipline that negatively affect their educational opportunities, with particular focus on heteronormativity, masculinity, and prioritization of technical skills at the expense of social knowledge. The field of engineering values empirical knowledge, which can be at odds with many other epistemologies and ontologies, especially queer ways of knowing [1]. In this research brief, we use Riley's work and Anzaldua's conceptions of identity borderlands to analyze one interview with Amelia, as she sits in the tensions between queer and engineering ways of knowing.

Authors' Positionality

Our author team consists of a visiting assistant engineering professor at a four-year college, a graduate student at a research-intensive university, and 4 undergraduates at a four-year college. We come from different backgrounds, and our identities range across race, ethnicity, LGBTQIA+, and disability, among other identity categories. We are all multiply marginalized in engineering–engineering doesn't feel like a space that will willingly accept all of our intersectional identities together. We want to highlight that through all of the authors on this paper, at least one person shares the following identities with Amelia: queer, engineering, gender, cultural background from the Caribbean, and immigrant.

Literature Review

Individuals have as many identities as they have groups they belong to [2]. Sometimes, these multiple identities conflict, leading individuals to shift an identity's perceived importance in spaces, downplay them, or even leave them unacknowledged [3]. Individuals often feel they must mold themselves into the dominant culture to develop a professional identity. If that culture creates a "chilly climate" for minoritized individuals, they may adopt behaviors that help them feel less stigmatized to avoid being discredited. The culture of engineering still fosters a heteronormative environment [4], requiring LGBTQ+ individuals to pass and cover their stigmatized LGBTQ+ identities [5].

The growing body of research on LGBTQ+ populations in engineering often focuses on the cultural aspects in the field that make LGBTQ+ engineers feel out of place [6], [7]. These cultural aspects have been described as prioritizing heteronormativity and masculinity, valuing silent professionalism, hostility toward queer people, and requiring cognitive energy to manage all identities [8]. The heteronormative environment requires LGBTQ+ individuals to restructure their identities in engineering.

The dominant epistemologies in engineering include a preference for rigor and empirical findings over topics like embodied knowing and personal experience [1]. The ways engineers *know* differ from the ways many other groups of people *know*. The desire for rigor in engineering subjugates other ways of knowing as lesser [1]. Unlike in engineering, other ways of knowing,

particularly queer epistemologies, value embodied knowledge [9]. Queerness provides an embodied truth and leads to the questioning and repositioning of what *knowing* is. Individuals with multiple epistemological viewpoints can span the spectrum of epistemologies, oftentimes uncomfortably.

Queer ways of knowing necessitate accepting (or at the very least reckoning with) the unknowability of sexual orientation and gender [9]. Engineering aims to be very knowable and certain. Its ways of knowing are deductive, reductionary, quantifiable, and well-suited to tackle problems that can seem certainly solvable.

Conceptual Framework

Conocimiento te guia (a need to feel whole and integrated) provides an internal compass directing an individual toward a holistic sense of self. Anzaldúa developed a seven-stage theoretical framework to conceptualize how individuals accept their multiple identities through a guiding sense of holistic self [10]. These stages take individuals on a journey through borderlands that involves navigating tensions between identities, surrendering old selves, and healing from the cracks between different social identities. Ideally, the last stage leads to an individual resting at the (un)comfortable flexible borderland between identities. With bridges now constructed at the borderlands, an individual at this stage has a holistic sense of self that can sit in the inherent tension at the external material, socially constructed level. In the last stage, individuals feel less like they are forced to enact their identities with no choice. Instead, they can choose how, why, and when they engage in different narratives with others, enacting a plurality of self [11], as they iteratively re-author themselves and the spaces around them. Anzaldúa's framework allows us to consider racial and ethnic aspects in an epistemologically more accurate way for the participants.

Methods

Introduction to Amelia, our Participant

At the time of her interview, Amelia was in her early twenties. She was pursuing her undergraduate degree in Mechanical Engineering and navigating her identity as a queer Black cisgender woman. Her perspectives were informed by her background as an immigrant from the Caribbean to the US and her experiences of cultural, familial, and social expectations. These interviews explored intersections across many different identities and in this paper, we're focusing on Amelia's queer identity.

Data Collection and Analysis

The data analyzed here were collected as part of a larger study at a large Hispanic Serving Institution in Florida. All participants self-identified as part of the LGBTQ+ community and were affiliated with the engineering and/or computer science department. No additional filters were used to select participants. Participants were found through campus advertisements and snowball sampling. Interviews were conducted following an IRB-approved semi-structured interview protocol. Following the first interview, the interviewer (the first author) provided participants with a condensed autobiography of his journey coming out as gay, studying engineering, and discussing his family and background. Individual interviews lasted

approximately three hours each and were conducted two to three times per participant. Between interviews, the first author listened to the previously recorded interview and wrote analytic memos to generate clarifying questions he asked in subsequent interviews to delve more deeply into specific aspects of participants' narratives. The last interviews were used to communicate a synopsis of the first author's observations to participants.

The first author's role as the interviewer was that of a facilitator, rather than an expert. He shared knowledge about what he'd been studying and prioritized healing for participants by talking through shared experiences and finding community. While the primary objective of the interviews was to ask the questions in the semi-structured protocol for the sake of the study, the intention behind the interviews was to help the participant work through their narratives and understand something further about themselves and those around them in relation to their queer, gendered, engineering, and racial/ethnic identities. The first author approached research participants as collaborators, experts in their experiences. He also shared his experiences, knowledge, and self-analysis reciprocally.

The second interview discussions were a springboard for building themes and performing initial triangulation. Subsequently, the data were analyzed using a qualitative inductive process of open coding and analytic memoing [12]. The first author generated themes using transcripts and listened to interview voice recordings. In this paper, the authors synthesize one participant's narrative as she intertwines some of her identities. The interviews incorporated values of Participatory Action Research and *Platicas* [13], focusing on building understanding alongside participants collaboratively. Each interview with participants lasted between 2-4 hours. Each participant was interviewed 1-3 times.

Given the sheer magnitude and richness of the data, we present our initial analysis for one participant in this work-in-progress paper. All other co-authors analytically memoed Amelia's interviews, thematically open-coded them, and worked collectively to create and refine the themes described here.

Findings

Our two themes explain how Amelia sits in the space between her engineering and queer epistemologies. She recognizes that there are different ways of knowing as a queer person, as an engineer, and as both.

Theme 1: Amelia finds comfort in fluid labels

Understanding her bisexual identity as queer provides Amelia with fluidity and freedom. She "can be anything under this [queer] umbrella term," which she feels is liberating. However, in engineering spaces, she uses more specific terminology, e.g., bisexual, to identify her sexual orientation. Whereas in queer spaces, she values the flexibility of not having to label herself as bisexual, instead embracing queer as a broader, more inclusive term. Depending on the space that Amelia is in and who is interpreting her identities, Amelia feels the need to clarify or reconceptualize what the labels of her identity mean to her. She mentions not feeling the need to elucidate her perception of queerness because everyone has "their own perspective" on

identifying as queer. For Amelia, using the term queer provides her the flexibility to co-construct her identities alongside individuals who share a similar epistemological framing.

For individuals who struggle to grasp less concrete ideas, such as in an engineering space where definition and simplification are key to success, Amelia feels the need "to narrow [down] where [she falls] into queerness, [and she] usually [follows] up with a definition" of her queer experiences, specifically that she likes both women and men, even though Amelia herself also defines queer as anything "other than straight." Amelia possesses the ability to synthesize multiple definitions of the same word for different audiences. This demonstrates her comfort and confidence in how both herself and others perceive her identity: "that [a] person's perspective [or] definition of you doesn't change what you've done, who you are, or … what you value."

Having the space to move across, between, and through constricting identity labels like gay, bisexual, and pansexual provides Amelia an unbounded exploratory space to understand herself by using and redefining labels iteratively: "The process of figuring yourself out and then re-figuring yourself out. Like terms and like definitions, [are] like super like, constricting [and] hard [...] I'm just like, what if? What if I just do what I have a pull for? And let's just call that gay." Amelia describes this approach as freeing, contrasting it with the constraints of fixed categories. She likens identity to a Venn diagram, where "if you have like two intersecting circles, you're the middle, but you can also be this circle or that circle," emphasizing how a person can exist in multiple overlapping spaces at once rather than being confined to one category.

Theme 2: Amelia has fluid boundaries about what it means to be queer, which allow her to co-exist as a queer engineer

Amelia mentions that "being gay means something different for every single person." For Amelia, there is a larger picture behind the simplification offered by labels. She sees the labels of queer, gay, bisexual, or pansexual as a shorthand for communicating a larger, more nuanced picture. Amelia ponders a "bigger picture," as she grasps unknowable ideas in engineering and acknowledges when a picture is "cropped," or simplified. She mentions that people who do not have an idea of this broader uncropped, or unbounded picture are more prone to using simplified, cropped, and bounded ways of understanding when having "to understand something that is so hard to simplify," such as when understanding queerness from a non-queer experience.

Amelia's experiences being both queer and an engineer have allowed her to sit in the borderlands of both identities, empowering her to look back and forth between them from different perspectives. The different epistemological spaces those identities inhabit have caused dissonance.These spaces enabled her to move through borderlands by navigating different ideas and piecing together different parts of herself to heal the fissures between her identities. This allows a level of flexibility between identities and ways of knowing. As she put her different identities back together over the years, she formed bridges across her different identities and learned to sit in the uncomfortable yet flexible epistemological borderlands between her queer and engineer self.

Through her journey at the borderlands, or sitting in this tension-filled space, Amelia has facilitated her understanding of the boundaries of these spaces. Sitting in tension has also helped

her understand that the multiple ways of knowing associated with these spaces are simultaneously valid because they both exist within and outside her. What she can believe knowing is, given her queer experience, can coexist with what she has learned knowing is in engineering. Since both exist, her understanding of her safety in those spaces can also change.

Amelia develops a sense of safety in her identities and ways of knowing that allow her engineering and queer identities not to threaten each other. She uses different ways of knowing to navigate different spaces and characterizes it as being "open-minded." Understanding herself in her redrawn framing of being a queer engineer allows Amelia to feel "safe." Additionally, her knowledge of more complexity amidst otherwise simplified terms lets her see engineering ways of knowing as a subset of many ways of understanding the world, leading to the insight that she can't know everything through engineering epistemologies.

Having redrawn boundaries around knowledge, Amelia can see the boundaries of engineering epistemology in a broader epistemological landscape. She can see from her queer identity, invoking queer ways of knowing, to look at her epistemological engineering landscape. Looking at engineering ways of knowing from queer ways of knowing allows her to dynamically redraw the boundaries of these spaces so she can be both. This allows her to criticize and see beyond any one way of knowing. "And that's how I see engineering, but, it's like you know, there are so many things that, like, we can't understand through engineering but nonetheless they exist. Nonetheless, it's still a thing like affecting us, um, so it's a method or like a tool or like a lens, you know." Amelia characterized engineering ways of knowing as reductionist, simplifying, and filled with trade-offs. She also discussed how engineering epistemology purports to have "the right answer" to problems and acknowledges that there are many right answers.

Discussion

Amelia navigates the tension of her borderland queer and engineering identities [14]. She recognizes that the dominant discourses that define her racial, skin color, linguistic, immigrant, sexual, and gendered identities are not compatible. Correspondingly, her understanding of her engineering identity also needs to be flexible and in the borderlands [11] to make sense given the dissonance experienced in her other identities. Her worldview, as informed by previous experiences, necessitates a queering of her understanding of engineering.

She can navigate a prescriptive engineering world alongside engineers who may not question their racial, sexual orientation, gender, and other identities, and she simultaneously recognizes there are additional non-dominant "right answers" that an individual can arrive at if they understand the problem differently. Just as "binary conceptions of gender and sexuality are woefully inadequate for knowing the complex experiences and realities of gender and desire" [9, p. 159], so too are binary representations of problems when understanding herself as a queer woman of color in engineering. As Amelia said, "a fact can be a fact, and whether you have additional explanation on it or not…[t]hat doesn't mean that it's not real…" By being at the borderlands of queer and engineering ways of knowing, Amelia re-authors the discourses surrounding identity labels fluidly [15], [16]. Fluid reconceptualizations allow her to use queer ways of knowing to reframe internal dialogs [2], [17] of what an engineer is to mitigate threats to her engineering identity and belongingness. This comfortability communicates that she is in a

later stage of identity development and uses her reframing to navigate the tensions of identity threats.

Conclusion

Through Amelia's interview data, queer engineering students tend to hold more fluid ideas of queer sexual orientation and gender identities while possessing more objective and reductive engineering epistemologies. This impacts the way they define the fluid aspects of their identities, redefining their queer sexual orientations in different spaces. Because of this ability to look from different perspectives and redefine based on different lenses, queer engineering students hold the ability to look beyond one way of knowing and refine their own realities and perceptions. A powerful tool that many engineering education spaces lack, this means of redefinition allows for informed choices regarding the ways to invoke different epistemologies based on their understanding of their sexual orientation and gender identity, comprehension of engineering, and who they are as an individual.

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