

Critical theorizing can contribute to marginalized students' agency in engineering persistence.

### Purpose + Theoretical Framework

Within qualitative research on the persistence of underrepresented students in undergraduate STEM majors, the concept of student agency has had significant development. In a synthesis of research, Ong, Wright, Espinosa, and Orfield (2011, pp. 188–189) noted “agency and personal drive” as a major resource for women of color in STEM undergraduate programs. This personal quality was not primarily individualism devoid of culture or social support, but rather it often tapped into identity in a marginalized community for empowerment. Ko, Kachchaf, Hodari, and Ong (2014) noted several coping strategies employed by women of color in undergraduate Physics and Astronomy majors, including eight navigational strategies identified as significant forms of agency: “seeking an environment that enabled success, circumventing unsupportive advisors, combating isolation using peer networks, consciously demonstrating abilities to counteract doubt, finding safe spaces for their whole selves, getting out to stay in STEM, remembering their passion for science, and engaging in activism.” The list above includes both physical actions that reshape their academic and social experience, as well as internal psychological mechanisms for support. The actions of physical and logistical navigation are also one of the three dimensions of becoming an engineer noted by Stevens et al. (2008). Thus in the qualitative STEM persistence literature, agency is typically treated as a personal characteristic or as an element of enacted coping and navigational strategies.

Critical theory offers an additional perspective on agency in oppression. For example, bell hooks (1992) writes about the potential power of “theory as liberatory practice.” For individuals experiencing marginalization there is a power in naming the oppression and occupying the theorizing space (Yosso, 2005). Generally the oppressing majoritarian forces occupy the theorizing space, and shape the narrative which forms the basis of interpreting “objective” truth. The acts of theorizing, including criticizing and deconstructing the dominant narrative, are subversive and agentic in themselves, and often connect to and lead to other subversive actions.

The conception of agency in the critical literature goes beyond the coping abilities and navigational strategies noted in the literature, including the ability to name one’s oppression and reinterpret one’s own experience. While we have not found any research directly connecting this form of agency to undergraduate STEM retention, we do note that acts of apparent theorizing have been noted in the qualitative retention literature. Seymour and Hewitt (1997) note the presence of feminist themes in some of their interviews with women in undergraduate STEM programs. Some students contrasted feminist interpretations with dominant explanations of innate biological ability, although in some cases students also feared being labeled a feminist.

This paper investigates the role of critical theorizing on marginal persistence in STEM, through an analysis of agency in the narrative interviews of a woman in the first year of an undergraduate engineering major.

### Mode of Inquiry

The focus of this work will be on the student-constructed narrative, with the understanding that “human beings, individually and socially, lead storied lives”(Connelly & Clandinin, 2003, p. 477). The affordances of taking an in depth narrative inquiry approach towards one individual, include the ability to explore temporal development of the narrative over time, as well as complexity between multiple competing which are reinforced, refuted, or left in tension with one another. These affordances of complexity and development allow us to see processes of critical theorizing as they unfold.

### Data Collection and Selection

We conducted videotaped interviews with four first year engineering students participating in the Women-in-Engineering seminar and living-and-learning program at a large east coast public university. These students were concurrently enrolled in an Introduction to Engineering Design class, required of all engineering majors at the university, which involved a group project to design and construct a robotic hovercraft. The first interview with Rachel (pseudonym) raised themes of agency, which she and the interviewer both wanted to pursue in further interviews. In the spring semester Rachel took an English class which explored pedagogical theories in reading and tutoring experiences. This class material became pivotal for Rachel and for the content of our second and third interviews as it gave her tools for understanding and critiquing her own experiences with engineering pedagogy.

We conceptualize narrative in Rachel’s interviews in multiple ways. Rachel has an overarching narrative of her own life and experience, which is shaping her experience and is being partially shared through these interviews. At the same time, Rachel and the interviewer are jointly constructing a narrative which gives shape and stability to a certain form of her story, and the interviewer is a participant in the social construction of the narrative. Within that narrative process, there are also distinct and overlapping storylines, sub-narratives, or themes. These are identified out of the broader narrative by several markers: thematic repetition of stories or ideas, moments when Rachel’s affect was particularly strong, and her own labelling as a major point or side story. We grouped the interview content by sub-narrative and interview date, to track how initial early formulations of the identified sub-narratives developed and shifted over time, particularly with respect to agency and critical theorizing. Although several narratives have been and continue to be explored (e.g. “I suck at math,” women in STEM), we present the example of the “Where do I fit in STEM” narrative here for purposes of the proposal.

### Results/Analysis - “Where Do I Fit in Engineering?” Narrative

As a student in her first year of the engineering major, Rachel is engaged in a process of defining engineering and herself as an engineer. Particularly in the first semester interview, as we might expect, there is significant weight put on the messages given by course content, textbooks, professors, and peers about what constitutes engineering. The dominant narrative Rachel receives about engineering is that it is monolithic, heavily technical, and uncreative; whereas she extrapolates a broad engineering identity for herself as a nontechnical leader, creative, and communicative.

I do doubt like am I really fit for engineering? Like what am I supposed to do with like all this art and science, like all this English and science stuff and English literature stuff? Like so far I can definitely manage the team, I know what's going on, I can talk to the instructor, I communicate really well. I can build the hovercraft if you tell me what to do. But if you ask me to design the circuit schematic I wouldn't be able to...

1<sup>st</sup> interview

Here and at several points in the first interview, we see her non-technical identity result in a direct questioning of her future in engineering:

So it was just like it has nothing to do with the actual engineering thing, which is I probably *I don't want to say it maybe hopefully I won't change my major because I really don't want to* but I don't think that has-- see the stuff that has to do with the group has nothing to do with the actual building which I don't know how that's supposed to relate to the success of an engineering major completing.

1<sup>st</sup> interview, (emphasis mine)

Thus in the context of her first and only formal engineering instruction, the emphasis on technical knowledge and skills and has led her to worry (“hopefully I won’t change my major”) in ways reminiscent of various passive and deficit narratives of minority experience in STEM.

In the spring term, Rachel encounters the concept of plurality in her English class, which she uses to help map out and sharpen her critique of engineering (and STEM) culture (2<sup>nd</sup> interview). Rachel sees plurality as a feature of a work environment or discipline, when multiple perspectives and skill sets are needed and valued; but she also sees certain individuals such as Steve Jobs as embodying plurality, in that they use multiple perspectives and skill sets. She does not see such role models as having learned plurality from their engineering studies, and theorizes about the social forces that create the STEM curriculum as it stands:

If society doesn't encourage that the departments won't ever encourage that. Because academia is a part of society. And therefore the professors, the professors I think have plurality themselves but they see that. Oh these kids are going to go into technical jobs they're going to work for Boeing or design some cool stuff. They're never going to have to worry about what the product actually does, they're never going to have to worry about ok like who's actually making the metal...But the fact that like the cultural demand or the societal demand on engineering school is producing these really genius people who are just technically brilliant. Doesn't ever-- they don't ever need to change or adapt the department.

2<sup>nd</sup> interview

Here, her professors may have a conception of plurality themselves but not value passing it along to their students because the culturally expected role of engineers is not to worry about complex, interdisciplinary, plural elements of their designs.

This cultural theorizing about her being in what she perceives to be a staunchly non-plural engineering culture does not seem to constrict or depress Rachel. Rather, she uses the theory of

plurality to help give extra meaning and value to her own background and skills and to strengthen her sense of persistence. In this quote we see Rachel talk herself through her frustrations with her technical preparation by reversing the traditional narrative of the importance of technical versus pluralistic content.

So, when I thought about it more and I was like I could always improve my technical skills I could always get better grades in my technical classes because I have to study. On the other hand you can't always develop your sense of cultural plurality or your sense of your transfer studies or your ability to model and connect relationship between your technical skills and your application.

3<sup>rd</sup> interview

In general, when examining Rachel's narrative of how she fits into STEM, we see a shift from the first interview to the second. In the first interview, Rachel is resistant and frustrated with the way engineering is being presented, but her critiques focus more on specific class practices and her struggles cause her to question her engineering trajectory and position. In the second interview she moves to a much more actively critical position, where she connects many of the prior complaints to newfound pedagogical theories, cultural analysis, and impressions of real world value. Her narrative construction is a good example of bell hooks' liberatory theory at work empowering marginalized groups in the process of making meaning of their oppression. What results is agency on several levels, including the power to question one's surroundings and to form a critique of the system, and the enhanced freedom and ability to take agentic actions.

### Significance

While agency is commonly discussed as a personal drive or an element of navigational strategies, our work suggests that the act of critical theorizing within narratives of STEM persistence is an important aspect of student agency which deserves our further attention.

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