”She’s Walking into Like Systems Dynamics. What Is She Doing Here?” A Narrative Analysis of a Latina Engineer

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Introduction

A narrative analysis provides a subjective analytical view of the world from the narrator's reconstruction of events and presents an interpretation and understanding of these events to others. Furthermore, a narrative is jointly constructed by the speaker and listener on how they choose to selectively filter the event [1]. This narrative analysis provides a lens into the experiences of a Latina engineering student at the University of Colorado Boulder but does not represent the interpretations and understandings as generalizable fact. It is an attempt to provide insight into this student's experience.

This paper provides a narrative analysis of a seven-minute interview excerpt from a Latina woman (pseudonym Iliana) who currently practices engineering as a career and who studied mechanical engineering at and graduated from the University of Colorado Boulder's College of Engineering and Applied Science (CEAS). This project analyzed the description of her experience to understand better the mechanisms and circumstances that contributed to her retention and identity development as a Latina woman engineer who is working now as an opto-mechanical engineer in the Pacific Northwest. This student described her experience during her undergraduate engineering studies.

In this analysis, Iliana's response is represented as a counter narrative to the majoritarian narrative about who belongs and can succeed in the CEAS space. This examination represents the ways in which Iliana accessed resources in the Engineering GoldShirt Program counter space, positioned herself in and out of various social spaces, and developed her personal, social and professional identities through dialogical relationships with others in the CEAS.

Background

Iliana was a participant in the Engineering GoldShirt Program, of which the author served as the program director. (The program is described in detail in the next section). Over the five years of Iliana's matriculation at University of Colorado Boulder in the CEAS, the program director/instructor developed a strong relationship with her in her various roles as a student, mentor and employee. Iliana enrolled in the Introduction to Physics and Self-Management and Leadership Principles courses, was a student assistant, was a student mentor to incoming GoldShirt students, and was an active member in the Society of Hispanic Professional Engineers (SHPE) which is supported in the Broadening Opportunity through Leadership and Development (BOLD) Center. The Engineering GoldShirt Program is one of the programs supported by the BOLD Center.

Through developing a relationship with Iliana, she shared of herself and was very engaged in social and political issues and often participated in forms of resistance including protests for

animal rights, civil rights, and LGBTQ rights. In my opinion, my knowledge of her activism and my relationship with her cultivated a unique lens into her experience in studying engineering at University of Colorado Boulder as a Latina, first-generation, low-income woman.

Background on the Engineering GoldShirt Program

The Engineering GoldShirt Program is modeled after the athletic redshirt program, which many college athletic programs use to develop first-year athletes. Redshirt athletes spend their first year participating in physical development activities aimed at improving their athletic performance before fully participating in collegiate sports. These redshirt athletes are rostered on the team but have limited playing time in games as they continue their development to improve as athletes. Since their first year is largely developmental, these athletes are eligible for five years of their athletic scholarships.

Likewise, the Engineering GoldShirt Program scholars participate in academic courses and activities designed to improve their academic performance in mathematics, physics, chemistry, and humanities courses. Participants in the Engineering GoldShirt Program were not directly admitted into the CEAS due to a variety of factors including graduating from an under resourced high school, their test scores, grade point average (GPA), courses taken in high school, etc. Many of them were underrepresented minority (URM), women, first-generation and low-income students who may need additional academic and navigational support as they transition to and through the engineering curriculum. Through an on-campus interview day experience, these students are extended enrollment in the Engineering GoldShirt Program. The program brings these scholars together in a cohort, and these students live and learn together in the residence hall on main campus. The program staff advises students in navigating their college experience, creates and implements community-building activities, plans and implements a summer bridge program, and monitors students' academic performance throughout the semester. Tutoring, mentoring, and socializing opportunities are also key areas that the Engineering GoldShirt Program provides for students. Additionally, students received a participation and academic performance scholarship that increases from year to year [2].

The goals of the Engineering GoldShirt Program include the following:

- To increase student interest in, and knowledge of engineering as an educational and career choice;
- To build a sense of community among Engineering GoldShirt Program students and the larger; CEAS student population;
- To prepare students to perform and succeed in a traditional engineering curriculum
- To attract a more diverse student body to the CEAS;
- To serve as a national model for successful recruitment and retention of underrepresented students.

In striving to meet these programmatic goals, the Engineering GoldShirt Program serves as a safe space for students in the construction of themselves and provides them the opportunity to develop their personal, social, academic and professional identities.

Over the last five years, the second-fall retention percentage averaged 93% for students in the Engineering GoldShirt Program who continue to use the program as a resource. In fact, the second fall retention for students in the fall 2018 cohort was a record-breaking 98%. The sizes of the cohorts over the last five years and their retention over time is represented in the table below:

	N	**2nd Fall Retention**		**3rd Fall Retention**		**4th Fall Retention**		**5th Fall Retention**		**6th Fall Retention**	
		%	N	%	N	%	N	%	N	%	N
2014	28	93%	26	79%	22	64%	19	57%	16	46%	13
2015	30	93%	28	80%	24	80%	24	73%	22		
2016	50	90%	45	70%	35	66%	33				
2017	43	91%	39	84%	36						
2018	42	98%	41								
2019	43										
TOTAL	208		179		117		76		38		13
AVERAGE		93%	36	78%	29	71%	25	65%	19	46%	13

Table 1: Number of students in Engineering GoldShirt Program by cohort with retention over time

As of the fall 2019 semester, 188 students enrolled and participated in the Engineering GoldShirt Program; this total includes first-year students in 2019 (43), and all students who returned from fall 2014 - fall 2018 (43+41+36+33+22+13). Seven students beyond their 6th fall are currently enrolled, but are not represented in these totals.

URM students in the CEAS represent about 18% of the total enrollment; whereas, URM female students only represent 5% of the total CEAS enrollment. Additionally, URM faculty comprise 5.2% of the tenure track faculty and 7.4% of the instructional faculty of the CEAS. Hence, most faculty and students in the CEAS are non-URM.

Research Question

The research question focuses on Iliana's experiences navigating her engineering education as a first-generation, low-income Latina. What do her responses say about her experience studying engineering as a first-generation, low-income, Latina? The following research question is the focus of the analysis: **What does one woman of color's description of her experiences in a university's undergraduate engineering program reveal about the supports, barriers, and challenges for different students in the process of forming engineering identities?**

Iliana was chosen as the participant for this analysis – a purposive sample; she was the right "window" into the phenomenon in which I sought to describe and we had a strong connection. A purposive sample is a non-probability sample that is subjective, judgmental and selective, and is appropriate for analyzing and illuminating the phenomenon of this study. Regarding my interaction with Iliana over the years, Iliana and I developed a very strong mentor-student relationship. As the instructor of three of her courses, I often interacted with Iliana in the

Introduction to Physics and Self-Management and Leadership Principles courses and during office hours outside of class. As her supervisor, I interacted frequently with her when she worked as a student assistant in the BOLD Center. As a mentor for incoming Engineering GoldShirt Program students, Iliana guided first-year GoldShirt students academically and socially as new college students; furthermore, I observed Iliana as a leader and active member of the University of Colorado Boulder chapter of the Society of Hispanic Professional Engineers (SHPE). Iliana often sought out my advice when encountering difficulty in school and her personal life, and the instructor provided Iliana with advice and access to resources as deemed appropriate, not only in her academic and personal life but also in her engineering professional life. The BOLD Center also celebrated her successes. Through this relationship, Iliana shared her lived experiences encountered during her time studying engineering at the University of Colorado Boulder.

Theoretical Framework

Critical Discourse Analysis. This paper draws upon a Critical Discourse Analysis (CDA) lens to make meaning from Iliana's response. Fairclough [3] stated that CDA starts with social issues and problems and seeks to discern the ways in which language relates to social power and domination, works ideologically, and negotiates personal and social identities (p. 230). CDA is committed to progressive social change and is interested in generating emancipatory knowledge. CDA asks questions about how discourse structures when deployed reproduce social dominance and "focuses on the ways discourse structures enact, confirm, legitimate, reproduce, and challenge relations of power abuse (dominance) in society" [4]. Dominant ideological-discursive formations have the capacity to naturalize ideologies. A goal of CDA is to denaturalize these naturalized ideologies by showing "how social structures determine properties of discourse and how discourse in turn determines social structures." [5]; another goal if CDA is to "uncover the ways in which discourse and ideology are intertwined" [6]. These ideologies are then operationalized by the dominant by using oppressive social systems to appear natural and mask the mechanisms of oppression. As Jaworski & Coupland [1] stated, "critical discourse analysts need to see themselves as politically engaged, working alongside disenfranchised social groups" (p. 29).

Figured Worlds. The formation of an engineering identity requires a person to have dynamic experiences, linked to their sense of belonging to the "figured worlds" [7] of engineering, both in colleges and in the practice of the engineering profession. A figured world is "a socially and culturally constructed realm of interpretation in which particular characters and actors are recognized, significance is assigned to certain acts, and particular outcomes are valued over others" [7]. Everyday activities and events form and reform a figured world. Participants in figured worlds coproduce activities, discourses, performances and artifacts and carry out its tasks; these participants "also have styles of interacting within distinguishable perspectives on and orientations toward it" [7].
For many students from communities traditionally underrepresented in the engineering discipline, the figured worlds of CEASs and workplaces are unfamiliar, complicating the development of an engineering identity for these students. Learning and being in these spaces can cause these students to experience isolation and eventually to leave the CEAS.

Many women of color who enter these unfamiliar figured worlds must navigate their way to develop their engineering identities; their navigation may be very different from the majority of students who pursue engineering as a career [8]. Others with whom a person is in social contact influence that person's identity development and a person's positionality in a given figured world.

Dialogical Relationships. Dialogical relationships with others impact the development of personal and engineering identity; an individual represents their own identity through the perspective and lens of others [9]. We "represent ourselves to ourselves from the vantage point and words of others, and these representations are significant to our experience of ourselves" [9][7]. While an individual makes efforts to develop their own identity, others impact that individual's identity development through the perspectives that others express with their words. In the figured worlds of engineering, women of color are often self-authored by others in these figured worlds whose words, thoughts and actions impact their engineering identity development, often in negative ways.

Counter Stories. Solórzano and Yosso [10] described the counter story as a tool for exposing, analyzing, and challenging majoritarian stories of racial privilege and of the dominant discourse on race. They further explain that counter stories are designed to further the struggle for racial reform and are essential to survival and liberation. Strauss and Corbin [11] explained that creating counter stories requires theoretical sensitivity, described as having an awareness of the subtleties of the meaning of data. Researchers who have theoretical sensitivity have a capacity to distinguish pertinent from non-pertinent data.

Positional Identities. Holland et al. [7] described positional identities as "the day-to-day on the ground relations of power, deference and entitlement, social affiliation and distance – with the social-interactional, social-relational structures of the lived world" and "a person's apprehension of her social position in a lived world that is dependent on others present, of her greater or lesser access to spaces, activities and genres and through those genres, authoritative voices or any voice at all" (p. 127-128). Positional identities are associated with the acts that establish and reify relations of hierarchy, distance and affiliation. Relational identities are concerned with behavior as it relates to social relationships with others and with how an individual identifies one's position relative to others. These identities are mediated through ways a person feels comfortable or constrained when interacting with others such as speaking to, commanding or entering the space of another person.

These elements of this theoretical framework will be used to describe and analyze Iliana's experience while studying engineering at the University of Colorado Boulder's CEAS. My fundamental analytical approach employs Critical Discourse Analysis which focuses on illuminating the social issues of power and dominance. The figured worlds theory will characterize the CEAS environment and the ways in which it operates from a student perspective. Student peers frequently engage in dialogue, whether inside or outside of the classroom; these dialogical relationships and interactions shape an individual's identity development. Through these theories and concepts, this analysis not

only illuminates the social issues of dominance and power, but also Iliana's engineering success counter story. Using positional identity theory supports the ways in which Iliana navigating the figured world of the CEAS through her participation in the Engineering GoldShirt Program.

Literature Review

Engineering identity development depends on three dimensions as outlined by Stevens and O'Connor [8] which include accountable disciplinary knowledge (ADK), forming an engineering identity, and navigating through engineering education. The ways in which a person understands and actively identifies themselves in relation to the disciplinary practice impact their engineering identity formation; moreover, the ways in which others within the same social spaces (including friends, families, university representatives and professionals in the field) actively identify the person shape who that person is and becomes. This double-sidedness of engineering identity development is akin conceptually to Holland et al. [7] who identified identity as forming not only by one's own understanding, but also by the ways in which others and institutional practices position a person. Within this double-sided process of identity development, engineering identity develops and stabilizes over time. Different forms of ADK position people differently while forming engineering identity.

In Rodriguez, Cunningham and Jordan's study [12], researchers found that deep understanding and alignment with learning STEM concepts and understanding one's place within the STEM community in the present and the future resulted in students' self-recognition. This self-recognition hinged on the degree in which students identified with the characteristics they saw indicative of being a STEM person. While self-recognition was important, Rodriguez et al. [12] found that peer recognition enabled students to feel intellectually accepted and that they had met academic standards. In the study, their Latina participants found it difficult to persist in STEM without peer recognition; the lack of peer recognition left many of them doubting their abilities and questioning their place within the STEM community.

Carlone and Johnson [13] asserted that identity recognition is an essential component for women of color in STEM fields and that Latinas need to recognize themselves and to be recognized by others in developing their salient STEM identity which supports success in their STEM discipline. The failure of professors to recognize women of color as promising, legitimate science students disrupted these women's science identities; yet these women of color still pursued science related careers and proved that "discrimination is not destiny"[13].

Since Iliana is a Latina engineer, these ideas of peer and self-recognition are relevant to her experience and this analysis. The ways in which Iliana acquired ADK and navigated the CEAS figured world with the support of the Engineering GoldShirt Program figured world justify the need to provide the support of the Engineering GoldShirt Program for additional underserved students from similar backgrounds who encounter similar challenges and barriers. Hopefully, Iliana's counter story will be an inspiration to others, serve as a lens into the inequity some students experience in the hegemonic figured world of CEAS and motivate those in positions of power to change the injustices and the toxic social climate these students encounter.

Problem Statement

CDA begins with a social problem. In this case, the problem is that underrepresented minority (URM) students in the CEAS have unwelcoming experiences that create barriers and difficulty for these students studying engineering and forming their engineering identities. Retention of these students is also a problem; retention rates through degree completion are significantly lower for students who are URM students as compared to their white male peers[14].

These problems are hegemonic in nature, tied to historical practices of exclusion and oppression of many non-white male middle class persons, including people of color, low-income people, and women. Many engineering schools and colleges are comprised of mostly white middle-class male students, and the engineering culture and social space is optimized for white male students to succeed. In optimizing engineering education in this way, non-white, non-middle class, low-income, and women students face isolation, unwelcoming interactions with their professors and peers, and are discouraged from studying engineering. Furthermore, many students leave in silence and hesitate to discuss their experiences. This project targets the silence around URM student experiences in engineering and shares the voice of one URM student describing their engineering experience in CEAS, adding an important narrative to our understanding of this problem.

Description of the Data

To provide context for this analysis, the data gathered and analyzed in this paper was a part of the Learning Ethnography of New Engineers (LENE) research project which sought to understand new engineers' experiences in the early years of their professional engineering careers. One of the objectives of the LENE research project was to understand the ways in which new engineers drew from the learning and knowledge they had developed while studying engineering in the CEAS at the University of Colorado Boulder. The data for this project is a seven-minute transcription of the student's response to the following request during an interview for a research project on learning ethnographies of new engineers: "Tell me about your experience studying engineering as an undergraduate." Instead of talking about her classes, what she learned, or her area of expertise, she talked about the dynamics of her experiences and interactions with her peers and professors. This discourse shifted from focusing on academic learning as it applies to the professional engineering practice to focusing on her struggles with interactions with her peers and professors. This was a surprise and intriguing. After this initial response, I asked that she expound upon comments that she made about how others treat people based upon how they look. This additional response provided a critical perspective on her experience, which is why I chose to study this narrative more intently.

Methods

This project takes a Critical Discourse Analysis (CDA) view using narrative analysis of the ways in which the student tells her story to position and represent herself. This analysis illuminates her agency and the difficulty she experienced navigating an engineering education [4].

I audio recorded a semi-structured interview with Iliana over Google Hangouts on February 28, 2017. Although the interview was conducted using the Google Hangouts video conferencing tool, I only audio recorded the interview and did not video record, so I do not have any video recording data. I transcribed the full interview which lasted 35 minutes and 16 seconds. From this transcription, I extracted the audio data beginning at the 14 minute and 19 second mark to the 21 minute and 11 second mark where Iliana talked about her experiences with studying engineering from a social and interpersonal perspective. I then added conventions to the transcript, indicating pauses, extensions of sounds and syllables, rising and falling shifts, emphasis, volume changes, coughs, and faster paced sentences and phrases. After reviewing the modified transcript with peer researchers and receiving feedback I added line breaks after long pauses to examine the pause patterns throughout the transcript.

To find answers to my research question, I read the transcript multiple times searching for salient topics and themes through a CDA lens to unveil themes around the supports, barriers and challenges that Iliana faced in the process of forming her engineering identity. Through this process, I searched for examples of figured worlds, identity development, dialogical relationships, power and privilege, self-recognition, counter stories and positional identities.

I focused on times that Iliana mentioned experiences of disparity and pushback from her peers and professors in the CEAS figured world. I also sought out times when Iliana mentioned drawing upon resources in the Engineering GoldShirt Program to counter the negative messaging she encountered. I noted concepts that Iliana implied through the ways in which she talked about her experiences and noted the care she took in speaking about the silent yet discriminatory and discouraging practices in the CEAS. As I noted these salient ideas and concepts, I drew a diagram of the salient concepts I discovered, documenting each concept in circles and then connecting related concepts to one another. As I reviewed my diagram of connected concepts, I created a list of emerging themes and concepts that were the most interrelated to others and considered the interrelatedness of the concepts in my analysis.

I audio recorded a feedback session with peer researchers and listened carefully to the peer feedback multiple times and gathered written feedback on the transcript from my peers. Then, I listened to this audio recording and coded for emerging themes that the researchers discovered, confirming and adding to the findings that I'd discovered through my initial analysis. I then reviewed these notes and sketched a diagram linking the emerging themes that were illuminated from the feedback. I used this diagram to organize my thinking around the phenomenon that described in Iliana's narrative.

After examining the transcript, I created another diagram to represent my thoughts about the ways in which Iliana's positioning orientation changed over time. Positioning refers to "how participants locate themselves and others in lived story lines and moral spaces[15]. This diagram (see Figure 1 later in this paper) also represented the interactions between Iliana, professors, and peer engineering students.

From here, I synthesized these ideas to document my findings from this analysis. The features of the discourse that became most salient for my findings included implicature as it relates to

hedging and hesitation and race, gender and white male students, figured worlds, positioning, overcoming doubt, and social spaces and counter stories.

Findings

Through analyzing Iliana's narrative, I categorized concepts and ideas into several findings including implicature; figured worlds and positioning; overcoming doubt; and social spaces and counter stories. Below I provide the insight into these findings with evidence from Iliana's narrative.

Implicature. Implicature is a way of interpreting what a speaker alludes to, with meaning that extends beyond what they are actually saying but is relevant to the context of the conversation. Grice[16] claimed that in most cases, people expect cooperation in conversation and that the utterances people make are true, relevant to the ongoing conversations, and are as clear and concise as possible. When these rules are not followed, listeners need to figure out why; hence, implicatures infer speaker intention arising from a listener's understanding of semantic meaning and conversational principles [17][6]. In the implicature category of my findings, I identified two ways that Iliana drew on implicature in her narrative including "hesitation and hedging" and "race, gender and the white male engineering student".

Hesitation and Hedging. I claim that Iliana shared her thoughts and perspective with me because she felt safe with discussing these sensitive topics and she appreciated the Engineering GoldShirt Program staff's work to support the GoldShirt students. Other people may have refused to answer the questions I asked, but Iliana did not shut down. In lines 6-9, Iliana explained that the Engineering GoldShirt Program supported her and other minorities and alleviated some of the difficulty that she experienced studying engineering at the University of Colorado Boulder:

6 well > I think if it wasn't for the Engineering GoldShirt Program it would have been a lot
7 more difficult.< In the Engineering GoldShirt Program you are surrounded with a lot of
8 people a lot of underrepresented minorities um (1.0) which I think is very
9 important when you are going into such a male dominated field. Um (2.1)

Though she responded to my questions and requests, she was often vague and expresses her discomfort very indirectly, for example, through frequent pauses, coughs, and clearing her throat. In Iliana's narrative, implicature was pervasive; to begin with, there was much hedging, hesitating and deflecting in the ways in which she responded to questions and requests for elaboration. The first indication of hedging and hesitation

occurred early in the narrative where I detected long pauses between phrases between lines 1-6:

1 TE: Tell me about your experience studying engineering as an
undergraduate (TIME: 2 14:19.1)
3 ILIANA: (hhh) Um (3.5)
4 So it was definitely (3.0)
5 it was hard um @ obviously but (2.1)
6 I think it was difficult. (1.3).

In this excerpt, Iliana was considering how to frame what she wanted to say, evidenced by the long pauses between phrases. Furthermore, the aspirations in line 3 and laughter in line 5 further support the claim of her hesitation and nervousness in responding to the questions.

Also, Iliana implied racial references about white males without saying she was referring to white males. Iliana's statement below about minorities and males implies race and an unspoken reference to white males in the engineering field.

8 the Engineering GoldShirt Program you are surrounded
with a lot of people a lot of underrepresented
9 minorities um (1.0) which I think is very important
when you are going into such a male
10 dominated field. Um (2.1)

The reference to "underrepresented minorities" and the "male dominated field" implied race without actually calling out race. Furthermore, she made no reference to women in engineering which supports the implicature she gave about race in the engineering field. This statement also supported the claim that Iliana was taking care to frame how to say things carefully to protect herself from being marginalized or dismissed from the white social space of the university. In lines 18-22, Iliana expressed the following:

18 just how different - or how difficult it could be - or it would
have been if I:: hadn't been
19 surrounded by those people. And I mean um (0.3) I've got to
kinda see how um people
20 can (2.0)…
21 in this country↓ see someone differently↑ because of
um…because of the way they look
22 or because they are:: different (1.4)

Iliana's reference to "how um people can in this country see someone differently" refers to how white people treat people of color differently. This claim is supported by her next comment "because of the way they look", referring to a person's race or ethnicity. Her use of the words "different" and "differently" implied that she referred to people who are non-white and that white people discriminate against non-white people.

Another indication of implicature in Iliana's narrative is her change in the use of pronouns. Early in the narrative, Iliana uses "I" to talk about her experiences and perspectives; later she shifts to "you" to make generalizations. By shifting pronouns, Iliana deflected her personal experiences to a more generalized experience of all women of color in engineering. This shift occurred after I asked Iliana to expound on her statement about how others treat people based on how they look. First she hesitated with coughing and clearing her throat and proceeded to answer the question:

33 TE: You talked about, um you said something about others treating people based on 34 how they look. Can you kind of expound upon that?
35 ILIANA: Umm. ((Cough))
36 …Umm ((Cough))
37 I think um - so some - um I think some professors↑ (2.0)
38 I mean I was always one to go to office↑ hours↑ and I think I saw definitely it play
39 out the most. When you are in class you know the professors are just lecturing but
40 in office↑ hours I got to see it a lot because um (0.9)

In the beginning of this excerpt, Iliana's coughing and clearing her throat communicated her discomfort with the researcher's follow up question; furthermore, her pause on line 37 was an indication that Iliana thought carefully about how to proceed and describe her experience. Additionally, Iliana began to shift in pronouns from "I" to "you", indicating the start generalizing about her experiences to describe the experiences of women of color in engineering.

Race, Gender and White Male Engineering Students. Iliana expressed the discrimination she experienced due to race and gender without referring to race and gender; she also implied white students, particularly white males, were privileged in the classroom and in office hours including the professors. While Iliana still used "I" to refer to herself, she also shifted and used "you", "they", "everybody", "other" and "that person" to refer to white male students. In lines 41-49, Iliana described her interactions with her professors and peer white male students as follows:

41 I would see like <u>other</u> people's answers get answered first or get more <u>attention</u> um
42 and I and I um that's the professor aspect of it, there are other examples I'm sure. And 43 then when I was working in groups I would just see kind of um saw (3.1)
44 um people doubt↑ me↑ so I would say like " Yea↑, I got the answer to this" and they
45 would have to go check↓ it with someone else↓ or something like that. So, I kind of (1.6)

46 you just learn over time well, are they doing that to <u>that person</u>? Is it are they getting
47 the same treatment↑? Um sometimes you just kinda (2.5)
48 sometimes you just walk into a room↓ and you just <u>feel</u> like everyone's like STARING at you

The staring that Iliana referred to in line 49 indicates the surveillance and gazing that often occurs when a person of color walks into a social space and is the only or one of few people of color. White male students who stared made Iliana feel like she did not belong in the classroom. Her reference to "you" is actually referring to her and others who experience this gazing, surveillance and monitoring which oftentimes communicates a sense that the person does not belong, and white male students doubt and do not trust them.

Figured Worlds and Positioning. Iliana's experiences could be represented by her movement in and out of different figured worlds in an attempt to make sense and construct meaning out of the everyday interactions and by understanding how she constructed contextualized cues through her encounters with professors and her white peers. Initially, Iliana was positioned outside of the CEAS figured world, as she was not directly admitted into the CEAS. The Engineering GoldShirt Program was created to support students like Iliana who may need additional support in a number of areas to navigate the CEAS and the university; as Iliana's words in lines 8-12 below illustrate, the Engineering GoldShirt Program is a figured world within the CEAS figured world After interviewing to be a participant in the Engineering GoldShirt Program, Iliana was invited to participate in the Engineering GoldShirt Program and was admitted into the CEAS as an engineering student, therefore, becoming a participant in both figured worlds. Early in Iliana's interview, she spoke about how important the Engineering GoldShirt Program figured world was to her and her growth, development and success:

7 well > I think if it wasn't for the Engineering GoldShirt Program it would have been a lot more
8 difficult.< In the Engineering GoldShirt Program you are surrounded with a lot of people a lot of
9 underrepresented minorities um (1.0) which I think is very important when you are
10 going into such a male dominated field. Um (2.1)
11 and being around that really made me feel - like I belonged ↑ In the first few years of
12 the Engineering GoldShirt Program we were in a lot of classes together so um (1.8)
13 it it was definitely:: - I think it was definitely:: beneficial to me because I got to um
14 (0.5) be with my friends↓ and there were also very good resource↑ just academically
15 emotionally and all other ways um and it wasn't until I↓ think when we started getting

16 into the um getting into the into -- the regular curriculum (1.5)
17 of our majors that I started to realize um (3)
18 just how different - or how difficult it could be - or it would have been if I:: hadn't
19 been surrounded by those people.

This excerpt supports the importance of the GoldShirt figured world to Iliana; she spoke of the comfort and sense of belonging she had when she was surrounded by the people in the Engineering GoldShirt Program, especially the people of color. She further elaborated that being surrounded by people of color in the Engineering GoldShirt Program figured world helped her to counter the effects of the white male dominated culture of the larger CEAS figured world. Iliana also found it beneficial to be in the GoldShirt classes together with other GoldShirt students to whom she referred to as friends who supported her academically, socially and in all other ways. Using the words "in all other ways" communicated how crucial the people in Engineering GoldShirt Program were to Iliana's functioning as a well-adjusted and effective CEAS student.

As Iliana began taking classes in the "regular curriculum" – the courses in which all other engineering students in her major enrolled - she recognized how much more difficult the courses and the experiences would have been if she did not have the support of her GoldShirt peers. These statements support how much Iliana relied on the GoldShirt figured world as she existed and studied in the larger CEAS figured world.

On the other hand, Iliana frequently encountered pushback from her professors during lectures and office hours and from her peers in lectures, office hours and while working in groups with her peers. The excerpt below provides insight into Iliana's experiences of pushback from professors and her white male peers.

37 I think um - so some - um I think some professors↑ (2.0)
38 I mean I was always one to go to office↑ hours↑ and I think I saw definitely it play
39 out the most. When you are in class you know the professors are just lecturing but in
40 office↑ hours I got to see it a lot because um (0.9)
41 I would see like <u>other</u> people's answers get answered first or get more <u>attention</u> um
42 and I and I um that's the professor aspect of it, there are other examples I'm sure.
43 And then when I was working in groups I would just see kind of um saw
44 um people doubt↑ me↑ so I would say like " Yea↑, I got the answer to this" and they
45 would have to go check↓ it with someone else↓ or something like that. So, I kind of (1.6)
46 you just learn over time well, are they doing that to <u>that person</u>? Is it are they getting

47 the same treatment↑? Um sometimes you just kinda (2.5)
48 sometimes you just walk into a room↓ and you just <u>feel</u> like everyone's like STARING at you or really (1.3)
49 I never really (0.8) there is no way of knowing what that's all about..but you just feel↑
50 it sometimes some people are like "oh she's walking into like systems dynamics↑.
51 What is she <u>doing</u> here?" or something like that.

Iliana established her position by proactively initiating efforts to learn and perform well academically; however, her professors and white male peers pushed back by rendering her invisible in office hours and by professors privileging the white male students in office hours by answering their questions first and giving the white male students the most attention.

When working in groups, Iliana was often marginalized by her white male peers when problem solving; she would work through engineering problems and solve the problems correctly, but her peers thought it was necessary to validate her answers with someone else who they considered a legitimate source. The lack of trust and doubt that her peers demonstrated through dialogical relationships in study groups with Iliana influenced her to doubt herself, hindering her identity development as an engineer. Furthermore, Iliana recognized this practice as inequitable by questioning if her peers were checking the answers of "that person" - white male students - and if these other people were getting the same treatment.

When Iliana entered her systems dynamics class, she described how "everyone" – white male students – stared at her when she walked into the classroom. Iliana did not mention if anyone verbalized anything during the initial stare, so the silence combined with the staring was particularly violent toward her. Her peers were offended by her presence. In lines 50-51, Iliana states that some people – white male peers – communicated that she did not belong in systems dynamics. They questioned her ability and why she was in the academic space of the systems dynamics course like they were the experts and gatekeepers for who belonged in systems dynamics, and, therefore, who belonged in engineering. This push toward Iliana by her white male peers positioned Iliana marginally, and challenged her goals of becoming an engineer. To remain in the CEAS figured world, Iliana pushed back against this marginalization, and remained in this toxic and hostile academic space, costing her extra energy that she could have used to focus on her academic work. These and other experiences create racial fatigue and could be the catalysts for these students leaving engineering altogether.

Iliana used resources provided by the Engineering GoldShirt Program and relied on her GoldShirt peers for support, engagement and friendships as encouragement to press forward in her engineering studies. With these and other resources, Iliana self-constructed her identity, removed barriers and moved around obstacles in her way. Through her ongoing dialogical relationships with her peers and professors, which initially may have

been toxic, Iliana continued to negotiate her position within and between the CEAS and GoldShirt figured worlds.

These figured worlds provided Iliana references to position herself in ways to promote her personal, social, academic and engineering identity development over time. Iliana was able to move between figured worlds by engaging in activities that supported her success including going to class, going to office hours, studying with her peers, etc.

Figure 1 provides a conceptual representation of the positioning findings of Iliana's narrative.

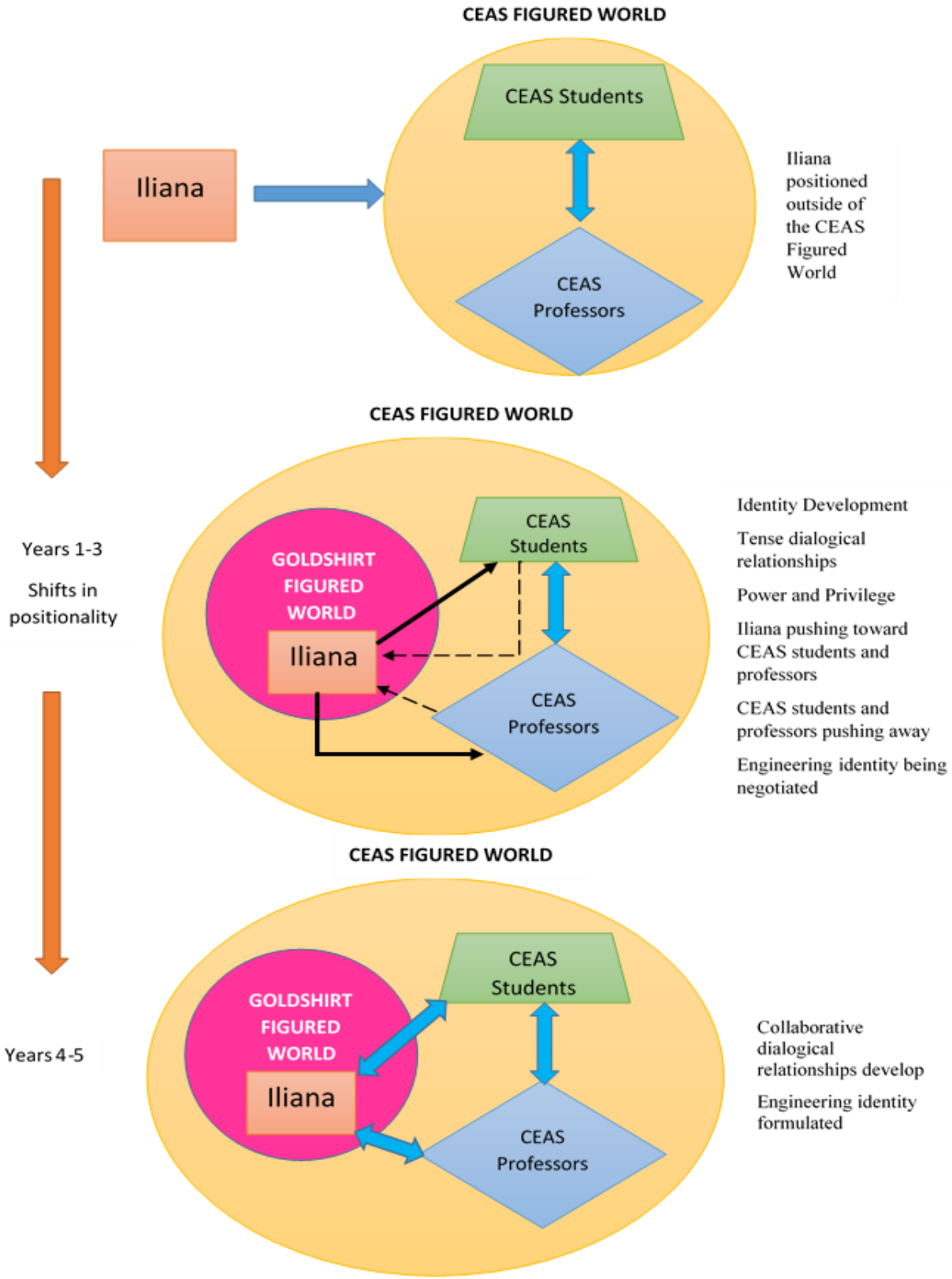

Figure 1: Iliana's Positioning between the CEAS and Engineering GoldShirt Program Figured Worlds

Overcoming Doubt. Expending energy to prove that she belonged costs Iliana racial fatigue and burnout and the possibility of an early exit from an engineering education; utilizing her mental resources to combat the pushback was unfair. Iliana's white male peers constantly doubted her, but her resistance to their push to marginalize her stagnated their force to push her out. Iliana's efforts to remove doubt and develop trust over time was taxing and tiring, and Iliana did not forget about it and felt the need to prove her white male peers wrong for the five years that she studied in the CEAS figured world. Ultimately, Iliana was able to break through the barrier of doubt in part because of the confidence she developed in the Engineering GoldShirt Program figured world.

The excerpt below addresses how Iliana persisted and, over time, developed healthier dialogical relationships with her white male peers; they became friends and developed reciprocal trusting relationships. Her white male peers eventually considered her an expert and referred others to her during their senior design project.

52 … It's just kind of something you I just feel but I think over time you start developing
53 friendships and um people that trust↑ you and I think I've had a few instances where
54 it's like my senior design project and people were like "Oh Iliana↑ can do that. She's the
55 best↑ at it. We trust↑ her" or something and they value you and trust you. Um I think
56 these things are - were more important. You can definitely see – (2.1)
57 it doesn't↑ start out that way↓. Those people at some point did doubt my
58 abilities…and yeah… I think in some ways it was like..all↑ five years. (21:11)

Social Spaces and Counter Stories. A master or majoritarian story is an "account that justifies the world as it is" [18]. Solórzano and Yosso [10] described counter stories as tools for exposing, analyzing, and challenging majoritarian stories of racial privilege and to further the struggle for racial reform essential to survival and liberation. Counter stories paint pictures that may be unfamiliar to what many consider normal and represent sites of resistance to master narratives [19] while providing "competing perceptions of social life [20]. Telling counter stories emphasizes aspects of the silenced world and provides space for the emersion of a more complex depiction of reality [19].

Iliana's narrative is a powerful counter story that challenged the normalcy of who belonged and who could succeed in the CEAS figured world. Iliana moved in and out of many social spaces during her undergraduate engineering studies. Many of the spaces she mentioned in her narrative were in classrooms, during office hours and in group work for various courses. In line 42, she mentioned toxic environments with the professor, and she eluded to the fact that other toxic environments exist:

42 um that's the professor aspect of it, there are other examples I'm sure.

…

Though she was not specific about the examples, she stated that other toxic social spaces existed.

Her peers stared at her and questioned why she was walking into systems dynamics. These experiences created discomfort and generated a sense of not belonging for Iliana, yet she was still expected to perform at the same level as those students who were not challenged about enrolling in systems dynamics and walking into the classroom. Though she encountered these hostile environments, Iliana spoke back to what others said her reality was. The excerpt from lines 23 -32 shows Iliana recognizing and reflecting back on her strengths, her love of learning, and the friends and other resources she accessed to reach her goals:

23 and um it is definitely something that made me doubt↑ where I was at times↑ and I
24 always took it back to um and always thought back to (1.4)…
25 just how much I had already accomplished and how all the people that were there …(1.9)
26 just all the resources↑ that I was given. Um there was a lot of people to support me.
27 They were definitely:: (2.8)
28 a key aspect of it all. Um ((Cough))
29 I think one thing is that that what definitely kept me going was that I actually liked↑
30 what I was doing. I knew a lot of my friends um who were like "I don't like learning↑
31 this learning this stuff" but I really just:: once I got an answer it was just…so
32 rewarding↑. I actually liked↑ it.. I think it was definitely very important.

To counter the doubt of her peers, Iliana speaks to her reflection on what she had already accomplished and that a key aspect to her accomplishments were the supportive people, her friends in the Engineering GoldShirt Program figured world, who served as resources and who supported her. In this sense, Iliana represented the Engineering GoldShirt Program figured world as a safe space for her to draw upon her friends and resources and to position herself in the CEAS figured world.

Another way that Iliana spoke back to others who doubted her was through her love of learning engineering concepts and theories. She stated how her white male peers would often say that they did not like learning "this stuff" (engineering), but she did, and she felt fulfilled and rewarded when she found solutions. Iliana's love of learning was crucial to her persistence in engineering and her engineering identity development. Her love of learning helped her to cope with the issues she encountered and navigate within the CEAS figured world. Iliana's counter narrative witnessed to the fact that Latinas belong

in engineering and are fully capable of succeeding in engineering. Her persistence served as a resistance to the majoritarian narrative that the engineering discipline is only for white male students.

Conclusion

This narrative analysis of Iliana, a Latina engineer, provided a lens into the world of what it means to be a woman of color who studies engineering at predominantly white institutions (PWI's) and who had the support of a program like the Engineering GoldShirt Program. I wrote this analysis for this purpose and not to generalize broadly the experience of every woman of color or of every Latina who studies engineering. I hope that this analysis will prompt everyone in the engineering education space to detoxify engineering education spaces so that all students, especially those from marginalized backgrounds, can learn and develop in healthy learning environments. This analysis sought to answer the following research question:

What does one woman of color's description of her experiences in a university's undergraduate engineering program reveal about the supports, barriers, and challenges for different students in the process of forming engineering identities?

Based on this analysis, the following answers emerged about the barriers, challenges and supports that this woman of color experienced during her engineering identity formation:

- **Barriers:** Professors and peers treated Iliana as invisible, not belonging by ignoring her, doubting her and not trusting her. Her white male peers questioned her existence in the CEAS figured world, her ability and her presence, creating toxic social spaces in the engineering education learning space.

- **Challenges**: Iliana experienced racial fatigue, burnout, and felt the need to prove herself as a legitimate engineering student. Since her white male peers doubted her, she began to doubt herself. She had to reestablish constantly her confidence and repositioned herself to succeed.

- **Supports:** The "GoldShirt Figured World" provided resources to support Iliana's success; within the GoldShirt figured world included friends and peers who supported Iliana through burnout and fatigue. They supported her through the times when others doubted Iliana's ability and supported her as she emerged as an expert. Iliana also reflecting on her own successes and expertise that helped her when negotiating relationships and developing her engineering identity. She became an expert, and her white male peers who initially doubted her abilities began to ask her for assistance and saw her as an expert.

Initially, the Engineering GoldShirt Program was established to support students in their first year and then transition them more fully into the larger CEAS population. Over the years, it has become apparent that many GoldShirt students need more than one year of support. Many students rely on the Engineering GoldShirt Program for healthy peer relationships, access to resources and encouragement when dealing with barriers and challenges.

So, why should students abandon the Engineering GoldShirt Program and community to assimilate to the large CEAS student population? I do not think they should disconnect from the Engineering GoldShirt Program since Iliana may not have persisted to graduation without the Engineering GoldShirt Program in place to support her.

URM students, especially female students, encounter toxic, racial academic climates in engineering. To best support them, faculty, staff and peer students, need to find ways to eliminate toxicity in the CEAS and to support their success. Making a commitment to being aware of occurrences that marginalize and isolate URM students is a big first step. One big takeaway from this case study is to challenge faculty, staff and peer engineering students to pay attention and raise their awareness about what happens in academic spaces including the classroom, office hours and team projects. They need to be prepared to interrupt negative experiences that URM students encounter and resolve issues that occur.

The few URM students that enrolled in many CEASs are often isolated, especially in their engineering departments. Oftentimes, they are the only URM student in their classes at PWIs. Other non-URM students may not know how to interact with URM students if they have never encountered or interacted with a URM student. Addressing and overcoming stereotypes and biases could reduce the level of toxicity in the academic learning environment.

Additionally, CEASs and university campuses need to provide communities of support and resources throughout their studies as URM students become more isolated in their departments beyond years 1 and 2. More URM faculty could serve as role models and interrupt the marginalization that many URM students experience. Moving forward, to understand better and resolve these issues, researchers should continue to conduct qualitative research studies aimed at examining experiences of URM students in engineering colleges. Topics of consideration include microaggressions, isolation, racial stress, racial battle fatigue, fragile and robust resilience and virtuous and vicious cycles. The combination of these phenomena could explain the complex academic environments that URM students often need to navigate.

APPENDIX A

Conventions (Shiffrin)

Colon	:	extension of sound/syllable. More colons mean prolonged stretch.
Period	.	A stopping fall in tone (not end of a sentence)
Dash	-	Halting, abrupt cutoff. Multiple dashes mean stammering quality.
Up/down arrows	↑↓	Rising and falling shifts
Underlining	_	Emphasis
Capital Letters	A	Spoken much louder
Parentheses	( )	Amount of pause
	(hhh)	Aspirations
Double Parentheses	(())	Coughs, clearning throat, sniffs, snorts, whispers, etc.
Greater/Less Than	><	Delivered at a faster pace
At sign	@	Laughter
Three dots	…	Ellipsis, parts omitted in quotations from other sources

APPENDIX B

Recently, I received an unsolicited email from Iliana. While I have not conducted a narrative analysis on her statements, reading it speaks to the importance of the Engineering GoldShirt Program her relationships with her GoldShirt peers, her love of learning and her new trajectory of wanting to impact the world more in her engineering career. Iliana's email is below:

> "How are you doing? I've been thinking about the BOLD Center and the Engineering GoldShirt Program lately. I was in Colorado a few weeks ago and ran into Jo, Ja, and Yo at a bar in Denver. It was completely random, but it was so nice to see them! It made me think about everyone else in the cohort, and you of course. I hope you are doing well.
>
> I'm still working at ZEPAN. I started off as an engineer doing technical support, and then got promoted to the Product Manager of the software. It's been nice and I've learned a lot, but I have been thinking about going back to school. I thought for a while that I would be happy as long as I was learning, but I think I need to do something that I am more passionate about and really want to make a bigger impact. I'm thinking of doing Environmental Engineering, and possibly doing a PhD. I started looking at programs here in Washington, and I'm thinking about Oregon as well. I'm really interested in doing research, and maybe even becoming a professor. It's a pretty big change for me at this point, but something just feels right about it. Anyways, I just wanted to drop you a line and see how you are doing. If you have any advice for me, I would love to hear it" (Iliana, personal communication, June 16, 2019).

Not only is Iliana thriving in her career after being promoted as Product Manager, she looks to make a bigger impact. Learning was not enough for her; she is looking to be more passionate in her work and pursue environmental engineering. One has to be extraordinary and has to have access to extra supports to overcome the white hegemonic system that rule the CEAS figured world. Iliana's narrative and follow up email demonstrate just how extraordinary she is. Iliana's sending this unsolicited email implies that she still considers herself in the GoldShirt figured world and continues to draw on the resources that helped her to be a successful engineer. I hope that the Engineering GoldShirt Program has this and other positive effects on other students who are in the GoldShirt figured world, both as undergraduates and alumni.

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