Understanding the Intersection of First-Generation Degree Seeking Women, Engineering, and Public Universities

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The California State University system (CSU) is the largest university system in the nation. The CSU system is comprised of 23 regional campuses and as of fall 2018 has an enrollment of 481,210 students. While the state comprises about 12% of the US population, it only produces about 10% of the engineering degrees awarded [1]. Not only is the state lagging behind on engineering degree production; but also on the rate at which women earn engineering degrees. The CSU system grants engineering degrees to women at a rate of 16.8%, trailing the national average of 20%. To compound a risk of non-completion, the CSU also educates a student population that is approximately one-third first generation degree seeking [2]. Even with targeted efforts, the gap in attainment by women and achievement of first generation students have fallen behind. While quantitative data can point to the differences in achievement, a more complete picture of how first generation degree seeking women experience undergraduate engineering programs at CSU campuses must be formed. To understand this intersection of identities a two phase qualitative study was conducted- women who has received their degree and those who are still currently enrolled. The qualitative nature of the study and critical lens strives to fill in the why behind the numbers.

Statement of the Problem

The majority of California's college going population will come from a group more diverse than other generations. This group will be comprised in a larger percent of students who come from a historically underserved population [3]. To keep up with demands for engineering professionals, the system must adjust to a changing student body. Many studies have pointed to factors that decrease persistence in engineering such as: working while attending school [4], lower rates of preparation for college [5] and part-time enrollment [6]. Many of these factors describe a typical CSU student. To compound the problem in STEM majors, there is a persistent "weed out by curriculum structure purposely constructed to lower the number of STEM majors-- in part, because our existing science and engineering programs cannot handle the number of students who state an interest in science" [7 p. 9]. This prescriptive curriculum can make it more difficult to enter throughout their career or to repeat courses without delaying graduation [8].

While quantitative studies have been completed to point to factors that decrease success in engineering curriculum, little work has been done to understand the factors that underlie the issues. The question of degree attainment is compounded by the intersection of multiple identities a student carries- gender, ethnicity and first generation degree seeking status. Current efforts are falling short to increase enrollment of women and marginalized groups. The current body of literature that examines socio-cultural factors that impact persistence of women in the field point to disengagement of the field [9], a lack of work life balance [10] and unwelcoming environment for learning [11]. Most of the literature that examines first generation degree seeking students focuses on lack of social capital of mismatch in expectations of the university and student [12].

Purpose

Current efforts to engage women in the field have proven unsuccessful and have not increased the understanding of the underlying socio-cultural factors that impact persistence and entrance. First generation women in engineering programs are a critical group in the degree production of

the CSU system. Previous studies have not looked at the intersection of gender, first generation status, the field of engineering and the public university. The interaction of curricular, social, structure, economic and familial factors cannot be separated from each other. To understand the experience of first generation women in public universities a qualitative methodology and critical lens must be used. In beginning to understand this group, the CSU and other public university systems can move towards providing better services to engage these women in the field of engineering.

Significance

The need for engineers is growing so rapidly that it is anticipated to "grow at a rate three times greater than other fields" in the upcoming years [13p. 6]. This need for engineers is coupled with a plummeting rate of entrance into engineering programs. According to the NCES, in 2011-2012 4.5% of bachelors' degrees awarded in the United States were granted in engineering [6]. There is a vacuum of engineering talent produced by American institutions and the rate of new enrollment is declining. To bridge this gap, a broader range of students must be reached. Current strategic goals for ASEE indicate the by 2020 the undergraduate community of engineers should be comprised of at least 25% women; 12% Hispanic, and 8% African American students [14].

By discipline, only 13.2% of the degrees in mechanical engineering are granted to women, while 49.7% of the environmental engineering degrees are awarded to women. If these two percentages are averaged, the rate of attainment would appear far better at 31%, (still a far cry from even between the genders); however, mechanical engineering is the most populous degree. In 2014 25,436 degrees were awarded in mechanical engineering, while only 1,124 degrees were conferred in environmental engineering. Even the 21% of degree awarded in civil engineering can do little to bolster the percentage rate of attainment when half as many, 11,900 degree were awarded in civil engineering [15]. While women have made some progress it is not enough to bridge the gap in attainment.

The CSU provides the diverse population needed to keep up with engineering degree production. However, the rate of engineering degree attainment is plagued by a variety of structural, and cultural factors that prohibit students from entering and matriculating with an engineering degree. Current efforts to improve graduation rates have exacerbated the achievement gap for first generation degree seeking students, who trail behind their peers by 13% [16] Within their engineering courses, first generation students are .15 to .2 GPA points behind their non-first generation counter parts in core classes with some achievement gaps as high as 1.02. The same gaps are seen with women in engineering courses [2]. When the CSU and the UC systems are compared there is a greater mismatch in degree production. The CSU offers its 480,000 students 73 accredited engineering programs housed at 16 of its regional campuses compared to 54 degree programs offered to the 222,000 undergraduate UC students; but produced less than half the degrees awarded to UC students. The UC are producing 2.5 times more degrees with half of the number of students enrolled [1].

Research Question

The multiple phases of the research and critical lens used in the analysis provided a more complete understanding of the research question. The characteristics of the participants of the study allowed for the research question to be examined to understand the intersection of the first generation status and gender. The hope is that understanding how women experience

undergraduate engineering programs at public state universities, the broadest impact on participation can be made. The goal of this project is to look at various stages of a woman's educational journey in engineering to examine the following:

> How does the intersectionality of gender and first generation college status impact a woman's experience in undergraduate engineering programs?

Review of the literature

Women and URM in engineering

Although 35% of the workforce will need to be STEM educated, only 2% of US high school graduates will complete a STEM degree [17]. Many studies have found that women are one third less likely to enter the field of engineering [17, 8, 18,19]. This could be due to the fact that women have a lower math self-concept than their male counterparts [17]. Mau found that women could have a math self-efficacy of up to 20% lower than their male counter parts [20]. When discussing the lack of entrance by women into the field specifically, the problem seems to be rooted in incongruity. Rosenthal, et al, show that women did not choose fields in which they feel that they won't belong and would opt for a more conducive environment for their learning [21]. This mismatch could be due to signaling threat [22], lack of social good to the work [23] or lower science self- efficacy [19].

When the lens of underrepresented groups are taken into consideration with gender the formation of identify as an engineering is stunted and makes it more difficult for students to progress through their degree program [24]. Hughes and Hurtado found that those students who had been singled out for their gender or experienced "negative cross-racial interactions" where more likely to develop a strong identity as an engineer [24]. Trenor et al found that an increased sense of belonging among a diverse group of female engineering students was the largest predictor of persistence [25]. This sense of belonging was reinforced most strongly by positive interactions with faculty, perceived social support and perceptions of the field of engineering [25].

First Generation Degree Seeking Students

California is projected to have a statewide workforce shortage of 1 million degrees by the year 2030 [16]. To keep up with the demand for highly skilled workers the base of degree seeking individuals must be broadened. First generation degree seeking college students can be defined in two different ways- those who will be the first in their family to earn a college degree (one of their parents may have some college) and those who are the first in their family to attend college. Ishitani found that first generation students are 1.3 times more likely to leave their institutions than their non-first generation peers [26]. In fact they are 8.5 times more likely to leave in their second year of college than their counterparts. This is a critical juncture for engineering students in their curriculum as well. To compound the dropout rate, student enrolled at a private university were 35% less likely to leave than their public school peers [26].

May and Chubin point to disproportionate resources at home and in the K-12 systems that limits progression in STEM of first generation students. This leads to a lack of social capital as students progress [27]. Even as students progress in their studies, the increase in their self-efficacy does not result in increased GPA [28].

The multiple identities and mismatch of cultural expectations between first generation and non-first generation college students completes the picture of their experience. The working class context that many first generation students hail from often means that they work while in college and have more outside responsibilities limiting their time on campus [29]. The independence valued by the university system is at odds with the interdependence many first generation students value [29]. Wentworth and Peterson found that first generation students are less likely to strive for higher income, but are instead concerned about making connections [30]. This sentiment is echoed by Stephens et al who found that first generation students are more likely to indicate helping their family as a reason to attend college, where as non-first generation students what to explore possibilities. Orbe cautions that the family relationship is not as cut and dry as may be thought for first generation college women [31]. He found that women are often caught between two worlds- the educated and non-educated and are likely to not discuss their college experience around non-college educated family. The push pull first generation women, in particular, feel is compounded by the factors of the discipline and university type.

The CSU

The current public university system in California was established by the 1960 Donahue Higher Education Act, better known as California's Master Plan for Higher Education [1]. The structure of the system is in three tiers- the state-wide University of California (UC), the regionally orientated California State University (CSU), and the locally focused Community Colleges (CC) [7]. Each of these systems has a different enrollment criterion: the UC system being the most selective and the CC system open to all students who are at least 18 years old or a high school graduate. As established in the Master Plan, the goal of the UC system is to award bachelor's degrees to the top 12.5% of high school graduates and the CSU has a target of 33.3% of the population [7].

As largest university system in the nation, the CSU system is comprised of 23 regional campuses throughout California, 16 of which have at least one ABET accredited undergraduate engineering program [32]. 21 of the 23 campuses are designated as HSI and 14 are AANAPISI. System-wide one-third of students are first generation degree seeking students and 55% of students will be the first in their family to receive a college degree. Approximately 54% of students receive Pell grants and half are people of color [2]. The diversity of the student body puts a variety of compounding factors on the persistence of students.

In 2018 the CSU graduated 7,395 students with undergraduate engineering degrees [32]. Less than 17% of these degrees were granted to women. [2] The rate of attainment by women in engineering at the CSU campuses is plagued by various factors. Bowman points to competition between the systems (UC and CSU) for students, reliance on the community college path for students to transfer, and limited degrees offered locally, which can all limit participation by women at the CSU [1]. This is coupled with initial lack of college readiness, and the weed-out curriculum to stretch already limited resources, which results in a system that falls short of degree attainment rates and exacerbates the inequities that plague the field.

In response to low graduation rates, the CSU embarked on the graduation initiative 2025 (GI2025). The initiative follows Graduation Initiative 2015 (GI2015) and seeks to increase 4 year graduation rates of first time freshmen to 40% and 6 year graduation rates to 70%. GI 2025 also seeks to decrease the gap in achievement exacerbated by GI 2015 between marginalized groups and their counterparts [2]. At the end of the previous initiatives, the graduation rates had

increased but the gap in achievement between first generation and non-first generation students was 13% [16]. In further study, the rate of attrition of students is most largely impacted by first generation degree seeking status, followed by Pell status and URM. [3]

Conceptual Framework

Feminist Poststructuralism

Using the Feminist Poststructuralism constructs to make a complete illustration of the literature and give indications of the success of women in undergraduate engineering programs preserved the issues that are uniquely feminine. Weedon explained that by not looking at all four constructs of Feminist Poststructuralism, the particular meaning to women and invisible factors of the experience were lost. These constructs include Power, Language and Discourse, Common Sense, and Subjectivity and each gives a dimension to the experiences of marginalized groups in the field [33].

These dimensions of identity and existence in a field look at the sociocultural aspects of experience that cannot be quantified on a survey, SAT score, or grade. Instead, the frame gives a window into the lived experience of women. These tenets also give way to a fluid sense of identity and make it more difficult for women to persist and enter the field of engineering. Davies and Gannon define Feminist Poststructuralism as a third kind of Feminist theory after radical and liberal feminism [34]. They continue "feminist post-structuralism troubles the binary categories male and female, making visible the constitutive force of linguistic practices, and dismantling their apparent inevitability" [34 p. 321]. Without a frame that looks to gender to inform practice and reality, there is no way to uncover the dichotomy that exists within the field of engineering.

Dual Identity

The subjectivity espoused by Feminist Poststructuralism is reflected in the ideas of a dual identity. People, in particular women in STEM, are subjected to factors outside of the "norm." The notion of double consciousness is applied to women in mathematics; however the frame can be applied to women as an engineer or as an engineer and scholar. Logel, et al, claim that the first generation degree seeking women, in this case, the marginalized group, are seen as something else before a student or scholar. That is to say that, female math students are thought of as a female first and then a student. This layer of identity is a double edged sword. The expectations for the women are set in mathematics and if a woman does not perform in that matter, they are seen as a threat. This is the root of stereotype threat. If the frame is thought of generally, women are seen as out of the norm in the field of engineering. This also can be extended in the negative belief that engineers who do not do well in basic calculus are seen as not cut out for the field. These assumptions of the image of an engineer push people from the field of study [35].

Methodology

The project was designed to gather a pseudo longitudinal picture of the experience of first generation degree seeking women in undergraduate engineering programs at California State Universities. There were two stages involved in the data collection- interviews with those women who had already received their degree (professionals) and those still enrolled in the last one-quarter of their program (students). All the women attended the same two universities and

received engineering degrees. The interviews were conducted following a standard protocol that evolved as the interviews progressed. Each interview lasted one and a half to two and a half hours.

The interview protocol was designed to further probe major themes in the literature especially those that have emerged from the work of Hewitt and Seymour [12], Cech et al. [10, 11] and to shed understanding on those findings from quantitative work done by Ishitani [26], May and Chubin [27], French et al. [4], and Wang et al. [9] to mention a few. The questions were intended to address how the women dealt the pressures and barriers of the field, their interactions with their families and peers and persistence in the field including future aspirations.

Participant Selection

The women interviewed were self-selected for the project. Of the larger set of 22 women who participated in the project, 10 of them self-identified as first generation college students. A brief summary is shown in table 1.

Identifier	Phase	University	Discipline	Transfer status	Ethnicity
RU*	After Degree	1	Civil	Transfer	Hispanic
JT*	After Degree	2	Civil	Transfer	Hispanic
MB*	After Degree	1	Civil	Transfer	Hispanic
JA*	After Degree	1	Civil	Freshman	Hispanic
AE*	Undergrad	1	Industrial Eng.	Freshman	African American
RY*	Undergrad	1	Mechanical	Transfer	White
PM*	Undergrad	2	Civil	Transfer	Hispanic
SR*	Undergrad	2	Civil	Freshman	Hispanic
JG*	Undergrad	2	Civil	Transfer	Hispanic
ER*	Undergrad	1	Mechanical	Freshman	Hispanic

Procedures

The interviews all following the sample initial protocol. The protocol was designed to probe themes largely seen through the body of literature including: social engagement, socio-cultural issues, self-efficacy and gender. As the interviews proceeded the protocol evolved to respond to the participant. In particular, those women who identified as first generation degree seeking talked much more about their families and were asked about the challenges they perceived as a first generation college student and the incongruity between work and gender roles they faced.

Data Analysis Methods

The interviews were recorded and transcribed. These transcripts were coded in multiple round of coding following Saldana [36] and Bazeley [37]. Open coding began as soon as the interviews began and continued with a constant comparative. As the interviews progressed, a second round

of protocol coding began using codes that emerged from the data. The data was subject to four rounds of formal coding to ensure reliability as well as to make certain that overgeneralization was not occurring. After a formal list of codes were developed, a final round of protocol coding was performed on each transcript.

Trustworthiness

The coding was subjected to member checking as well as inter-coder reliability. The codes were member checked by one of the participants and many of the interviews were coding by another researcher and compared to the primary researcher. All of the recordings and transcripts are stored in a secure location and identifying factors of the universities, employers and participants are removed to preserve anonymity. The findings were made available to each participant.

Findings

Both universities that the women attend/attended in the study serve approximately fifty percent first generation students. The women in the study were no exception, 45% of the women are first-generation degree seeking students. The intersection of gender, major and first generation status had a major impact on the experience of these women. The first generation degree seeking women transferred to the degree granting university at a rate of 60% compared to the whole set of women who transferred at a rate of 31%. In addition, the average time to degree of the first generation degree seeking women was five and two thirds years- nearly a year longer than their non-first generation degree seeking counterparts. Three major findings emerged from the data.

Theme 1: Isolation and independence

The women who were first-generation status in the study experienced some of the same themes that the whole group did; however, these themes were at a more amplified level. The level of isolation that the women feel was not limited to their experience at school, it extended to their home life too. There was no one for the women to turn to at home and the competition and cold environment they faced at school intensified the loneliness. This isolation was balanced with a sense of independence. The women took pride in the fact that they had completed, or will complete, their degree on their own.

Separation from home

The trade-off the entire group of women in the study felt was not exactly what the first generation women experience. The women were caught in a type of no man's land. On one hand, they were entering a field that required a complete surrender of your life. On the other hand, the women had no safe spot to fall back on. The family often relied on the woman, or pushed her harder in the field to succeed to change her future dynamic. They were not only isolated at school, but also in their families. The mismatch of their values and upbringing and the demands of and chilly nature of the field left the women stranded.

I definitely think that I am having a different experience. I am one of the only first generation student in my class it's just really different. The way we live, our family structure, is very different. I commute a long way to school too. The commute has made it hard too because I spend at least two hours to go to school. So it's different. Where we live is different, how we live is different, our relationships with our parent and our families are different. I am not saying that I have it harder but for instance. My mom doesn't speak English. Well she can understand

English but she speaks very little English. For them (not first generation students) I feel like they can ask their parents for help. Even if their parents don't know they figure out a way to help them. Like if they ever need math help so my mom couldn't help me they didn't even know to push me. So if I needed help I didn't have it. Luckily I am pretty smart by myself. (JG, student)

"I did it on my own"

The lack of parent collegiate background forced the women to take control of their future. The first generation degree seekers had a sense of pride and defiance of expectations when they reflected the notion that they completed their undergraduate degree on their own.

I had done it on my own. No one helps me, no one did this for me, I don't owe anyone anything. It's not like old my friends and my… If it weren't for my cousin's uncle were it to work for so-and-so… Who gave me this letter of recommendation… Or this tutor… It was just fell on me. I found my friends. I went to ASCE on my own. It's not like anyone held my hand and helped me a lot. I was never that kind of person who was a do it on your own type of person. No. It just happened that way. I would've embraced help. It just wasn't there for me. It just wasn't near me. It wasn't an option. I never felt defeated though. (RU, professional)

This sentiment was reflected by AB, who commented on the fresh start nature of entering the field. She notes that there was no knowledge to even form a social network.

I was going into my brand-new field with my family and friends to know anything about that of my close friends knew nothing about. So I started over and basically created my own network. I haven't even really thought of it that way but I really did. I had to start all over. (AB, professional)

Theme 2: The importance of public agency

For first-generation women, a huge driving factor in their persistence in the field was the promise of a public agency. The public agency provided security, an opportunity to serve their community with their degree and a place where the women were valued for their difference from the rest of the field. Unlike the whole sample of women, first generation women are explicit in their desire to work for a public agency. Whereas the whole sample of women indicated doing something with their degree was important, first-generation women looked to the public agency in particular to invest in their community and be validated in the process.

Investing in a community

More than just working for a public agency, the women saw their degrees as a way to serve their community and provide basic services, like protection from disasters or providing a roof over someone's head.

I want to seek a job when I get out with good benefits. Everyone asks me why I don't want to travel and join the private sector. They pay for your transportation when interested in it. I was thinking of my dad. He's instilled in me and I kind of absorbed [the thought] "you get what you need and you be happy with it". I think the city job gives me more than I need. The benefits are great, and your security is good. Not to be one of us people that doesn't do anything it's paid by it's nice to have security. It's appealing to me. I've also always been involved in the community. I used to work at the YMCA when I was in high school. I like that I like to be part of my

community…I like the togetherness and really working in the community and so I think I was a little part of it be cool. If my job was serving the community it would be perfect. (PM, student)

Security of Outcome

The security of outcome provided by the public agency allowed them to build a future for themselves. In contrast with the whole sample, who indicated to some extent that they would rather travel and make money in a private company, the first generation women had no basis of security in their family to fall back upon. As VG stated about professors, "When you have security… it allows you freedom to experiment." Not only did a public sector job provide the women with a secure outcome, it also provided them with a predictable schedule and regulated demands. These factors made it easier for the women to balance home and work.

So not necessarily have a major community but the global community. I like a public agency because it was real laid-back and was better for me. But I like private too because I like to be busy. Sometimes I get too busy and I get stressed out. I first wanted public agency so I could settle down and have a family and kids and be a mom and stuff like that. But [the private firm I work for] now, they have moms there too. [The moms] work from home or they just do their thing. So one reason the public versus private maybe not needed. I don't know well enough though. My dad is in construction. I know the way his private company works. He has to travel all over the place for work. One year he is at a job here, then he spends a half a year as far as San Diego at a job. [He was gone a lot but] it was okay because my mom was home. It wouldn't work [for me as a woman] if I had to work and have a family. I want to just help. (SR, student)

Not only did the public sector provided the women with stable work environments, it allowed them to grow as professionals. The security that the women were lacking in their previous home life was developed in the public agency. This security allowed the women to grow as professionals and try new areas of their career.

I don't know. I love what I do. I love that my current job [at a public agency] allows me to try new things. For example if I wanted to try writing a grant, I can. They let me do things that I want to try. It opens up all this new knowledge and… I'm not stuck in a cubicle doing an alignment analysis or anything like that I love where I work. I love the people. I love that they allow me to explore and learn new things. But… Through my master's in public and ministration process I found that I'm really interested in… I don't know… Like city council. Maybe Board of Supervisors. Maybe that's the way I'm to go. Politics. I feel like that's the only way that you can actually make a difference. As engineers, we build stuff and design staff and health stuff like that but we still answer to someone else. If you like the bigger difference comes in making the decision that are implemented in your city. I'm super family-oriented so I don't see myself leaving this area because my entire family is here. My mom, my sisters, everyone's here. I do see myself possibly going into local politics. Maybe after I have a family. I think after I have a family I might change my fields. I would think if you were to asked me I was thinking of changing fields but I like what I do so… I'm not looking for something else. But it could possibly be the way it goes. (JA, professional)

Theme 3: Projective comparative norming

For first-generation women, comparative norming was a crushing burden. Comparative norming is the comparison of a person's achievement or value to an arbitrary benchmark. The practice

leads to a fluid unable to define sense of accomplishment and identity. Projective comparative norming is the assignment of social capital to their peers and using that as a basis for comparison.Not only were the women in an environment that did not follow consistent guidelines for being and for success, they were approaching the field at a disadvantage. This feeling of not having the assets that their peer group had built a wall up for the women and isolated them further from the field.

Social Capital

The women were starting their academic career a step behind their peers who had parents who were college graduates. The social mobility that the women perceived their peers to have was another layer of difference.

A lot of the smart kids, I have noticed, don't have to shout when they have the right answer or the wrong answer. Unless I am really confident, I have to shout. Those students don't work either. They are wealthy. Their parents pay for them for everything. One of the kids is wealthy and then got a full ride to school too so he has extra money saved up. (JG, student)

This step up did not end when the students graduated. The first-generation degree-seeking women felt that it would be more of a challenge for them to find a job when they left college.

I have to find a job for myself when I get out. They [the smart students in the class] don't work and have everything handed to them. Their parents help them with school work and can get them a job when they get out. They are all engineers anyways. (PM, student)

The insulation of norming

We are trying to excel together; we're not trying to one up each other. We're anyone upping our lives so we're not trying to one up each other. (SR, student)

The uniqueness the women felt as first-generation students removed them from some of the comparative norming that the whole group experienced. That is not to say that the subgroup of women did not find themselves comparing their performance to some arbitrary and hidden measure of success, quite the opposite. The women felt that because there was no basis for comparison in their pre-collegiate life, that they were more insulated from the burden of competition and academic grades.

You really have to take your time and do well in your courses rather than push yourself through. I think the challenge is that you are always trying too hard. I'm really hard on myself so I had to be forgiving myself in a case. I had to go and tell myself to slow down and be forgiving myself and be on my own clock. I don't think people really put so much pressure you, you put on yourself. My parents never went to college. There was always me pushing myself with [grades]. (AE, student)

Discussion

A looming shortage of one million college degrees has forced the CSU system into action to fill the need. While the Graduation Initiative 2025 has turned attention to graduation rates, and time to degree previous initiatives have not addressed the bridge the achievement gap of marginalized learners. Without engaging a more diverse student body, the CSU cannot expect to alleviate the shortfall. With over 75 million dollars in investment from the state for GI 2025 and continuing

funding for HSI and AANAPISI status, the CSU must make strategic use of its investment [38]. The women in this study, much like the CSU student body, had a numbers of factors that make them high risk to not complete a degree- they are first generation degree seeking, attend a public university, work while attending school, and are women in the field of engineering- but succeed in their pursuit. In understanding their experiences to a greater level, the CSU can build strategic supports to meet the needs of these students and increase not only their graduation rates, but also the number of students entering the field of engineering.

The findings support and deepen the literature and give next steps to consider. Overwhelmingly the women felt a sense of isolation. While this is common in women in engineering, the added layer of the lack of support at home and limited social capital the women brought with them to the university left them stranded. The women tried to balance demands of a prescriptive and rigorous curriculum with family demands and work. The university and field's climate of independence and self-reliance [29] further reinforced the sense of isolation the women negotiated. To counteract this the university could provide a space for women to feel supported socially as well as academically. While advising and tutoring are the bulk of the funds from GI 2025, they should be paired with an inclusive supportive social environment. These practices would increase a sense of belonging and counteract the comparative norming the women experience and increase their retention [25]

The culture of independence does not end at the university- but a predominate culture of disengagement in the field [9]. This social disengagement leads to a larger wedge between the home and academic life of these women. To work against the culture of social disengagement, the university should work to connect students with mentors in the university and in the field especially with those who work at a public agency. This high impact practice is already a goal of GI 2025 [38] but catering to students and connecting them with public agencies serves a number of purposes. First, it allows women to contribute to their community [29] and allows them to be appreciated for the perspective they bring to the table [24]. This would bring attention to the social capital they possess and allows them to build in the future. Public agency also allows the women to maintain a home life balance that they may not be able to find in a public agency.

We must broaden participation in engineering to evolve as a field. First generation degree seeking women not only fill the state's need for a highly skilled work force, but also provide a path to financial security for their families. Just saying we should engage these learners is not enough, we need to provide targeted support- curricular, academically and socially.

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