Community: Voices from a Small Cohort

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Abstract

PEEPS (Program for Engineering Excellence for Partner Schools) NSF S-STEM scholarship was designed to support students from low socioeconomic, first generation and/or underrepresented groups in obtaining an undergraduate engineering degree at California Polytechnic State University in San Luis Obispo (Cal Poly). Students receive up to $10,000/year to aid in paying tuition, housing or other school expenses. The program was modeled after the Posse Foundation cohort model. At our university, student cohorts are formed by scheduling them into engineering major and support courses together. Students also engaged in monthly advising sessions, tutoring services, engineering success courses, group socials and engineering outreach activities.

There is a total of 13 students in two cohorts. These students are currently in their 3rd and 4th year at the university. Last spring, we interviewed each student individually to see if we could learn from their experiences. The interviews were transcribed and analyzed for themes. There is much in the interviews, but we discuss the findings using Yosso's Community Cultural Wealth model. We discuss the role of financial support, navigating a predominantly white institution (navigational capital), a smoother transition into university life (Social Capital), peers as social support (Social Capital), and aspiring to make a social impact (Resistance Capital).

It is our hope that this paper gives voice to these students who have brought with them assets as they maneuver this predominately white institution. It is our hope the insights from this paper will help all of us develop support structures that will transform our institutions and others like it.

Introduction

It has been four years since the first cohort of students in the S-STEM PEEPS grant started at Cal Poly. There are only 13 of them, but we wanted to capture their individual experiences and see if we could find common themes. We know that using such a small sample size can mean that generalizations are difficult, but we also know that these individuals have an important story to tell.

This paper explores their stories that were collected through an interview process. We analyzed the transcripts for themes and have used Yosso's Community Cultural Wealth model to describe the findings.

Theoretical Foundations

The underrepresentation of students of color, women, first-generation and low-income students in engineering education is often framed in a way that positions the students lacking the skills needed to navigate these institutions. Tara Yosso [1] created the Community Cultural Wealth Model to challenge the notions of what are considered traditionally valuable skills and strengths in the education system. Yosso emphasizes the different strengths that students of color bring to their education that is often unacknowledged by the dominant culture which are conceptualized as aspirational, navigational, social, linguistic, familial and resistant capital.

This paper will particularly emphasize on navigational, social and resistant capital as it relates to the students in the PEEPS program. Yosso argues that through the lived experiences of marginalization, communities of color build resilience and strength in creating ways to navigate an oppressive system, which she calls navigational capital. In spite of institutionalized barriers and added stressors, communities of Color are able to use their social networks and connections to access both instrumental resources and emotional support systems traditionally barred from these communities. Yosso deemed this strength as social capital. According to Yosso, students with close ties to marginalized communities of color, are likely to leverage their education to do work that gives back to their community or attempts to dismantle oppressive structures (resistant capital).

The Posse Foundation [2] has developed a robust cohort model that follows students from high school to college. The evidence [3,4] around these models is convincing. Some of the best practices in cohort models include a small group usually between six to twelve individuals, collocated in some way, engagement in activities that connect the individual, and a support system that enables the formation of the cohort. We used these guiding principles to design the experience for the two cohorts

Overview of the PEEPS Program

The PEEPS (Program for Engineering Excellence for Partner Schools) scholarship program designed to provide a holistic approach to support students with financial need, first generation, or from an underrepresented group. We designed a host of interventions appropriate for our university. The Posse Foundation cohort model was a starting point for the design. The design included two cohorts, one of 6 students and the other of 7 students who received a up to $10,000 per year scholarship. We also worked with an academic support team that provided advising, class enrollment priority and tutoring services. The results from an institutional point of view are not significantly better and may even be worse than the university as a whole. Two students have left the university (84% retention) that is approximately the retention of all engineering students. We have written several other papers on the recruitment strategies, outcomes, and institutional change, [5,6,7], but in this paper, we hope to give a place where the student's voices can be heard directly.

Methodology

Semi-structured interviews were conducted by an external evaluator. The interviewer started with basic questions about the student’s experiences with the cohort, advising resources, their major, and upbringing. On occasion, the interviewer asked follow-up questions for deeper understanding. The interviews lasted approximately forty-five minutes and were recorded. The audio recordings were transcribed using an online service (rev.com) and were also reviewed for accuracy. Researchers then used the online platform Dedoose (dedoose.com) and an iterative inductive coding technique to identify themes and patterns. This type of qualitative narrative analysis is common in the social sciences to analyze narratives [8,9,10,11]. We used an iterative method that we recognize is subjective in nature, but we feel the resulting themes are robust and supported by the known experiences of the individuals. Even though this is a small sample size,

the insights are important and we feel strongly these student's experience point to institutional patterns [12].

Interviewees

Of the 13 participants, 12 were engineering majors and one participant switched their major to another STEM defined major, construction management, during the program. Of the 13 students, 10 identified as from an underrepresented minority group and three identify as female.

Interviewee	Gender	Race	Major
Interviewee #1 & 3	Male	Hispanic/Latinx	Environmental Engineering
Interviewee #2	Male	Asian	Mechanical Engineering
Interviewee #4	Male	Hispanic/Latinx	Construction Management
Interviewee #5	Female	Hispanic/Latinx	Manufacturing Engineering
Interviewee #6 & 11	Female	Hispanic/Latinx	Mechanical Engineering
Interviewee #7 & 9	Male	Hispanic/Latinx	Civil Engineering
Interviewee #8 & 13	Male	Hispanic/Latinx	Mechanical Engineering
Interviewee #10	Male	White	Civil Engineering
Interviewee #12	Male	Asian	Civil Engineering

Results - Outcomes

Most students mentioned the financial and social aspects of this cohort program as significant contributions to their academic success. Other excerpts emphasize a pattern amongst students aspiring to make a social impact with their extracurricular activities and later on in their engineering careers.

The Role of Financial Support

Many students mentioned that financial reward of the scholarship as a significant factor in their decision to choose this institution. Many students also mentioned that easing the financial burden for their family was a contributing factor in choosing their school as well.

"I had applied to like 20 scholarships, easy, just 'cause like I knew going to college was going to be tough for my parents and I wanted to get out in front of it and I was just applying, denied, applying, denied, and I think I saw the PEEPs one and I was like man, like, another scholarship, I'm probably not gonna get it, but you know what, let's apply… I accepted as soon as I got that and I just felt great 'cause it seemed like a good fit so that's kinda why I chose here" (interviewee #4)

"It's really nice. It helped a ton, and made school a lot easier on my parents." (interviewee #10)

"Yeah, I applied for it .... I just kind of like, did it. I was still not sure where I wanted to go to school. Then once, I did and I got it, I was like,"Wow!" like between the two schools, like Cal Poly and the other school, it kind of help me to choose Cal Poly. I think just since being in it, it's been a really nice support system. Financial help is great and it's really helpful; it's kind of a weight off my shoulders and my parent's shoulders" (interviewee #11)

"I mean in the end what it would've really come down to was, more so financial aid. You know, what was I gonna get? Because surely enough, my parents-- Let alone my dad. Because my dad's the only one that works at home. My mom's a stay at home mom. He would be the only one that would be contributing to paying for my education, and for me, it was just of most importance that ... I could lower the amount as much as possible that my dad had to pay for me. Because again, he paid for my high school, and that for me meant a lot. Seeing how hard he worked throughout my whole life, it's like "This is the least I could do to pay it back." (interviewee #13)

Navigating a Predominantly White Institution (navigational capital)

Although most students had prior knowledge that this university was a predominantly White institution, they did not anticipate exactly how much this would affect their comfortability and sense of belonging on campus. According to Yosso, students of Color have experience navigating systems that were created with the dominant, White culture in mind. Through these experiences, students learn to adapt, survive and thrive in these environments despite the systemic barriers and/or added stress to students of Color. The interviews highlight students using their navigational capital in this new environment as they familiarized themselves with engineering academia and shared knowledge and resources with their peers. As most of the participants in this scholarship program are students of Color, the lack of diversity at this institution became a salient factor upon arriving. However, students were able to find a sense of comfort, familiarity, and connection with their PEEPs peers, that seemed to lessen the effects of culture shock.

"I come from Santa Maria so its bunch of Hispanic people a bunch of Pilipino people. And I come here and they're like, "Yeah you're never going to see this again." Okay alright I'll take your word for it. I don't know if I actually believe you but then I sat at my first class, this was a bunch of mechanical engineers, and it was all just white guys

Everywhere. It was just kinda weird. I don't know if I felt intimidated or if it felt daunting but it was just a surprise you know." (interviewee #3)

A Mexican-American student reflects on the culture shock of growing up in a largely Latinx neighborhood and entering a predominantly White institution:

"I didn't necessarily feel comfortable. I just felt kind of weird. And out of place... [The PEEPS students] met before school started, and it definitely helped seeing people of different backgrounds, minority groups. I was like 'This is great'... I'm really glad not only because I got the scholarship, but that I'm able to be a part of this wonderful group of people. And the different experience they have, or backgrounds that they have, it's nice because I have my own story. They have their own"

Yeah, so that was my first welcoming group and little cohort that I felt-- Yeah I guess I never really thought about it, but honestly that's a main reason why I feel more comfortable coming here. And then SHPE [Society or Hispanic Professional Engineers], because of the whole familia environment. And I definitely feel like they're my family away from home, as well as PEEPS." (Interviewee #1)

Although this student struggled with the culture shock of predominantly White area, they were able to find a sense of belonging in the connections they created with other students of Color in their cohort.

"I did quite a bit of research before coming here. I mean, I'm sure thinking back on it, there were some things, some minute things that I didn't really perceive at the time as being something that would affect me. Definitely one of those things was in the Bay Area, you never really have to second-guess the importance of diversity, or second-guess why you would celebrate being a minority. Or the fact that you are one. You don't really feel like a minority when you're in the Bay Area, at least when you look like me because much of our population is Asian. But coming here .... I never felt like the other, for sure. But it was very much a realization of one day, "Oh, I'm the only one who looks like me." And that's not necessarily a bad thing, but it is something that I have to accept … so that was an interesting realization"

"Yeah, kind of growing up and then coming to Cal Poly, I had some issues with cultural identity because my ethnicity and my race don't really match up. My parents are from Peru, so South America, Latin America. They grew up there, and Peru has a very strong Asian Peruvian culture. But then coming to America, I'm only perceived as Asian and Chinese, which are all of my features. So it was very different. It was seen as something special when I was in the Bay Area. "Oh wow, a Chinese girl who can fluently speak Spanish." And there here it was more like, "Uh, what? That's a thing that exists? People like you are seen as normal in your country?" And I'm like, "Yeah, pretty much." It's not that weird." (interviewee #6)

A smoother transition into University life (Social Capital)

Despite the persistent "weed out" culture amongst engineering students and faculty at this institution, students in the PEEPS programs were able to provide not only social support but also academic support to one another. Yosso refers to social capital as the networks and connections with other people in a community that serves to support traditionally marginalized students. Connecting with students who have similar experiences or cultural backgrounds can help students not only navigate this environment but also serve as an emotional support.

> *"Also, just kind of having the support system just coming in here and having a group of people I didn't know but I got to know a lot faster than I would have if I was in a class and I had to like learn some. It takes a couple weeks and stuff. It's always really nice. Just coming to college, it's so much different than high school. It's so much bigger than high school. I think being able to walk around and see a familiar face is just really nice sometimes." (interview 1)*

> *"'It's just ... [textbooks are] so expensive. And a lot of other PEEPS that are ahead of me, I usually buy books from them and it's a good way to save money and still keep it in the family" (interview 1)*

> *"'Especially I would say the first year it helped make the transition a lot easier, especially with registration last year and just having people in my classes and by now I've been able to meet more people, but those initial hurdles were a lot easier to overcome and so now even like just having a class or two that I might have with people, like even right now I think might have one or two of my classes with another PEEP. One of those classes we had homework that was pretty confusing, so just being besides that person, I didn't know anyone else in the class but it was a really big class or at the very least, I didn't have anyone else's contact information" (interview 1)*

Although students in this program were given access to tutoring and advising resources, this student remarks on the significance of peer mentoring. The social network in the cohort served as both an academic and emotional support resource for this student. A peer in their class was able to help with more specific class concerns and was more approachable to the student.

> *"The outside, like MEP [Multicultural Engineering Program], resources like [Advisors] I typically don't see them. It's either I'm busy, I have to schedule a meeting ... I don't know. I find it harder to talk to them about real-life issues that- I don't know. It's just a little bit harder to be able to talk to them about stuff that's going on in a particular class because I know that if I talk to a PEEP, they'll understand. They'll understand the issue and they'll either try to help me right away, or if they Can say, "Hey, you want to borrow my notes? Do you want to be able to see how I've done the work in the past?" (interview 8)*

When asked if the student is competitive with other students in the cohort, the student responded:

> *"Everyone learns [at] different paces and everyone is at different levels of their degree, so for the most part I wouldn't say I feel the need to compete. If we have a class together cool, that's awesome, but if we don't, hey I still might need your help, and they will help so it's never like a race or anything. No, I don't see it like that at all."*

Despite the competitive nature of engineering academia, this group has created a system of peer support. This student expresses that having another PEEP in class with them is more of a relief rather than someone to compare themselves to.

Peers as social support (Social Capital)

Many students in the cohort referred to the close emotional bond that they formed with one another. Students spent more time together in classes and social events during the first years of their education, but still seem to have a strong friendship despite having branched off into their respective majors and concentrations.

> *"'It was really awkward at first. Just a different set of advisors introducing us you know, 'You guys are going to be best friends' or whatever. They probably didn't say that. That's kinda what we were all thinking just six people being put together and being expected to work together and to be honest I got really lucky with them. They were all really nice people ... We all bonded really quickly. There were times when we would sit down at the dining halls and we would just be working on stuff together… But definitely they've helped me come a long way academically and there were some good friendships being formed." (interview 3)*

> *"'Well, first of all, it's like-minded people. That's one thing I noticed. They're all very motivated, they're all focused, they're all just good people, it's easy to be around them, it's easy to go to them for help, I don't feel uncomfortable saying like, 'Hey, I don't get this, can you help me out?' It's just [be]cause we have that relationship if you need anything, let us know. We're there for you. So that's really cool how we were able to get that going quick, too. I felt like we clicked really well." (interview 4)*

> *"Nothing really changes between us. After a while. Even though we're spread apart and we don't see each other as often, nothing really changes. Our interactions don't change between each other" (Interview 2)*

Aspiring to make a social impact (Resistance Capital)

According to Yosso, marginalized communities have a historical involvement with social justice issues. Growing up in a community specifically affected by institutional oppression may expose people to inequities and connect them to social justice causes through engaging with friends, family or other community members. With this background, Yosso argues that students of Color from marginalized communities are much more likely to use their education to further the social

good. These excerpts highlight how students' past experiences have affected their intrinsic desire to do work that gives back to the community or works to break down oppressive structures.

> *Not so much with engineering outside, but I have done some outreach with SHPE. For example, we did solar panel installation for a low income family. I think the most rewarding event was doing Code Academy at [a local] elementary school. They needed some students who spoke Spanish so I volunteered because it worked with me and they were in second grade, they were learning how to code. Well, just basics. Learning the terms. So that was really fun, and doing that in Spanish, it was tough…*
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> *With one of my clubs I'm trying to get more involved with [a local elementary school] because they have a very large native Spanish speaking population. So I think it would be great to help them out, because I think the English learning program is really intense, but I think it's also important that they don't forget Spanish and learn how to read and how to write it fluently, and just not forget it…*
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> *Yeah, I think I definitely tend to do more extra-curriculars than I should just because that's something that I really enjoy doing ... I think my volunteer, my outreach is kind of like my self-care. Just surrounding myself with other people and younger kids is something I really enjoy" (interviewee #5)*
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> *"'I would tell them you can do it, too. If I can do it, you can do. There's nothing that makes me special for doing engineering like anyone else doesn't have it. I've done a couple volunteer things with children and I remember, one time I was doing it and there was a group of three boys and a girl and the girl was just kind of there. They had to shoot a ball or something like that and the girl would just go get the ball and bring it back. The boys were fine with it and I asked [the girl], 'Oh, what do you think we should do?' [Trying to make] her voice heard more because I feel like, even from a younger age, the boys are the builders and the makers and the girls are doing other things...*
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> *I really enjoy doing volunteering. Especially, with girls to get them to know that you can do it. That you can do whatever you want to do, even if it's not Engineering." (interview 11)*
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> *It's just very eye opening into what engineering really is, what's out there, and what I could be potentially studying in college… there's different reasons why I chose it. One was because I would be able to contribute to society and have a positive impact, that was really my main one. And then of course there's the monetary compensation and having good pay. And job security. I believe that … the world's always gonna need an engineer. (interview 13)*
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> *"We get together, we go out to the community, we do different things, community service, different kind[s of] building together with the youth and just a good time together.*
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> *Yeah, I like to do things and go out, I've been on missionary trips. I'm part of Engineers Without Borders right now and we were able to travel to Nicaragua and help a small*

community build a water distribution system. It's still in the works but I'm definitely involved. I just like to do things with that, involve myself with things like that. (interview 4)

'Well I mean just early on one of the things that I saw growing up that kinda just inspired me to do this type of work was just, I have vivid memories of me going to school, like elementary school, and counting the homeless people that I saw… So just early on that kinda sparked that question, that why, that's not fair, that's not right." (Interview 4)

"I guess for me it sort of just made sense to come here. It was more so like, well I mean when I was deciding what I wanted to do, it was sort of like well what have I done and then what's out there? And how does that match up? And one of the things I looked in to with civil [engineering] was it's a very broad sort of engineering thing, it covers the structures, transportation, water, geo tech, and construction. So you have some leeway with that. So it sorta just made sense, well to me what drives me? Okay, poverty, homelessness, what's one of the ways I can address that? Building houses in a sense shelters or understanding what kind of projects can be done. So I sort of just kinda like swayed into civil [engineering]because it was broad and it had aspects I was looking for. And then I had the PEEP scholarship so I was like this is a sign" (interview 4)

Well, it's really easy to say, "Oh, the next generation can handle it," but I think they've been saying that for- for too long. For too long now. And, I don't know, I think it's up to us in the engineering field to think about those sustainable practices. But I think it's also really important for us to educate and teach the younger kids what they can do now, and I think it's mostly education. That's always what comes back to me when I'm in those classes. Like we wouldn't have to be dealing with these problems if, from early on, we learned not to do that, or to start composting when we were five years old, saving water, turning off the lights" (interview 5)

"So many people hold it as a low skill if you're working in the field. It's like people don't understand that it's something ... It's not a common skill that everyone has.

So many people can't handle the labor. So many people there that are in the agricultural field don't want to be there, but they do it just to support their family. You learn so much from people who work there.

If you're young, they don't want you to be in the fields because they're there because it's sometimes their last resort. But they see us younger people who are from here, it's like, "Take advantage of this schooling system." Sometimes I feel like I liked the work environment there because of the people, rather than the work. But also- It just opens my eye ... Opens my eyes to see that you can learn so much from people who aren't teachers-who don't really have a degree to say ... It's sometimes what you learn from there is even more valuable than a math problem. You could take even more ... It could take you farther sometimes.

Yeah, so that's something ... I don't want to let go of that.

That's maybe why I want to stay within that environment. Probably something in agricultural. Well, my plan is get a Bachelor's in Civil [Engineering]. Hopefully either structural or water, and then probably major ... Master in agricultural engineering." (interview 7)

Conclusion

The results of this scholarship program would not be considered "successful" in the traditional academic sense. Four students in the cohort are currently on academic probation and two students have left. The students in this intervention did not have a significantly better outcome in their academic progress than their peers outside of the program. When comparing retention rates and the number of students on academic probation the sample of students from the PEEPS program actually had higher attrition and academic probation as compared to underrepresented engineering students outside of the program.

The authors' intentions with this paper are not to put blame on the students for this outcome. The results of this intervention do not emphasize a deficit on the students' part, but rather the institution itself. Providing comprehensive academic resources to students in a small learning community is not sufficient enough to ensure all of the students will graduate. It is our belief, that to affect the retention of historically underrepresented students, the institution must commit to a large-scale, multi-faceted transformation.

However, the interviews illuminate what the students themselves brought to this program. They fostered an influential and cohesive support system amongst one another. Although the academic services and scholarship were very useful for the students, there is a level of support that a university program cannot provide. Students were able to give each other individualized support in the classroom by being a familiar face in a large class, studying together and sharing class materials. Students also shared other resources and professional development opportunities through involvement in co-curricular projects and clubs. Within this group, strong friendships and emotional support systems were formed. The cohort created a space to be with and relate to other students of Color navigating a predominantly White institution. According to the cultural wealth model, these students utilized their social capital to make the most of and support one another during the course of their education.

Limitations and Future Directions

Although the intentions of this paper are to illuminate the students' voices and themes emerging from their reflections on participating in this program, it is crucial to acknowledge the identities of the authors. Of the four authors three identify as White women and one identifies as an Asian woman. Although a majority of the authors have experiences of underrepresentation in engineering based on their gender, the authors may lack the perspective of being marginalized based on race. It is necessary to acknowledge that the analysis and conclusions in this paper were made from the limited perspectives of these authors and cannot speak for the lived experiences of these students.

The effects of this program emphasize that in order to achieve equity in the engineering workforce, it is going to take much more than a small scale intervention with a handful of students. The results of this intervention emphasize that interrupting the exclusionary culture of STEM and Engineering, in particular, cannot be solved entirely by providing social, advising and financial resources to students vulnerable to attrition. Institutions must look at the larger picture of years of historical underrepresentation and make a commitment to reviewing policies and structures in place that serve to exclude students of Color, women, low-income or first-generation students. On an individual level, it is crucial to acknowledge how the traditionally hegemonic culture of engineering (White, male, middle/upper class) has affected the attitudes, biases, and behaviors of the people working with students in these throughout the course of their education. Although the cohort model serves as an effective social support for traditionally marginalized students in this study, high impact practices (HIPS) such as these serve to put a band-aid on a leaky pipeline, ignoring the underlying systemic barriers in place.

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