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Creating Community Among Women of Color in STEM at the University of San Diego

Alejandro Picasso
University of San Diego, apicasso@sandiego.edu

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Abstract

Women of color (WOC) are underrepresented in STEM (science, technology, engineering, and mathematics) and many feel disconnected from their fields of study. At the University of San Diego (USD), a predominately White institution, WOC in STEM are particularly underrepresented. Thus, I explored how USD might create a community that could enhance the belonging, retention, and the future success of WOC in STEM. I sought to learn if the USD environment welcomed and allowed WOC to feel they belonged. Findings indicated USD and the STEM departments provide these students with a welcoming environment. However, the lack of representation of WOC faculty and staff at USD has created a disconnect between these women and the faculty. Several students questioned whether they belong. A more diverse faculty, as well as support in connecting WOC with each other would help these students feel they belong in STEM at USD.

Keywords: belonging, women of color, STEM, community

Creating Community Among Women of Color in STEM at the University of San Diego

As a first-generation person of color working and attending universities for the past 7 years, I know the importance of community. I was the first in my family to leave home and go to a new city to attend school. From a large community to no community. The process was and remains a challenging and nonlinear journey. There were many times when I wanted to pack up and go home. What kept me in school was the support I received from classmates and professors that I eventually found. As a Latinx student studying biology as an undergrad, I acknowledged that most of the people in my major did not look like me. Many of them were White. This really did not bother me as I grew up in a very White neighborhood, but I fully became aware of my identity. I did not feel a connection to my peers and was filled with feelings of inadequacy and that I did not belong.

Thankfully, I was able to connect with peers that looked like me and it led me to the STEM center. A peer-to-peer tutoring center where they understood my feelings. The community I became a part of helped me persist, even when I felt like STEM was not for me. These experiences and values have led me to the connection between persistence and having a community. This understanding also made me aware that I was not the only one with this lack of community.

I witnessed many female minorities struggle in the sciences and then leave the field altogether. It is difficult to see someone struggle but it is even harder to see them move on from the challenges they faced in a particular major and not fully embrace their potential. This is very important to me because I also see the need for more scientists in our society. It would be an understatement to say that the world has many problems that science cannot solve yet, i.e., terminal illnesses, autoimmune disorders, climate change, habitat/species conservation, etc.

WOC are underrepresented in the STEM fields and continue to be an untapped source of scientific talent and potential. Their talent is needed in the United States to continue scientific innovation and to remain competitive in the global economy. Additionally, efforts to eliminate the gender pay gap should include supporting women in fields that lead to higher salaries.

I studied how WOC in STEM feel about their significance at USD and if they belong. More specifically, I studied if the students have a community that will support them through the coursework and will keep them motivated to finish their STEM degrees. WOC are a disproportionate minority in the STEM fields, so it can be difficult to find people that can relate to their backgrounds and struggles. This lack of connection can lead to women changing majors and leaving the STEM fields. For the purpose of this study, I reflected on the notion of belonging and community in STEM, and I define it this way: When WOC feeling accepted in their home departments by their professors, when WOC feel that they are at the same academic level as their White and privileged peers and when WOC feel that they can rely on their peers to support them in their academics.

This definition of belonging guided my research and provided me with a framework to establish an understanding of whether WOC at USD feel like they are a part of the community. The participants of this study had the opportunity to define community for themselves and further inform my research. I gained an understanding of what kind of community WOC need from USD to fully support them in their goals and to keep them in the STEM fields. With this, I assessed where USD is successful and where USD needs to improve. With this in mind, my research question was: How can USD create a community that will enhance retention, persistence, and the future success of WOC in STEM? Furthermore, how can I help meet the needs of these students and enact change in the traditional STEM culture?

Background and Literature Review

WOC have currently and historically been an underrepresented group in the STEM fields (Alfred et al., 2019). The STEM fields have typically been dominated by White males (Myers et al., 2019). Women have made strides in recent years, but the increase has mostly been for White women (Frederick et al., 2020). This lack of representation shows the lack of an intersectional approach to the issue and this limitation has been discussed in the literature (Gaston Gayles et al., 2018). However, only a fraction of the literature uses theoretical frameworks that address multiple dimensions of identity and intersectionality. The lack of WOC in the STEM fields requires an intersectional lens because WOC face additional challenges that steer them away from the sciences.

WOC face many gender inequalities in the education system but they still have great interest in the science and engineering fields when compared to White women (Riegle- Crumb & King, 2010). However, institutions are not responding to this interest and are thus failing to retain this talent pool (Malcom et al., 2011). Targeted efforts and programs aimed at WOC would be beneficial in recruiting and retaining WOC (Myers et al., 2019). Addressing the barriers for WOC is necessary to better foster environments that will keep WOC in fields that are historically seen as the "White men" profession with instances of sexism and racism (Frederick et al., 2020; Johnson et al., 2017; Myers et al., 2019).

Myers found that many students acknowledge the gap between the genders and many of the students were not able to see any recourse other than the women and people of color working hard and earning their spot in their programs. Another important issue is that some people of color have expressed that they felt stereotyped at times and felt that professors/administrators did

not believe they would do well based on their identities (Johnson et al., 2017; Myers et al., 2019; Wang et al., 2018).

This gender bias was not limited to faculty members. Some students had to deal with the expectations of being WOC in STEM and balancing their schooling with cultural expectations (Reyes, 2011). It is also important to note that many WOC have to battle being stereotyped into gender roles by family members (Frederick et al., 2020). Many of these women feel that studying and working in the sciences is a way for them to combat gender norms. However, Frederick found that a majority of the Latinx women interviewed felt that gender inequities are problems that were overcome by previous generations of female scientists. But WOC still find it difficult to feel welcomed in the STEM fields and to develop an identity in those departments that is not tied to their gender and ethnicity.

Success in the STEM fields is largely influenced by mentor-protege relationships where students are guided in their education and toward their careers (Malcom et al., 2011). So, increasing WOC in postsecondary faculty positions in STEM programs would be beneficial in the efforts of recruiting and retaining WOC. Creating environments where the faculty is relatable to the minority students allows them to feel comfortable and mitigate the effects of stereotypes and isolation (Johnston et al., 2021). Another important factor in creating welcoming environments is having diverse student populations (Espinosa, 2011). For example, the importance of peer support has been seen to affect the success of female minority students (Johnston et al., 2021; Walker, 2006). It has been seen as a powerful resource that has helped students overcome race-related issues in their STEM programs, particularly for African American students (Borum & Walker, 2012). Students also find same-race peer support as an important factor in success in the classroom and support them in obtaining their degrees (Borum

& Walker, 2012; Watkins & Mensah, 2019). The importance of same-race peers was even more imperative when people of color are attending PWIs (Watkins & Mensah, 2019).

Creating STEM programs that are diverse and inclusive of WOC can help make sure that this talent pool is recognized and help manifest their gifts. Other factors that have been shown to be beneficial to WOC were joining STEM-related organizations, participating in research opportunities, and when they discussed the course content with their peers (Espinosa, 2011; Johnston et al., 2021). These factors help students develop their scientific identity and feel more confident in their scientific abilities (Johnston et al., 2021). Building this self-confidence is a major factor in the persistence of minority students (Tate & Linn, 2005).

Context

The research was conducted at USD with undergraduate WOC in STEM programs. USD is a private catholic university that is a predominantly White institution (PWI). Given the cost associated with a private school, a majority of students come from families that are of high or higher socioeconomic status. According to the New York Times (2017), the median family income of a student from USD is $158,000 and over 66% of the students come from the top 20% of the highest earning households. With this affluent student population and a Catholic identity that can be more conservative, those associated with USD may have a lens that does not fully recognize the challenges of being a woman of color in a PWI.

My research examined the sense of belonging and community that USD has (or has not) created for WOC in the STEM majors, and the ways USD has been effective in aiding students to persist in the sciences. Some problems that arose from this examination included a limited number of students that meet the criteria for the study as USD is a small campus that is a PWI. Other challenges that arose were connected to the differences in identity between me and the

participants. I am a Mexican American man, and my experiences were different from those of the WOC that I studied. My identities created some limitations in my ability to understand the significance of certain actions, feelings, and thoughts that these students may have expressed.

Project Rationale

Supporting WOC in STEM to help them persist in their fields is a need that has been seen across college campuses. As the sciences have been dominated by White individuals, it can be difficult for some WOC to find their place in their STEM departments. Many have come to rely on counterspaces, which are places where the students could find validation that they belonged in their field (Johnson et al., 2017). Ideally, these would be in their home departments of study, but this is not always the case. Creating a STEM community that values WOC and recognizes their abilities can help in their retention.

On a broader scale, WOC remain underrepresented even though their interest in the sciences is greater than their White peers (Riegle-Crumb & King, 2010). So, it appears that there are barriers that are pushing them away from the STEM fields and keeping them from further developing their scientific talent. From my review of the literature, multiple factors affect students' academic success such as familial obligations, time commitments/management, and isolation (Johnston et al., 2021).

However, there has been a focus on how their identities in relation to their profession have a major influence on their underrepresentation and how they are perceived by themselves, by faculty, and by administrators. (Johnson et al., 2017; Myers et al., 2019; Wang et al., 2018). Thus, there is a need to examine what factors are affecting their persistence and sense of belonging to construct action plans to help address this issue.

I was able to get multiple students with varied and diverse backgrounds. This allowed my action research to help address the struggles of multiple overlapping identities of a diverse participant group rather than the struggles of one or two racial/ethnic identities. Beyond their identities of being a person of color and identifying as a woman, I hoped to gather students that come from different backgrounds. I collected data regarding the students' support systems, support systems' education status, living situations, and socioeconomic status. Again, if the participants had mostly fallen into one particular category, then my action research and cycles would consider this.

I connected with the faculty in these fields that teach STEM. They were helpful in recruiting students to participate in this action research. USD staff were also helpful in my recruitment efforts as a few have researched similar topics such as Ms. Juvera and Dr. Harley. Juvera has researched STEM students' accessibility to wellness programs and if the programs are effective in providing STEM with the necessary knowledge they need to thrive at USD (Juvera, 2022). Harley's work is centered on the experience of B lack engineers at USD. They provided me with valuable insights on how to connect with these student populations and helped me discover needs of theirs to be fulfilled as they have first-hand experience working with students in STEM.

Additionally, I reached out to student-led STEM clubs at USD as they are interested in furthering the scientific education of their members, clubs like Women in STEM, the STEM Outreach Club, and USD's chapter of the National Society of Black Engineers (NSBE). I also tapped into the resources and connections I've made through the Center for Health and Wellness Promotion. We had several student employees and volunteers that are a part of USD's STEM programs, so their connections helped in the recruitment of participants. With these connections,

I hoped to recruit a group of 10 WOC majoring in STEM fields for my action research. I was able to find 8 volunteers for my research.

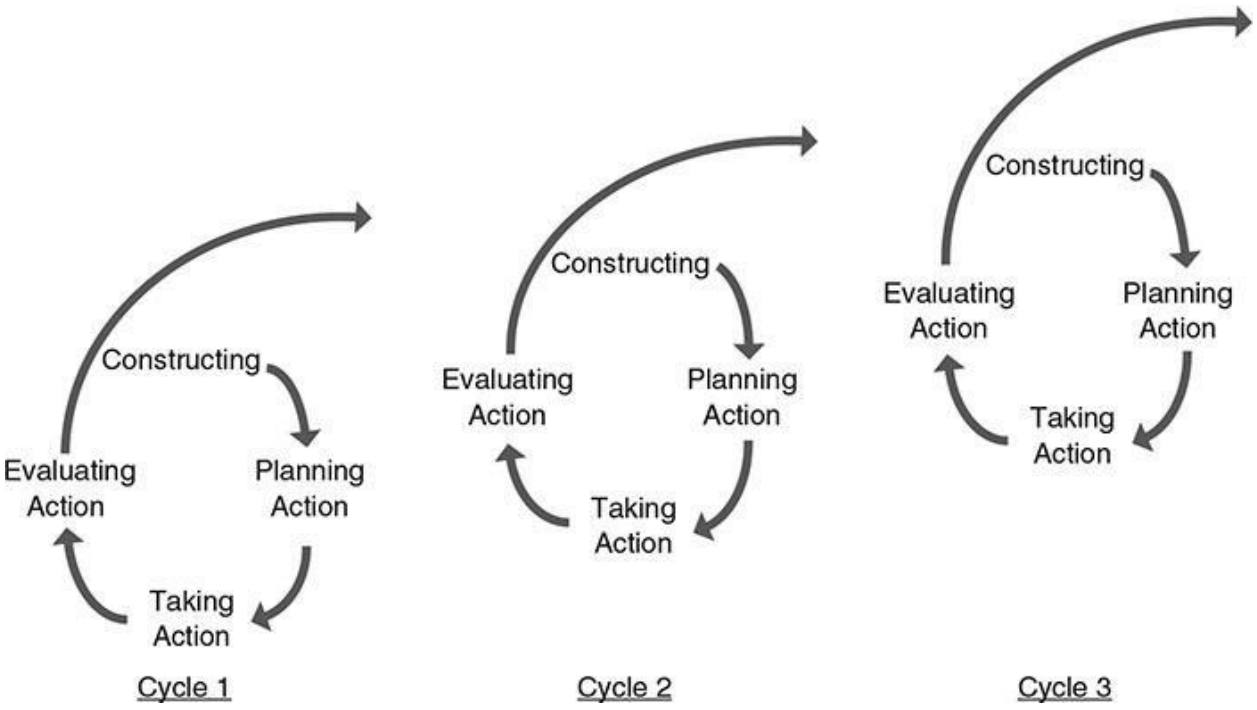
My critical friends were my cohort members in the higher education leadership program. Specifically, Monica Gonzalez Herrera, Kathrine Reyes, Anita Duong, and Pauline Herring. In their roles as graduate assistants they work with diverse student populations in a capacity that is more centered on a community when compared to my role which has a focus on wellness. They also work with many underrepresented students at USD and provided me with insights into what needs are not being met by the institution and what observations I should be making and researching. Their identities as WOC assisted me in the formulation of my surveys, interviews, and focus groups. Even though I am a person of color, it was still difficult for me to understand the challenges that WOC face and what they deem as important given my identity as a man. My critical friends served as checks and balances system to keep me from overstepping my inquiries and checking me on my assumptions.

Research Design

I used the Coghlan and Brannick (2001) cycles of action research methodology to inform my cycles. This methodology's use of evaluation followed by constructing was useful in creating meaningful actions to the issues that each cycle revealed. What I appreciated about these cycles is the use of constructing rather than diagnosing or reflecting. The implications of those are that what is observed is set in stone and not malleable. Constructing has a creative vibrance that allowed the students and I to build solutions after actions had been taken. This action research method contains four main steps in each cycle: constructing, planning action, taking action, and evaluating action. These four steps were repeated two times after the initial cycle, as illustrated:

Figure 1

Coghlan and Brannick (2001). *Cycles of action research*



I try to be very straightforward with my methods. I gravitate toward clarity and consensus which is more of a positivist stance. Thus, this way of thinking informed my choice of cycles of action research and the use of the Coghlan and Brannick (2001) model. I felt that these cycles were simple and provided me enough flexibility to adjust my cycles while trying to remain as objective as possible. The data collection was mostly qualitative rather than quantitative. However, the periods of evaluating and constructing allowed me to gain consensus from the students and better informed my research methods through further cycles. This was outside of a traditional positivist stance, but it provided an opportunity to address the issues that arose from our learning and to act. This also provided me with an opportunity to take a more creative approach, as mentioned earlier.

Data Collection

For this study, I initially chose a three-cycle, mixed-method approach but adjusted this to a two-cycle design. Given the difficulties of the recruitment process, I combined the presurvey and individual interviews into one cycle. I used surveys, individual interviews, and a focus group with an activity to gather information and insights about the student's experiences. I also provided journals for the participants so they could express any thoughts, questions, or reflections about the cycles. The journals were given once the participants had signed up to be a part of the action research. Participants were asked to journal after they completed each cycle and to journal any thoughts that came to them that they felt were important for the researcher to be aware that was not directly related to a certain cycle. Participants were asked to label the journal entries by date and to indicate if the entry was before, during, or after a certain cycle (i.e., before individual interview, after survey).

The first cycle's first part was a presurvey (see Appendix A) with a dual purpose of gathering initial information such as name, age, year in school, major(s) and minor(s), gender identity, racial/ethnic identity, living situation, if they are a low income or a first-generation student, parent(s)/guardian(s) highest level of education, and campus affiliations. The second purpose was to gain quantitative data using Likert scale statements that gave an understanding of their perceptions and feelings of themselves, the STEM programs at USD, and how their culture and their place within those programs as well as their place in USD. The Likert scale ranged from *strongly disagree* to *strongly agree* with two lesser options for *disagree* and *agree*, and a *neutral* option.

The second part of Cycle 1 involved individual interviews. For these interviews I created interview guides (see Appendix B) for each student. I allowed myself to ask follow-up questions

so I could gain a deeper and better understanding of the responses. I recorded any follow up questions asked in the interview guides. To be as consistent as possible for each student, I attempted to ask the students the same follow up question that I asked the previous students that were not in the original interview guide. The interviews were used to gain a better understanding of the students and their experiences and allowed them a space to verbalize their realities.

The second cycle was a focus group (see Appendix C) that had the students discuss common themes that emerged from the individual interviews, allowed the students to make connections with one another, they defined community and sense of belonging, and they provided feedback on how USD's STEM departments can better meet the needs of WOC and help them feel a part of the STEM community. Afterwards, the students completed a post-action research survey (see Appendix C) that contained the same Likert scale statement questions as the initial survey. This was used to measure if there were any changes made by the action research process.

The first cycle gave me a better understanding about how the students felt connected to their studies, how they felt in the classroom/lab, if they felt that their abilities and skills are recognized, if they felt that they have an opportunity and the space to develop their scientific identity, etc. The interview process gave a better understanding of the students' feelings of belonging in their programs and allowed the students to give suggestions on how USD can support them in the STEM and USD community. The second cycle was based on the results of the previous cycles, and the focus group was altered to best fit the needs expressed by the students from the first cycle. The purpose of the activity was to create community between these students at the small scale. Through this community building, we were able to begin to formulate practices that will continue this community building at a larger scale.

I analyzed the data in a few ways. I took note of the frequency of themes that were shared by the participants (i.e., asking about important support systems, taking note of when peers, family members, and faculty are mentioned as important). The purpose of this was to learn the common themes that are shared among the students. With the knowledge of these shared themes, I was able to further tailor my questions and the group activity to reveal the importance of the themes and why they were a large influence in their persistence and feelings of belonging. The quantitative data was analyzed to see consistencies or inconsistencies in their responses. This also aided in the discovery of what factors are influencing their persistence. I discussed the variance of the responses to give an accurate representation of all the participants. The data collected was categorized to make the information more digestible, but I provided the data in a narrative format to encompass the journey that the participants and I took in the action research process and what we were able to discover, learn, and conclude.

Cycle 1 Results and Findings

Presurvey

I began action research recruitment in September 2022. Recruitment efforts were very challenging given the small population of my targeted demographic. Between September 2022 and December 2022, I recruited only two participants. However, during this time I applied for a research grant and was able to secure funding to provide participants with incentives. After adding incentives to my research recruitment materials and getting them approved by the Institutional Review Board (IRB), I continued my recruitment efforts in February 2023. I recruited six more participants, to bring the total number of participants to eight by the end of the month. I began with Cycle 1 (Presurvey and Individual Interview) in November 2022. Given the difficulties of the recruitment process, I completed Cycle 1 on a rolling basis as I gained

participants. Thankfully, the first cycle was designed to gain data from each participant separately, so it made the process easier.

Demographic information about participants in this study can be found in Table 1. All participants were undergraduate students that were completing major(s) in STEM or minors in STEM. One participant was not majoring in STEM but was completing two STEM minors. I accepted this participant because I felt that their experiences should not be disqualified given the status of the student. Their experiences and work in STEM as WOC were not for me to discount. The racial and ethnic identities listed in Table 1 are how all participants self-identified. Given that this study was aimed at WOC, I was glad that a diverse group of participants decided to volunteer.

Table 1

Participant Characteristics

Participant Pseudonym	Classification	Major(s)	Minor(s)	Racial/Ethnic Identities
Suzanne	Junior	Behavioral Neuroscience	Biology	Hispanic
Lenuta	Senior	International Relations	Computer Science & Mathematics	Asian-American
Elinne	Junior	Behavioral Neuroscience	Chemistry & Ethnic Studies	White, Black, Latina
Jane	Senior	Industrial and Systems Engineering	Sustainability	Ghanaian-American
Jackie	Freshman	Biology	Business Management	Mexican/Hispanic
Afra	Junior	Biology	Chemistry	Filipino-American

Participant Pseudonym	Classification	Major(s)	Minor(s)	Racial/Ethnic Identities
Bianca	Senior	Mathematics & Computer Science	N/A	Persian
Diana	Sophomore	Industrial Engineering	N/A	Mexican

I sent the presurvey out to students as soon as I received their signed consent forms as well as their personalized journal and a scheduling link to get their availability for the individual interview. It typically took students a few days to a week to complete the survey and to give me their availability. The journal entries required me to send participants reminders to write logs of their thoughts and questions about the cycles.

The survey had three sections that the participants completed. The first section asked for general information like their name, email address, field of study, age, year in school, and contact information. The second section asked for demographic information like how the students are racially/ethnically identified, housing situation and its effects, socioeconomic status, parent(s)/guardian(s) highest level of education, campus affiliations, and any other additional information they felt like sharing. The final section contained the Likert scale statements with a range from *strongly disagree* to *strongly agree*. Each answer was assigned a numerical value to aid in data collection and analysis. The statement answers with their corresponding numerical values can be found in Table 2.

Table 2

Likert Scale Values

Statement answers	Statement values
Strongly Disagree	1

Statement answers	Statement values
Disagree	2
Slightly Disagree	3
Neutral	4
Slightly Agree	5
Agree	6
Strongly Agree	7

Likert Scale

The results of the Likert scale were a mix of *agree* and *disagree* which resulted in average scores that ranged from *neutral* to *slightly agree*. The statements fell into one of these four general categories: statements regarding their professors (see Table 3a), statements regarding their peers (see Table 3b), statements regarding their perceptions of their abilities and success (see Table 3c), and statements about their place and value at USD (see Table 3d). The statements and their average scores can be found in Tables 3a-3d.

Table 3a

Likert statement scores about professors

Likert statements	Average prescores
I feel connected to my STEM professors	4.625
The STEM professors understand the struggles that I face	4
I feel comfortable going to my STEM professors if I need assistance with coursework/lab work	5
If I am struggling with my work, I am confident that I can ask for help free of judgment	5.5
I am confident that identity does not influence the perception of my STEM professors of my knowledge, skills, abilities, and success	4.375

Table 3b

Likert statement scores about peers

Likert statements	Average prescores
I am confident that identity does not influence the perception of my STEM peers of my knowledge, skills, abilities, and success	4.25
I feel comfortable with the students in my STEM classes	4.5
I feel that I can go to my peers in my class for help	6.25
I can rely on my peers to support me through challenging courses/labs	5.75
I can rely on my peers to help me obtain my degree	4.375

Table 3c

Likert Statement Scores about student's perceptions of their abilities and success

Likert statements	Average prescores
I feel confident in my abilities and knowledge in the classroom	4.875
I feel confident in my abilities and knowledge in the lab	4.25
I feel I am at the same academic level as my privileged peers	4.625
I am flourishing at the University of San Diego	5.125
I am flourishing in my STEM courses	4.875

Table 3d

Likert Statement Scores about their place and value at USD

Likert statements	Average prescores
I feel welcomed at the University of San Diego	5.375
I feel like I belong at the University of San Diego	4.625
I feel like I am a part of the STEM community at the University of San Diego	5.25

Likert statements	Average prescores
I feel accepted in my field of study and home department	5.375
I feel like my culture, background, and lived experiences are valued at my institution.	4.25

As can be seen from the scores in Tables 3a-3d the averages scores ranged from *neutral* to *slightly agree*. What I found interesting from these Likert scale responses was the variation of responses from the students for some of the statements. For example, the statement "I feel comfortable with the students in my STEM classes" had an average score of 4.5 representing participants being in between neutrality and slightly agreeing. However, participants' individual scores varied widely. Suzanne gave a score of 3 (*slightly disagree*), Lenuta gave a score of 1 (*strongly disagree*), Elinne gave a score of 6 (*agree*), Jane gave a score of 2 (*disagree*), Jackie gave a score of 6 (*agree*), Afra gave a score of 7 (*strongly agree*), Bianca gave a score of 7 (*strongly agree*), and Diana gave a score of 4 (*neutral*). This variation appeared in other statements and there were also statements that had a majority of the participants in agreement. The statement "I feel welcomed at the University of San Diego" resulted in an average score of 5.375 representing participants slightly agreeing with the statement. The statement had three scores of 5 (*slightly agree*), three scores of 6 (*agree*), one score of 7 (*strongly agree*), and one score of 3 (*slightly disagree*).

Individual Interviews

Individual interviews took place a few days after receiving the presurvey from each participant. As mentioned earlier, the presurvey and interview were conducted on a rolling basis as I gained participants. Scheduling the individual interviews was straightforward as I based the interview times on the participants' availability and conducted all interviews via Zoom. The use

of Zoom also allowed me to record the interviews to review them later for data analysis. The time between the presurvey and interview allowed me to review the participant's responses to the presurvey. This gave me a sense of how the student felt and what I should be inquiring about in the interview.

At the beginning of each interview, I gave the participants instructions about the interview, informed them of the safe word, and made it clear that at any point they felt overwhelmed that they could do whatever they needed to take care of themselves. To start off the interview, I asked the participants very broadly to tell me about themselves. It was nice to get to know the participants on a personal level and to learn about their talents and interests outside of their education. Proceeding after that I began the formal questions of the interview. It was interesting to hear the stories of these students and the differences in experiences they had at USD. Formal questions consisted of what led them to pursue STEM, what their experiences have been in classes, what their experiences have been with peers and professors, the largest impact on success, what barriers they have faced, what are perceptions of others and themselves, what support to help them be more successful, what campus organizations that have made them feel welcomed, how their identity had influenced their experiences, what are things they want to change about the STEM culture, what support systems they use, and if they feel they belong in STEM, if they are welcomed by STEM and if they feel like they belong at USD.

Some questions were difficult to answer for some of the participants as they had never been asked nor ever considered them. This occurred on a few occasions, and I informed the students that they did not need to force an answer if they did not have one; I don't know or I am not sure are valid answers. I additionally asked the participants if they felt a drop-in STEM tutoring center would be helpful to them as USD does not have a dedicated center to support all

STEM majors. To conclude the interview questions, I asked participants what their favorite ice cream flavors are. This was to signal to the participants that we were wrapping up and to alleviate the seriousness of the Zoom call. It was an honor to hear the participants' stories and gain an understanding of the journeys they have taken. There were some commonalities in the interviews, particularly when it came to their suggestions about what USD could do to better support them. Several themes began to emerge, including: belonging, community, and contractions.

Belonging and Identity

Early on in the interviews, I asked participants what led them to pursue a degree in STEM and when they knew they wanted to pursue it. Overwhelmingly participants answered the question that they always had an aptitude and interest in science and mathematics from a young age. The drive and talent had been there, and they wanted to further their passion through a STEM degree. The challenge that arose when coming to USD was a feeling of being out of place. USD is a predominantly White institution and some of the participants question whether they should really be there. Most of the participants mentioned being one of the few if not the only WOC in their STEM classes. Compounding that with the academic rigors of a 4-year university, feelings of imposter syndrome were present in several participants. The questioning was not only due to their peers being predominantly White but also the fact that a majority of the faculty and staff were White.

This lack of representation among the faculty and staff made it challenging for participants to seek out help or feel like they were empowered to contribute to labs. This lack of representation continues when we look at the STEM fields. They are dominated by White men. This further feeds into the feelings of imposter syndrome. Elinne noted that the lack of doctors

that look like her makes her intimidated about becoming one. Elinne is worried that she may not go as far as she wants and struggles with the mental battle of self-doubt. Afra stated that it can be hard to picture yourself being successful and seeing others like you can help reassure your path. Suzanne spoke about questioning her own potential and not feeling empowered in labs. Suzanne felt she had to advocate for herself to do certain work in the lab given the overwhelming presence of men.

However, most of the other participants felt that their identity did not influence how others treated them for the most part. A majority of interactions with peers and faculty have been positive. Professors are generally approachable and helpful to students, particularly those who seek help during office hours. Professors are encouraging to the students and want to see the students succeed. However, three of participants mentioned that it can be intimidating to approach some professors, making it difficult for students to ask questions and get additional help with challenging questions. This is especially true when professors give the dreaded "You should know this already" or "You have all the information you need to solve this," which was noted by three of the participants. The differences in the participants experiences appeared to vary along the lines of their major and year in school. Engineering and math seemed the most comfortable with professors and their department in general. Other departments, like biology, seemed to be less comforting. It also appeared that younger participants, first and second years, felt less comfortable with professors as well.

There have been a few incidents with professors being outright discouraging toward students. Diana shared an incident where she was told to drop out of a class by a professor. Diana mentioned that she felt nervous at times when asking questions and had difficulties communicating with professors. Diana did say that these challenges came internally but these

feelings were not aided by the discouraging incident. It appeared that discouraging and demeaning incidents with professors were a tiny percentage of the interactions the students had with professors. But, it is important to take these incidents into account as these can lead to students further questioning whether they are good enough to be in a class and STEM major.

Community

What I learned about the community was that participants had good interactions with their peers in their STEM courses. Given that USD is a smaller school, students see similar faces often. Peers can be encouraging and helpful because "they are all on the same boat." Some students can get a bit competitive and act as if the coursework is beneath their level, but this has not affected the success of the participants. Peers can be generally helpful, but most participants felt that going to the professor was more beneficial. Professors seemed to be more encouraging toward the participants as well as more helpful in the learning process. The community among peers typically came from STEM organizations, STEM cultural organizations, and USD departments.

STEM organizations and clubs that were tied to the participants' field of study were invaluable in their success in STEM as well as making students feel welcomed. These organizations included but are not limited to the Nation Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), Society of Women Engineers (SWE), a pre-medicine fraternity, and the math club known as Tri-Pi as well as the Math Learning Center. Participants found these organizations a great space to make connections with peers that had similar goals as them and helped instill more confidence about going into the field. Alumni connections through these organizations were also beneficial for participants in discovering insights into the field and how to gain experience, this was particularly true for NSBE. Overall,

these organizations were just great places to connect and bond with their fellow students, learn about opportunities in their field, and persist through the struggles of STEM together.

In regard to the USD departments, Trio Student Support Services (SSS) is a center on campus that students found helpful. SSS hosts workshops, provides advising for students, and provides a space to connect with people with similar interests and backgrounds. Jackie and Suzanne particularly appreciate SSS as most of the advisors are people of color, came from low-income homes, and are first-generation college students, making it easier to connect with them and have professional staff that understands their challenges. This allowed them to feel more comfortable with the staff and the community and make connections that have aided them in obtaining their degree. Another campus department that was mentioned by Lenuta is the commuter commons. Lenuta was the only participant that was living off-campus with family and had to commute on average 3 hours every day. Additionally, Lenuta is a double minor in computer science and mathematics but an international relations major, which has made it a challenge to be integrated into the STEM and USD community. However, the commuter commons is a place that allowed her to find a sense of belonging. “The community in commuter commons is very gratifying and inclusive . . . I became a commuter assistant and my motivation was because I kind of wanted to reciprocate that same sense of belonging and welcoming I felt in my freshman year.”

Contributions

What I appreciate the most about these participants was the selflessness they displayed when speaking about the contributions they wanted to make in their STEM journey. The participants said they wanted to help others, create a safer world, and be role models for others. Afra, Elinne, Jackie, and Suzanne all wanted to go into the healthcare field. They want to help

people get back from their weakest points, make their lives better, save lives, and bring people comfort. Lenuta wants to play a role in cybersecurity and help keep people safe. Bianca wants to create a cleaner and more sustainable environment through the use of computer simulations. All participants wanted to serve as role models, whether it be for WOC like them or for people entering STEM in general. Jane wants to create a business or nonprofit that creates pathways for young black women to become engineers specifically from West Africa. Diana wants to be a role model in a different way, "I think I would like to try and show people that they also need to take care of their mental health . . . Everyone also just needs a mental break sometimes . . . just try and feel what you feel in the moment, and then go about your day. Just don't try to hold things back . . . More mental health and mental breaks into the whole like STEM culture about always having to do work and always having." I appreciate that all participants wanted to help other in some capacity. Using STEM as not only a pathway toward their goals but to improve things for others.

Observations and Reflections on Cycle 1

My initial observation from the presurvey was how diverse the participants were outside of their racial/ethnic identities. Half of the participants considered themselves to have been low-income at some point in their lives while the other half had never considered themselves low-income. Five participants were first-generation college students, and the remaining three participants had parent(s)/guardian(s) with educations that included bachelor's and graduate degrees.

Only one participant commuted to school from home, the other seven either lived on campus or in an apartment with roommates. Living on campus appeared to be both positive and negative for the students overall. On the positive end, the experience has made it convenient to

connect with students and faculty on campus. However, there were some challenges associated with the environment. Roommate activity can make it challenging to focus on your studies when roommates have guests over or if it is late at night and heading to a quiet spot on campus isn't ideal. Having your own room is beneficial in minimizing distractions but has led to lonely feelings for some of the participants.

All participants were a part of campus departments, campus organizations, campus jobs, labs, clubs, and honors societies. These organizations were where most of the students received support from the school. In terms of emotional support, participants received support from family, friends, roommates, advisors, professors, peers, and counseling services. Family and support systems were also said to be their biggest motivating factor in obtaining their degrees. This and wanting to better themselves by achieving a difficult degree. The participants were generally integrated into USD to some degree. The same could not be totally said with STEM. It appears that the engineering and math department had the best communities in terms of integrating students and helping them find a sense of belonging. This did not seem to be the same for the participants studying behavioral neuroscience and biology. The pre-medicine fraternity was mentioned, but only one of the participants that wanted to enter the healthcare profession was a part of it. That being said, participants stated that they would enjoy the opportunity to connect with more WOC in STEM and be a part of a community.

What I found the most surprising was that the survey results indicated that some of the students did not have the best experiences, but in the interviews a vast majority of them spoke very positively about their experiences in STEM and at USD. This led me to question the validity of the survey's effectiveness in capturing the experiences of the participants and/ perhaps some of the participants did not feel comfortable sharing the negative experiences with

me. Upon further reflection, a theme emerged from this observation: Resilience. These women have faced many challenges and barriers but have overcome them.

Planning and Action

The design of this action research project always planned to have a focus group with the intent of discussing the common themes that came up in the presurvey and interviews. The interviews were the most helpful for finding these themes, but I always felt like it needed something else. The intention of the focus group was to build community among these women. The women did give me an idea, particularly Bianca. She spoke about computer science needing more bonding activities. The math club she is a part of, Tri-Pi, wanted to be more inclusive and bring together all STEM majors. This inspired me to create a fun activity that would help create a bond among this group. The focus group would be a discussion of commonalities, finding ways USD could help create a sense of belonging for WOC, and bonding over a fun activity.

Cycle 2 Results and Findings

Scheduling for the second cycle was incredibly challenging. Unlike the individual interviews which were scheduled virtually, I wanted to bring the participants together in person. Given that the participants were full-time students and many of them had numerous responsibilities outside of school, picking a date and time was difficult. After multiple scheduling attempts, I was able to schedule a time for six of the eight participants to come together for the focus group. On the day, one participant was unable to attend due to a last-minute school obligation. Regardless of this, five of the participants attended the focus group.

Summary of Cycle 2

Conducting the focus group was an incredible experience. The participants that attended the focus group were Suzanne, Elinne, Jane, Bianca, and Diana. I had the participants introduce

themselves by stating their name, major, year, how they identified ethnically, and where their parents hailed from. After that, we began to discuss the commonalities from the interviews.

Professors

We began with professors. Diana started by recounting some negative experiences with some professors and the participants all wanted to know who it was. I did not want to police the information that they would share as long as they respected the privacy of their fellow participants. Diana continued sharing her experience with a White male professor who was discouraging when she would ask for help. She dropped the class and took the course at a later time with another professor, to which Jane and Bianca both shared that the second individual is a great professor. Diana also recounted another negative experience with a professor in a religious course that assumed that students were all familiar with the content of the bible. Diana was not familiar with the context and when asked for help, was told to drop the class. Bianca proceeded to recommend a professor to Diana and the other participants expressed that the professor is great.

Jane spoke about some experiences she had with an engineering professor that was discriminatory toward her and treated her differently than her peers. This was apparent by constant put-downs and by giving her lower grades than her peers for the same or better work. Jane gave the professor a bad evaluation and was asked by the other participants for the name of the professor, which some wrote down. Bianca did not have negative experiences similar to Jane's and Diana's but did speak about seeing it happen to other students. Particularly a professor giving a lower grade to a female student than her coding partner for the exact same code. The students spoke to another professor but nothing came of it other than the student writing bad evaluations.

Suzanne entered USD as a biology major but found herself being very discouraged by male professors in her courses. Despite trying to improve and going to office hours, the professors would discredit the time Suzanne would put in. After switching her major to behavioral neuroscience, she found herself being more supported by her professors. This was in part to the fact that most of her professors in behavioral neuroscience were female and were much more motivating. Elinne agreed with Suzanne's assessment of the behavioral neuroscience professors. Elinne had been a behavioral neuroscience major as the start of her freshman year and had not really experienced negative interactions with professors. Jane gave a great summation of the influence professors have on the success of their students, "Professors definitely make or break you in class. They are the ones that are giving you the material and you're trying to learn from them and if they are not willing to support you and understand your background and your learning experience –it's not going to be helpful."

Peers and Campus organizations

Making connections with peers varied for each participant. Bianca mentioned that connecting with peers varied from department to department. Bianca felt that it was easier to connect with peers in math, particularly those who would go to the Math Learning Center and study together. In computer science, however, connections with peers are typically limited to your coding partner as you are working on the same project. Jane had similar experiences as she found it easy to connect with industrial and systems engineering students. However, making connections with mechanical engineering students was harder as they are typically older White men that were prejudiced toward her and other women by judging them and thinking that they could not do the work.

Suzanne spoke about joining a behavioral neuroscience lab but found the process to be intimidating as she did not want to be the only student of color in that lab. Fortunately, Suzanne was familiar with many of the students and has made connections with most of them in the lab. The lab is also mostly made up of women and the professor is a woman of color, which has made Suzanne more comfortable.

Creating connections in campus organizations appeared to be varied from department to department as well. Elinne has not had challenges connecting with peers that are studying behavioral neuroscience or pre-medicine. As she mentioned earlier in her interview, she is part of a pre-med fraternity. Elinne spoke about how she had good experiences in the fraternity during the interview but had come to realize that the organization does have some issues like competitiveness and cliquey behavior. Additionally, Elinne is one of the few WOC in the fraternity. It is different from what she expected but she still has her friends and roommates that support her.

The engineering campus organizations appear to be very successful in creating connections among students. Diana mentioned recently joining the Society of Women Engineers (SWE), the Society of Hispanic Professional Engineers (SHPE), and the Institute of Industrial Engineers. Experiences in these clubs for her have varied but it has been great to connect with students with similar backgrounds and have a support group. Jane is a member of the Nation Society of Black Engineers (NSBE) and is incredibly grateful for the experiences she has had with the organization. Jane spoke about how NSBE has given her many opportunities and networking connections all over the nation.

Being a part of NSBE is a lifelong membership and has provided the opportunity to serve as an example to others:

> I am able to be a model leader for other people that may not think they want to be an engineer. I'm just happy to be that because I wish I had that as a freshman. Representation is really important . . . Seeing other people that are successful in your major and who have the same identity as you makes people want to pursue what they think they can't do.

Jane continued to praise other engineering clubs, "I love SWE. It's so supportive in that organization and the food and conversations are great . . . The Society of Hispanic Professional Engineers has a great bond with NSBE, and we do a lot of collaborative events throughout the year."

I asked the participants if a STEM tutoring center on campus would be beneficial to students in their studies and making connections. The participants were generally supportive of this idea, but some felt that more resources and funds could be redirected to organizations like NSBE, SWE, and SHPE as they already have the students willing to dedicate their time to supporting other students.

Barriers

When we began the discussion around barriers, I mentioned a big theme that emerged from barriers was feelings of imposter syndrome and questioning whether they belonged in STEM. Bianca began by sharing that she had not experienced much imposter syndrome at USD as she felt she was just treated like any other student. However, imposter syndrome has become more apparent as she will be entering graduate school at a prestigious university. Bianca finds it a bit daunting as it is a long commitment and she will be working full time. After connecting with another incoming graduate student, Bianca felt more unsure as the other student had a large amount of experience and already had research in mind. Elinne shared this feeling of imposter

syndrome about medical school as she would be considered underrepresented. This causes some doubt to creep into her mind. Suzanne is also experiencing imposter syndrome when thinking about the health professions given her lack of connections and challenges in building up a resume. Again, making her question her path. This questioning also brought an interesting dilemma pointed out by Bianca. The dilemma of obtaining a position and questioning whether or not you got that position because of your identity or due to quotas. Jane recounted her experience at an internship she had. The internship needed to fulfill a 40% diversity quota and Jane noticed immediately that she was being treated differently than others. It made her question why she was there but Jane did make the most of her experience and made it a good one. Jane noted that quotas can create a mental barrier for those that are underrepresented and how minorities have the aptitude to be successful, “It’s great that we have spots for minorities, but I could have done it without those saved spots.”

Defining and Creating Community

After discussing the themes and commonalities with the participants, I had them participate in an activity to define community and belonging. Additionally, how USD can create a community. Participants defined community as having support systems and people with similar backgrounds and experiences. Participants defined belonging as having a place where one feels included, listened to, and safe.

In terms of USD STEM departments helping create a sense of belonging, participants state that USD needs more representation of WOC and people of diverse backgrounds as professors. Additionally, professors need to be caring and understanding of their students, and not just be solely focused on research and obtaining tenure. Participants also wanted to see more diversity in students and diversity in clubs. Elinne mentioned earlier about being one of the few

WOC in her pre-med fraternity and how there should be more of an effort to include diverse students. The fraternity often speaks about the importance of diversity and inclusion but is not taking the opportunity to do so. The participants would love to see more diversity to make USD more comfortable for everyone. The clubs and other student organizations are doing a great job in creating community among WOC, particularly those tied to engineering and math. However, USD needs clubs and organizations like those for biology, behavioral neuroscience, and other departments because they do not have that kind of support.

Bonding Activity

I create a STEM jeopardy (see Appendix D) for the participants to play. I did not want to create a competition between the students as some mentioned they wished some of their peers were not so competitive. So, I had them work as one team and they would need to work together as I chose multiple STEM subjects. I did set some stakes for the games, as the participants would be competing for a prize if they reached a certain score. They would also be playing for the participants that were unable to attend the focus group. The participants were very excited about playing Jeopardy and they were glad they were able to do it together. All participants seemed to have enjoyed it even when it was incredibly challenging at times. The final score was 6000 points out of a possible 7500 points – 80%. With that score, they all received a prize of $10 gift cards to Salt & Straw.

Journal entries

Journal entries were reviewed after the individual interview portion of Cycle 1 and after the focus group of Cycle 2. The participants did not feel the need to write much in their journals as they felt they expressed all they needed in the surveys, interviews, and focus group. The only common reflection among some of the participants was not reflecting on their experiences as a

WOC in STEM. They had not previously taken the time to think about their experiences and reflect on the questions that I had posed to them. I was glad that this experience had caused some of the participants to explore their experience to a deeper level. I think this is because they have never taken the time to reflect as they are constantly working toward the next goal. They have persisted through the challenges and have not given them a second thought.

Postsurvey

After the focus group, I sent out an email to the participants with the postsurvey. I had all participants complete the postsurvey whether or not they attended the focus group. The postsurvey consisted of the same Likert scale statements as the presurvey. Additionally, students were also given the opportunity to provide feedback about the focus group in the postsurvey. The average results can be viewed in Tables 4a - 4d. There are two columns for postsurvey average scores. The first average postscores column contains the average scores for all participants. The second column with the label "FG Only" is the average score for participants that attended the focus group. Overall, the average scores for both post groups were either similar to the prescores or slightly higher than the average for the pre-scores with a few exceptions.

What I found most interesting were the changes seen in Table 4b that contained statements regarding their peers. Participants' comfort with students in their STEM classes rose from a score of 4.5 (between *neutral* and *slightly agree*) to a slightly higher score of 4.875 for the entire group and a score of 5.4 (between *slightly agree* and *agree*) for the focus group attendees. For the statement "I can rely on my peers to help me obtain my degree" there was a large increase from a score of 4.375 (between *neutral* and *slightly agree*) to a score of 5 (*slightly agree)* for the entire group and a score of 6 (*agree*) for the focus group attendees. However, the statement "I can rely on my peers to support me through challenging courses/labs" saw a small

decrease in scores for both postscores (see Table 4b). The statement "I feel that I can go to my peers in my class for help" saw a decrease from a score of 6.25 (between *agree* and *strongly agree*) to a score of 5.625 (between *slightly agree* and *agree*) for the entire group and a score of 5.6 (between *slightly agree* and *agree*) for focus group attendees.

Table 4a

Likert Statement Scores About Professors

Likert statements	Average prescores	Average postscores	Average postscores: FG only
I feel connected to my STEM professors	4.625	5.375	5.6
The STEM professors understand the struggles that I face	4	4.5	4.8
I feel comfortable going to my STEM professors if I need assistance with coursework/lab work	5	5.5	5.6
If I am struggling with my work, I am confident that I can ask for help free of judgment	5.5	5.625	5.4
I am confident that identity does not influence the perception of my STEM professors of my knowledge, skills, abilities, and success	4.375	4.375	5

Table 4b

Likert Statement Scores About Peers

Likert statements	Average prescores	Average postscores	Average postscores: FG only
I am confident that identity does	4.25	4.25	5.4

Likert statements	Average prescores	Average postscores	Average postscores: FG only
not influence the perception of my STEM peers of my knowledge, skills, abilities, and success			
I feel comfortable with the students in my STEM classes	4.5	4.875	5.4
I feel that I can go to my peers in my class for help	6.25	5.625	5.6
I can rely on my peers to support me through challenging courses/labs	5.75	5.5	5.6
I can rely on my peers to help me obtain my degree	4.375	5	6

Table 4c

Likert Statement Scores About Student's Perceptions of Their Abilities and Success

Likert statements	Average prescores	Average postscores	Average postscores: FG only
I feel confident in my abilities and knowledge in the classroom	4.875	5.125	5.2
I feel confident in my abilities and knowledge in the lab	4.25	5	5.2
I feel I am at the same academic level as my privileged peers	4.625	4.5	5
I am flourishing at the University of San Diego	5.125	5.5	6
I am flourishing in my STEM courses	4.875	5	5

Table 4d

Likert Statement Scores About Their Place and Value at USD

Likert statements	Average prescores	Average postscores	Average postscores: FG only
I feel welcomed at the University of San Diego	5.375	6	6
I feel like I belong at the University of San Diego	4.625	5.125	5.2
I feel like I am a part of the STEM community at the University of San Diego	5.25	5.25	5.6
I feel accepted in my field of study and home department	5.375	5.75	6
I feel like my culture, background, and lived experiences are valued at my institution.	4.25	4.625	5

The final section of the postsurvey allowed the participants to provide any additional information or feedback. I felt that the focus group was a good experience for the participants and for myself, and the three comments left affirmed that. Diana was happy to connect with students with similar experiences and situations. Jane spoke about how the focus group allowed her to discover new ideas that she had never spoken out loud. Additionally, Jane was able to relate to the struggles that other WOC in STEM faced but that she was unaware of. Lastly, Suzanne gave a great summation of the focus group "The focus group was great. It was nice to hear all the similar shared experiences across all the STEM majors. It also made me feel surer of myself and more supported knowing that we had similar paths and are going to make it through. Hearing how the comp science and engineering students collaborate and support each other across the different ethnicities is inspiring."

Observations and Reflections on Cycle 2

The focus group was an enjoyable and fruitful experience for the participants and me. Much of what we spoke about was covered by the participants in the individual interviews. That being said, the participants were able to gain an understanding of how other majors operate in terms of creating connections. It was observed by the participants as well as me that the engineering and math departments were the most successful at providing space for WOC. This was particularly true for the engineering clubs that were tied to racial and ethnic identities. It is unfortunate that there are not currently cultural clubs and organizations for different STEM majors and STEM-related professions like the healthcare field. The participants outside of engineering and math have found support from different sources around campus which is great. The challenge comes from the imposter syndrome that can occur when you do not have relatable support systems in your major. However, the focus group itself seemed to become a support system for the participants.

There were many moments when the participants were incredibly supportive of each other. When Bianca shared that she would be going to graduate school the following year - the other participants congratulated her and gave her a round of applause. When Elinne shared about her aspirations of becoming a doctor, participants respectfully and playfully corrected her that it's when she gets into medical school, not if. When Suzanne shared that she was part of a research lab, the participants eagerly inquired about her research. When the participants were sharing their negative experiences with professors, the other participants were empathetic about their experiences and recommended instructors that are better. All the participants were attentive to their peers throughout the focus group, and I am glad that they had an enjoyable experience connecting due to their shared experiences and similarities. The concluding activity of STEM

Jeopardy was enjoyable for the participants, it challenged them and took a collective effort for them to win. My intent for this focus group was to start creating a community with this group of amazing women. I felt that the focus group was successful in this effort, and it also gave the participants confidence that they were going to succeed in STEM.

The postsurvey results had most scores that were similar to or higher than those of the presurvey. I was glad to see that these participants were feelings confident and comfortable in STEM. This was more heavily seen in those that attended the focus group. I would like to believe that the focus group had an influence on this change. Given the comments from the postsurvey, it appeared that the focus group did have a positive influence on participants' scores. When comparing the focus group postscores to the overall postscores, a vast majority of the average scores were higher for those that attended the focus group. It would have been nice to have had all participants attend the focus group as I believe it would have led to those that did not attend to have higher scores.

Planning and Action

Now that I have gained an understanding of the experiences of these WOC and listened to their needs, I would like to offer recommendations to faculty, staff, and administrators at the University of San Diego. These recommendations will contribute to the sense of belonging, community, and care for WOC. These recommendations will also serve USD's continued mission of creating a more diverse, equitable, and inclusive environment for people of all backgrounds.

Recommendations

The action research process provided many useful insights about how to improve the sense of belonging and create a community for WOC in STEM at USD. These insights from the

participants have informed my recommendations and provided clear instructions to USD on how to create a more inclusive community. These recommendations address my research question: How can USD create a community that will enhance retention, persistence, and the future success of WOC in STEM?

Diverse Faculty and Staff

My first recommendation is to hire more diverse faculty and staff. It was mentioned by the participants that they would feel more comfortable and have an easier time reaching out to professors if they felt they would understand their background and relate to their struggles. More specifically, having more WOC professors will attract more WOC students, and will put the feelings of imposter syndrome at ease. Hiring a more diverse staff as well would be beneficial in supporting students of color on a holistic level. Two participants mentioned using USD's counseling services and how they would feel more comfortable if there was a more diverse counseling staff. Suzanne mentioned how she felt very comfortable with her academic advisor from Student Support Services because she has a relatable background. Hiring a diverse faculty and staff will create a more welcoming community and help WOC have a better sense of belonging at USD.

Cultural STEM clubs

The cultural STEM clubs appeared to have created the most supportive environments for students. The engineering department in particular had many cultural STEM clubs and organizations that those students felt were doing a great job in creating a community among black engineers, Hispanic engineers, and women engineers. The Math Learning Center also appeared to be creating a community among all students studying math. Delegating funds toward these clubs and organizations would assist these clubs in reaching out to more students of color

and funding community-building efforts. More importantly, creating clubs and organizations NSBE, SWE, and SHPE for other STEM majors like computer science, biology, chemistry, healthcare professions, etc. would be beneficial in creating a better community for students of color studying these other STEM majors This idea was brought forward by the participants that attended the focus group. USD has an opportunity to create these STEM cultural organizations in these other departments and better support WOC in all fields.

Community Building

Organizing community-building events for STEM WOC and students of color would also be beneficial in creating a sense of belonging for students. These events should include all STEM departments. These bonding and community-building events for STEM students would also be helpful in creating a less competitive environment and instilling more camaraderie among the students. Additionally, the creation of a dedicated STEM tutoring center for all STEM majors would help bring students from all departments together. Much like the Math Learning Center, this tutoring center would have peer-to-peer tutoring services and provide a space for students to connect with each other.

Research Opportunities and Internships

The participants mentioned that it would be incredibly beneficial if USD could provide more research opportunities and internships for WOC in STEM. Several participants felt that they were at a significant disadvantage as they are the first to be studying STEM and felt that they did not have connections they could use to gain opportunities in their respective fields of study. USD STEM departments should connect WOC and students of color with local STEM organizations and alumni to aid these students in gaining field experience and connections. In tandem with hiring more WOC professors to create a more inclusive environment, USD STEM

departments should allow these professors to conduct their own research labs. This will allow WOC to develop their research skills and apply the knowledge they are learning in the classroom in an environment that they are more comfortable in. This would make WOC more confident in their scientific abilities and give them the experience that can help them get hired in their field or aid them in continuing their education in graduate school.

Limitations

There were several limitations to this study. Given the small population of WOC specifically studying STEM, it made recruitment challenging. I was grateful for having the eight students participate in this study, but the small number of participants made it difficult to fully capture the experience of WOC in STEM. A larger sample size of 30 participants would be ideal (Mason, 2010). However, given the small size of the specific population I chose and the quality of the data I collected, that data was still valuable for USD. Other than the small population, recruiting was difficult due to the busy schedules of STEM students. Just with these eight participants, scheduling a focus group was difficult as the students have multiple responsibilities and complex schedules. I felt lucky that I was able to schedule a majority of the group for the focus group.

Students dedicating 3.5 hours for a study was likely not on the high end of their priorities when they had a full course load and other obligations. The addition of gift cards as an incentive made participation in the study more attractive to students. Bianca mentioned that she had heard of other research projects but would only consider them if they were valuable for her time. Students' time is very valuable and providing a direct benefit for them is necessary as their time is scarce. Another reason it was difficult to recruit students was the fatigue coming from the

COVID-19 pandemic. Social fatigue and challenges in engaging students seem to be a trend seen in student affairs.

Personal Learning

The action research process and journey I have taken conducting this research has been challenging and rewarding. I have never considered myself as a great student, let alone a good researcher. The journey has instilled some confidence in my research abilities, but I have come to learn that it is okay not to be perfect. What is important is to ask the difficult questions and challenge yourself to search for a conclusion. This is not always easy, it never felt easy with my research. There were many times where I was frozen in fear because I wanted my research to do justice to these women. What this project and the participants have inspired in me is to be is brave, not perfect. A value that I will share with those that feel like they do not belong in higher education.

Conclusion

This action research project had the intention of discovering how USD creates a community for WOC in STEM that is beneficial to students and aids them in persisting toward their degrees. It appears that some departments are more successful than others. The most successful was the engineering department with its use of cultural engineering clubs and organizations that provide a space for WOC to find a sense of belonging within their field of study. The math department appears to have a supportive environment for students as well, particularly with the use of the Math Learning Center which provides a physical space students can regularly go to for support. As for the other majors observed in this study, behavioral neuroscience, biology, and computer science, they could use additional support in creating cultural STEM clubs that can create communities like those of engineering and math.

To aid in the retention and future success of WOC in STEM, the University of San Diego should make a conscious effort to recruit and hire more faculty and staff that are of diverse backgrounds. This would create an environment where WOC will feel more comfortable with professors and reach out for support services as they will be interacting with individuals that understand their background. A more diverse and inclusive university will help usher in a new generation of scientists. Despite the challenges that these WOC have faced, they have persisted through it all. Their resilience is inspiring and whether they believe it or not, they are already role models for WOC that aspire to have STEM careers.

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Appendix A

Pre-action Research Survey

General Information Questions

1. Full Name
2. Preferred Name
3. Preferred Pronouns
4. Age
5. Major
6. Year
7. Email address
8. Phone Number
9. Preferred method of communication

Student Demographics

1. How do you identify racially/ethnically?
2. How would you describe your gender identity?
3. Do you live on or off campus?
4. Have you ever considered yourself as a low-income student?
5. Do you consider yourself a first generation student?
6. What is the highest level of education your first parent/guardian has achieved?
7. What is the highest level of education your second parent/guardian has achieved?
8. Please list any and all campus organizations you are apart of
9. Any additional information you would like to share?

Likert Scale Statements

1. I feel welcomed at the University of San Diego
2. I feel like I belong at the University of San Diego
3. I feel like I am a part of the STEM community at the University of San Diego.
4. I feel accepted in my field of study and home department
5. I feel confident in my abilities and knowledge in the classroom
6. I feel confident in my abilities and knowledge in the lab
7. I feel connected to my STEM professors
8. The STEM professors understand the struggles that I face
9. I feel comfortable going to my STEM professors if I need assistance with coursework/lab work
10. If I am struggling with my work, I am confident that I can ask for help free of judgment
11. I am confident that identity does not influence the perception of my STEM professors of my knowledge, skills, abilities, and success
12. I am confident that identity does not influence the perception of my STEM peers of my knowledge, skills, abilities, and success
13. I feel like my culture, background, and lived experiences are valued at my institution.
14. I feel I am at the same academic level as my privileged peers
15. I feel comfortable with the students in my STEM classes
16. I feel that I can go to my peers in my class for help

17. I can rely on my peers to support me through challenging courses/labs
18. I can rely on my peers to help me obtain my degree
19. I am flourishing at the University of San Diego
20. I am flourishing in my STEM courses

Appendix B

Interview Guide

Thank you again for participating in this action research project and for completing the presurvey. The second part of the action research process will be the individual interview. I will ask you a series of questions and you will have as much time as you need to answer the questions. If there are any questions you do not feel comfortable answering, please let me know and we can move on to further questions. If at any point you feel uncomfortable or overwhelmed, you can say the safe word "POTATO" and we bring the interview to an immediate stop. This discussion may be very emotional taxing, so please take your time and do what you need to do to take care of yourself. I also want to make it clear that this interview will be recorded for research purposes and I will be taking some notes. Only I will have access to the recording and the notes. This interview has been scheduled for 1 hour but we may not take the full time but please know that there is no need to rush, take your time answering the questions. Do you have any questions?

1. Tell me about yourself
2. What led you to pursuing a degree in STEM? When did you know you wanted to?
3. What have your experiences been in your STEM classes?
4. How have your interactions with your professors impacted your experience in your STEM coursework/lab?
5. How have your interactions with your peers impacted your experience in your STEM coursework/lab?
6. What has been the largest impact on your success in your coursework/lab?
7. What barriers have you faced in your pursuits of a STEM career?
8. How are your scientific abilities measured compared to your peers?
9. What support would help you be more successful in your STEM pursuits?
10. Do you feel like you belong in the STEM field?
11. Do you feel welcomed?
12. Have any campus organizations made you feel welcomed? If so, which organizations and how did they make you feel?
13. What makes you feel welcomed or what could make you feel welcomed?
14. Who or where can you go to if you need emotional support when your STEM coursework becomes overwhelming or stressful?
15. Has your identity influenced your experience as a STEM student? If yes, how so? If no, why not?
16. Is there something you would change about the STEM culture/traditions?
17. What has been your biggest motivation/inspiration in obtaining your degree?
18. What contributions do you want to make in your STEM journey?
19. Do you feel that a drop-in STEM tutoring center would be helpful in your studies? Do you think there is a big need for this?
20. Do you like ice cream? What kind?

Appendix C

Action Research Focus Group Guide

Introductions

- Please share your name, major, and year.
- What identities do we share?

Discussion

- Common themes that emerged from individual interviews - Ask for reflections on these themes
- Difference in the themes - why do we think this is?

Activity

- How do we define community?
- How do we define belonging?
- How can USD STEM departments help you all feel a sense of belonging?
- How can we create a community for women of color in STEM?

Final Reflections

- Do you all have any questions, comments, or concerns?

Post Action Research Survey

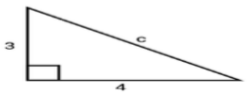
Likert Scale Statements

1. I feel welcomed at the University of San Diego
2. I feel like I belong at the University of San Diego
3. I feel like I am a part of the STEM community at the University of San Diego.
4. I feel accepted in my field of study and home department
5. I feel confident in my abilities and knowledge in the classroom
6. I feel confident in my abilities and knowledge in the lab
7. I feel connected to my STEM professors
8. The STEM professors understand the struggles that I face
9. I feel comfortable going to my STEM professors if I need assistance with coursework/lab work
10. If I am struggling with my work, I am confident that I can ask for help free of judgment
11. I am confident that identity does not influence the perception of my STEM professors of my knowledge, skills, abilities, and success
12. I am confident that identity does not influence the perception of my STEM peers of my knowledge, skills, abilities, and success

Appendix D

Action Research Focus Group Activity

4/17/23, 7:01 PM STEM Jeopardy

Math	Computer Science	Chemistry	Biology	Physics
100 The word "geometry" means to measure what?	**100** Which number system is used by computers to perform data operations?	**100** What is the lightest naturally occuring element?	**100** True or False: there are more bacteria than human cells	**100** What is the speed of light?
200 Find C  	**200** What term refers to the process of converting information or data into a code, especially to prevent unauthorized access	**200** Calculate pH of a buffer solution at the midpoint: $pH = 4.74 + \log\left(\frac{0.50}{0.50}\right)$	**200** What is the largest organ in the human body?	**200** What is Newton's second law? *Hint: It's an equation
300 Who was the first person to use calculus?	**300** Who is known as the father of computers?	**300** Trinitrotoluene is also known as	**300** What is most common element in the human body?	**300** Which law states that at a constant temperature, the volume of a fixed mass of gas is inversely proportional to its pressure?
400 What is the name of this sequence: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55?	**400** Who was the first computer programmer?	**400** ΔG = 0 indicates what?	**400** Who discovered the structure of DNA (Double Helix) *Hint It wasn't a man	**400** Famous engineer, chemist, and inventor Alfred Nobel started the Nobel Peace Prize because he feared the legacy his greatest invention would leave. What was the invention?
500 Evaluate $\lim_{x \to 0} \frac{\ln(1-x) - x\sin(x)}{1 - \cos^2(x)}$	**500** Why do we refer to capital letters as uppercase and non-capital letters as lowercase?	**500** What kind of reaction is this? 	**500** What is the answer to the old question "Nature versus Nurture"?	**500** What famous engineer predicted that we would have smartphones in the 1920s?