

Antiracist Institutional Transformation Matters: How Can Community Cultural Wealth and Counter-space Processes Illuminate Areas for Change?

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Anti-racist institutional transformation matters: how can community cultural wealth and counterspace processes illuminate areas for change?

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Introduction

Racial inequity within engineering education is one facet of the educational debt the United States has accrued since the beginning of its colonialist history. As Gloria Ladson-Billings described in her 2006 presidential address to the American Educational Research Association [1], the U.S. society has made a series of economic, sociopolitical, and moral decisions that have had a cumulative impact on communities of color, particularly Black, Indigenous, and Hispanic/Latinx communities. When we see differences in academic outcomes between White students and students of color, it is not an indication of an “achievement gap,” but rather an indication of the debt owed to groups that have been racially subjugated since the early days of public education. By shifting focus away from discussions of why students of color are failing within the dominant paradigm and toward ways that the dominant paradigm fails students of color, Ladson-Billings and other Critical Race scholars challenge us to expand our thinking about the appropriate strategies for improving equity in STEM.

The foundation of racial subjugation on which the U.S. education system was built produces inequalities in K-12 education which are further exacerbated by the White hegemony of postsecondary STEM education, particularly engineering [2]. As a result, Hispanic/Latinx, Black/African American, and American Indian/Alaskan Native students receive proportionately fewer bachelor’s degrees in engineering than should be the case based on their representation in colleges and universities. This is not to say that no progress has been made toward increasing diversity in STEM fields. Among universities that comprise the Pacific Northwest Alliance for Minority Participation (PNW LSAMP), the proportion of students enrolled in STEM who belong to NSF-designated “underrepresented minority” (URM)ⁱ groups has increased from 8% in the 2009-10 academic year to 16% in the 2019-20 academic year. The proportion of STEM degrees granted to students from URM groups has also increased over the past decade, from 6% in 2009-10 to 13% in 2019-20. However, White and Asianⁱⁱ students remain overrepresented among STEM degree recipients. While 84% of students enrolled in STEM fields in 2019-20 were White or Asian, 87% of students receiving bachelor degrees in STEM were White or Asian. Ladson-Billings [1] would argue that this observation does not indicate a racial achievement gap in engineering, but an educational debt owed to students from groups historically marginalized in STEM.

The current study is part of a larger project aimed at examining whether/how educational institutions can both nurture and elevate the value placed on the knowledge and experience possessed by students from racial/ethnic groups minoritized in STEM. This study focuses on the

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perspectives of students approaching STEM degree completion who are part of PNW LSAMP, an alliance of higher education programs serving Black/African American, American Indian/Alaskan Native, Hispanic/Latinx, and Hawaiian/Pacific Islander STEM students. For these students, PNW LSAMP serves as an important “counterspace” – a site where they can find affirmation, validation, and resistance to cultural hegemony [3], [4]. For PNW LSAMP students, LSAMP and other identity-based organizations help mitigate the adverse effects of attending predominantly/historically White and endemically racist social institutions [3], [4]. We argue that the adaptive response to oppressive conditions facilitated within these counterspaces occurs, in part, because they are sites where students can both activate existing community cultural wealth carried from their families and communities and develop skills and networks that contribute to continuing success [5], [6].

Our conversations with students from racial/ethnic groups minoritized in STEM who are approaching successful completion of a STEM degree highlight the importance of counterspaces within predominantly/historically White institutions (PWIs). At the same time, they draw attention to the persistent legacy of White supremacy ingrained in educational institutions that sustains the need for programs like LSAMP and other identity-based organizations. Insights from our participants regarding continued challenges despite strong personal assets and the support from organizations like LSAMP highlights the need for institutional transformation that reaches beyond student interventions [2]. In this paper, we raise more questions than we answer. We are hoping that through the process of sharing our thoughts with the broader ASEE community, we can further develop ideas regarding opportunities for anti-racist institutional transformation and incorporate them into ongoing research with students, program coordinators, and university leadership across the five PNW LSAMP universities and four PNW LSAMP community colleges.

Theoretical framework

Our research is motivated by an assets-based Critical Race Theory (CRT) approach aimed at developing a better understanding of the ways that knowledge and experience possessed by students from systemically marginalized groups both contribute to their educational success and draw attention to opportunities for institutional transformation [5], [7], [8]. In this paper, we focus specifically on the intersection between Tara Yosso’s community cultural wealth (CCW) and counterspaces frameworks [3], [5]. CCW highlights the cultural resources of systemically marginalized populations nurtured by families and communities [5]. This perspective can illuminate resources and strategies that students who persist in engineering and other STEM fields utilize along their educational pathway. Yosso argues that cultural centers on PWi campuses “provide a physical, epistemological, social, and academic counterspace for Students of Color to build a sense of community and nurture ‘critical resistant navigational skills’ [9]” [3, p. 84]. Counterspaces provide students from minoritized racial/ethnic groups with opportunities to activate CCW and further develop networks and resources to support persistence in STEM. While our research shows the power of counterspaces for mitigating the effects of racialized educational institutions, it also pushes us to think about the way that diversity programs can reinforce Whiteness as the implicit norm [2], [10]. We aim to discuss the individual-level experience of students and interaction with counterspaces as a means to examine how the individual agency of students from minoritized groups is limited by what Victor Ray describes as

“racialized organizations” [10]. In doing so, we hope to answer calls for an increased focus on institutional change in assets-based educational research [8].

Yosso defines Community Cultural Wealth as “an array of knowledge, skills, abilities and contacts possessed and utilized by Communities of Color to survive and resist macro and micro-forms of oppression” [5, p. 77]. Yosso’s CCW framework centers the experiences of individuals from systemically marginalized groups. Whereas educational scholars have typically conceptualized cultural capital as the cultural resources valued by the dominant group, Yosso argues that the distinct cultural resources of systemically marginalized populations nurtured by families and communities should be recognized [5]. Yosso’s framework includes six interrelated forms of CCW: aspirational capital, navigational capital, social capital, linguistic capital, familial capital, and resistant capital. Our operational definitions of these concepts, adapted from Yosso’s original conceptualization and informed by subsequent CCW research, are described in Table 1 below [5], [11]–[18].

Table 1: Our operational definitions of CCW

Aspirational	Belief in the ability to overcome barriers and persist in education
Navigational	The ability to locate and utilize the information and support necessary to navigate institutions designed within dominant paradigms
Social	Networks that provide access to instrumental and emotional support for persisting in education
Linguistic	Communication skills developed through practicing and switching between different languages, styles of communication, or forms of expression
Familial	Commitment to family/community and skills for building relationships that are developed within families
Resistant	Knowledge and skills for resistance developed in the context of structural inequalities/social injustice

Cultural capital research in education has largely focused on “knowledge of or facility with ‘highbrow’ aesthetic culture” [19, p. 567], despite the fact that Bourdieu sought to provide a structural critique of social inequality by conceptualizing cultural capital as relational and context-specific [20], [21]. We use the concept of CCW to provide a fuller understanding of how cultural resources less studied by mainstream educational scholars may serve as wealth for systemically marginalized students in STEM [17].

As with other cultural capital scholarship, most of the research using a CCW framework tends to overlook the relational aspects of cultural capital described by Bourdieu [22]. Individual assets only act as capital insofar as they are valued in a particular context [21], [23]. Putting CCW in conversation with counterspaces addresses this relational component of capital. Counterspaces provide a social context in which CCW is valued, where it might not be otherwise valued by educational institutions. Counterspaces also provide an opportunity to develop the types of social and cultural capital that tend to be valued by educational institutions and engage in narrative identity work that challenges dominant paradigms. In this way, counterspaces serve as a site for nurturing resistant capital (both conformist and transformational [24]). This reciprocal relationship between CCW and counterspaces – whereby counterspaces allow members to both activate existing CCW and develop new/deepened capital – is consistent with Margherio et al.’s findings regarding the interaction between CCW and counterspace processes [6].

Case and Hunter [4] propose a framework for examining the mechanisms whereby counterspaces produce adaptive response to oppressive conditions for students from marginalized groups. They suggest that counterspaces “challenge negative representations and notions concerning one or more marginalized identities” [4, p. 262] through three processes: narrative identity work, acts of resistance, and direct relational transactions. *Narrative identity work* involves the sharing of personal narratives and development of collective narratives that define the ideological and collective identity of a counterspace and allow for redefinition of personal identities within an affirming context. Counterspaces provide opportunities for students to engage in *acts of resistance* at a personal level (thinking/feeling/behaving in ways that are counter to hegemonic cultural expectations) and collective level (critiquing oppressive conditions). *Direct relational transactions* involve the development of social capital – counterspaces facilitate social support and transmission of cognitive strategies and other resources. Case and Hunter describe counterspaces as “living repositories of collective experiences and wisdom that can inform the everyday strategies through which marginalized individuals navigate oppressive contexts” [4, p. 266].

Attention to the relational aspects of CCW in the context of counterspaces can also help broaden the research utilizing the CCW framework to include an institutional focus. While CCW provides a welcome departure from deficit-based explanations of “gaps” in academic achievement, the theory has largely been used to describe how assets accumulated through background/community help students succeed within the existing educational paradigm. The CCW framework has also occasionally been used in ways that undermine its assets-based foundation, due to the difficulty in “emphasizing student voices without implicitly placing the onus for change on students” [8, p. 576]. A focus on student success within institutions that weren’t built with them in mind is important for reframing the narrative regarding “achievement gaps,” but this theory can also be helpful for illuminating misalignment between assets possessed by students from groups systemically marginalized in STEM fields and the capital valued by academic institutions. In doing so, we can identify levers for institutional transformation that could help elevate the value of community cultural wealth beyond counterspaces/ethnic enclaves within the university setting.

By identifying areas of misalignment between student assets and institutional values reflected in policies, we can illustrate the racialized nature of colleges and universities – shifting the focus toward institutional forces that sustain inequities [25]. Victor Ray’s theory of racialized organizations provides a useful perspective for thinking about the role that PWIs play in sustaining institutionalized racism more broadly [2], [10]. Ray argues that race and ethnicity scholars “typically examine organizations as hermetically sealed from the wider racialized social system” [10, p. 46], when instead we should be focusing on the role that organizations play in either reifying or challenging broader state policies that contract or expand the agency of racial groups.

Institutions of higher education play a pivotal role in mediating between the individual agency of individuals and groups and broader political and economic structures, so it is crucial for the advancement of racial justice that these institutions built by and for White people respond to the needs of students from groups that have been marginalized. As argued by Ebony McGee, the work of dismantling structural racism endemic to STEM education and industry cannot be left entirely to historically Black colleges and universities (HBCUs) [2]. In the analysis that follows, we examine ways that PWIs are/are not serving their mediating role in translating the needs of

students into anti-racist policies, as indicated by alignment/misalignment between community cultural wealth possessed by students and assets valued by the institution. We also look at how counterspaces can be an important site of respite and resistance for students from minoritized racial/ethnic groups on PWI campuses.

Data and methods

This paper presents findings from an analysis of semi-structured interviews with 11 students from racial/ethnic groups minoritized in STEM (Black/African American, Hispanic/Latinx, Native Hawaiian/Pacific Islander, American Indian/Alaska Native) who were approaching graduation with a STEM bachelors degree. These students are part of the Pacific Northwest Louis Stokes Alliance for Minority Participation (PNW LSAMP), a program that provides academic and social support for college STEM students from minoritized racial/ethnic groups. PNW LSAMP includes five universities and four community colleges. All students interviewed for this project were affiliated with PNW LSAMP programs at 4-year universities (which are all predominately/historically White institutions), but some had also been part of a community college LSAMP program, which are smaller cohort-based programs. University LSAMP programs vary somewhat across institutions within the Alliance, but all have an opt-out approach to enrollment. All students from eligible racial/ethnic groups expressing an interest in STEM are automatically affiliated with LSAMP on their university campus unless they elect to opt-out. These students are all included in outreach and publicity about PNW LSAMP events, and are welcome to visit LSAMP Centers. Some programs require students to provide intake information if they visit the center, but the expectation is that it the center is open to all eligible students. LSAMP centers vary in the resources offered, but most provide study/social space for students, textbook lending libraries, computers, printers, and access to LSAMP staff. LSAMP programs also provide services such as tutoring/academic support for students, professional/career development opportunities, information about graduate studies in STEM, peer mentorship programs, summer bridge programming, and research stipends.

Interviews lasted an average of 50 minutes. In these interviews, students were asked questions framed by Yosso's CCW framework regarding the assets they brought to their education and their experience in STEM. The interview protocol is included in Appendix A. We recognize our positionalities may have shaped the form and content of our interviews, both in the topics we chose to focus on and the way the participants responded to us as interviewers. Please refer to our positionality statements at the end of the paper if you would like more information on the perspectives we are operating from as researcher. All students were assigned a pseudonym to preserve anonymity. Details about demographics and social identities of the interview respondents are included in Appendix B. Interviews were coded in NVivo using a pre-determined coding scheme organized around Yosso's CCW framework. After preliminary deductive analyses were completed, we re-visited the data with an inductive approach that allowed for exploration of emergent themes regarding nuance of community cultural wealth dimensions, counterspace processes, and misalignment between assets and institutional policies. The findings below are focused around passages in the data that were coded as both a type of CCW and either a counterspace process or misalignment.

Findings

Preliminary findings from our analysis of interview data align with Margherio et al.'s [6] research highlighting the interplay between CCW and counterspaces. Students who have persisted in STEM into their Junior or Senior year describe LSAMP as a resource that helped them both activate existing forms of capital/cultural resources they possessed entering college and develop skills and networks that contributed to continuing success. Further, examination of challenges students encountered on their STEM pathway highlight limits on the capacity of counterspaces and other student-focused interventions to address equity issues that stem from policies at the organizational and state levels [1], [10]. The discussion of our findings that follows is aimed to explore both dimensions – the protective/supportive nature of counterspaces, and the challenge of relying solely on counterspaces to address systemic racism. We have organized our findings according to areas where we identified a misalignment between student assets and institutional values. Students interviewed for our study possess a great deal of community cultural wealth they bring from their families and backgrounds, and further cultivate within counterspaces on their university campuses. However, there are limits to which aspirational capital can help overcome bureaucratic barriers without ensuring all students have knowledge to the “hidden curriculum” [26]. Involvement in identity-affirming activities that build social, navigational, and resistant capital shouldn't be associated with an opportunity cost for minoritized students. Familial capital should be viewed as such by the institution, and students should not be penalized for having family obligations. Resistant capital developed within counterspaces shouldn't be paired with an expectation that students of color bear the burden of driving institutional change. Institutions should back up expressed commitments to increasing equity with policy and budget decisions that reflect those commitments.

Success shouldn't hinge on aspirational capital

Yosso [5] describes aspirational capital as a “culture of possibility,” whereby families believe and instill the belief in their children that they can transcend current circumstances and succeed in college despite real or perceived barriers (personal or institutional) [11], [12]. In our data, aspirational capital was most frequently expressed as expectations of upward mobility. Participants also described college education as something that was taken as a given when they were growing up. For example, Hector described how his mother had always wanted to be a veterinarian or a nurse but didn't have the education for it and instead worked as a housekeeper: “I saw firsthand what, you know, what that entails. And like that it wasn't really a career I wanted to pursue. And she constantly told me, you know, like this is what you kind of limit yourself to if you don't pursue education.” Similarly, Melissa was motivated by her mother's expectation of upward mobility: “She never went to college, so she didn't have any understanding of what it entailed. But she just said that, in order for you to make money, you have to get a degree, like, so that you don't, like, be low-income like us. You have to get a degree.”

The primary way that aspirational capital contributed to persistence in STEM was through its manifestation as encouragement/motivation/commitment. Students described the ongoing role of their family in helping them stay on course: “They encourage me. Obviously, they don't have the experience...but they still tell me don't give up. There's been times where I've come home and I've just been distraught, completely distraught, you know, because of school or I didn't do good in a class or on a test, and they're just saying, you know, don't give up. It'll all be worth it. So,

they're a big, big help." Aspirational capital did not tend to be expressed as an asset that was activated because of involvement with LSAMP or other identity-based organizations, but more as messages from families or close others that became ingrained in students' personalities and/or served as external sources of motivation. However, perseverance and the ability to hold onto hopes and dreams despite barriers was oftentimes nurtured through social connections made in LSAMP/other organizations.

Student's descriptions of their tenacity and belief in their dreams for the future highlight barriers that could be addressed at the institutional level to improve the experience of students from groups that have been systemically marginalized. For example, Carlos was near the end of his first year in Civil Engineering at a 4-year university after having transferred from Community College as a Junior. Carlos had a strong relationship with his immediate family, extended family, and broader religious community (familial capital) that provided him with both engineering mentors and emotional support (social capital). He wanted to pursue a degree in engineering because of its potential to improve lives and because he wanted to add diversity to postsecondary education by becoming a professor (resistant capital): "it's just the application, like, of engineering that has always stood out to me. It can help. It can be used for good."

Through his experience at a community college and transfer to a four-year university, Carlos had also developed a willingness to ask questions and ability to jump through bureaucratic hoops to get the information and support he needed to navigate the institution (navigational capital). While he possessed both navigational capital and aspirational capital derived from family and faith in God, the large role that these assets played in helping Carlos progress toward his degree and discussion of how they were utilized illuminate failings on the part of his community college to support students without hegemonic cultural capital:

Interviewer: So when you came to college, you said that your mom and dad didn't, uh, don't necessarily have the kind of institutional knowledge about the, about the college experience. Did you feel when you came to college, like you had a pretty good idea of how to navigate logistical things like registering for classes or accessing library resources or seeking out academic help or things like that?

Carlos: Yeah. I remember I had some brief help to sign up for [four-year university] with a friend. And she helped me out and I got denied. And then from there I had to go to [community college]. So it was like a rocky process. I just did not stop asking questions. I went to so many offices and they would be like, Oh, go here, go here, go here. And I just went to these places, like, it was very nerve wracking. I think if I didn't want it as much as I did, I probably would have given up. I think they should make it a little easier because there was a lot of obstacles I ran into along the way. But a lot of it was just me asking questions after another, after another. And it was eventually I got the answer and then eventually I got the task done.

Carlos went on to describe how the social capital developed in the context of LSAMP (both at the community college and partnering four-year university) through the counterspace process of direct relational transactions [4] helped ease his transition: "...that LSAMP bridge helped me so much...Definitely easier than coming out of high school to [community college]." While LSAMP allowed Carlos to access his navigational capital and develop social capital that helped

him on his path, he almost didn't make it that far - his statement that, "if I didn't want it as much as I did, I probably would have given up," illustrates how his opportunities were constrained by institutional limitations despite the community cultural wealth he possessed. Success shouldn't hinge, as Carlos reported, entirely on aspirational capital.

Similar to Carlos, several students described LSAMP as a key source of resources and information to help their persistence – this instrumental social capital was developed through direct relational transactions within LSAMP. According to Sylvia, "everything was just easy after LSAMP." LSAMP served as a site for students to learn the "hidden curriculum" of higher education [26]. The lack of universal advising to teach the hidden curriculum and/or provide holistic support in navigating bureaucratic institutional structures reflects assumptions that students possess hegemonic cultural capital and know where to go and what to ask.

Institutions should support students need for both social identity-affirming spaces and engineering identity development

Narrative identity work and direct relational transactions taking place within counterspaces were instrumental for helping students develop the navigational, social, and resistant capital to help them succeed in STEM. While involvement in these identity-affirming spaces gave them the tools and resources to feel supported and empowered, students were sometimes forced to decide between spending their limited time engaging in counterspaces and engaging in "mainstream" (coded White [10]) engineering organizations.

For example, Marcus described how much of his college career had been shaped by connections he made with students and faculty in the context of various counterspaces, and that his understanding of his social identity developed both through his upbringing and through narrative identity work within campus counterspaces. Because of that narrative identity work, he developed capital to help him navigate institutions not built with him in mind (navigational capital): "I, I've gotten to the point now where I'm kind of used to it where I'll walk into a space. Where it's like, okay, this is obviously not the space where I'm the most welcome, but I'm gonna be here and I'm going to represent. And I'm going to do what I need to do, and I'm going to be myself, and that's just how it's going to be." However, Marcus was stretched thin by his involvement in campus organizations, including both counterspaces and hegemonic organizations:

Interviewer: Are there other organizations that you're involved in? You said LSAMP. What other organizations are you involved in?

Marcus: I'm part of, we have a National Society for Black Engineers. I'm a part of that. As I said I'm a, I'm a mentor or coach rather for [a mentorship program for low income and racially minoritized high school students]. I currently work in the student government. Oh. Like as my job, I am, what else, it's a lot. I'm on a homecoming court on, uh, aye. I lose count. It's on my resume. I'm part of the National Society for Collegiate Scholars. I'm a part of that. I'm, I used to be the vice president of the Black Student Union. I touch a lot of places.

Interviewer: How do you find the time to do all of those things?

Marcus: I don't know. That's a great question. I have been struggling with time management since I got here. It's been, it's been rough. Sometimes it's easy.

Sometimes it's hard. Like today I had like two or three between last night and today I had like three or four homework assignments due and I had to, we had a, an event for Greek life that I had to be a part of. Like, I slept for like three hours last night. I haven't eaten today yet. Like this happens, it happens. But I'm here and I, I'm, I'm, I'm good.

When asked whether he felt like he was part of the engineering community on his campus, Marcus said that his engineering identity wasn't as strong as his peers, in part because of his deeper involvement with counterspaces across campus: "I don't know necessarily if I feel like I'm a part of that community in the same sense that I'm part of other communities. Like I know people who bleed live, eat, sleep, breathe engineering. Like if you ask them who they are, that's their thing is I'm an engineer." Though Marcus was involved in the National Society of Black Engineers (NSBE), he identified more strongly with the Black community than the engineering community.

Similarly, Carlos prioritized LSAMP and SHPE (the Society of Hispanic Professional Engineers) over the micro gravity club when thinking about where to focus his energy: "I was going to join micro gravity but I did not want to overwhelm myself. But just SHPE and LSAMP is primarily my focus." Stephanie also prioritized involvement in LSAMP over other hegemonic organizations: "other than LSAMP, I don't have claim to any other groups on campus or places because I, I live off campus about 30 minutes off campus. And as soon as I'm done for the day or as soon as I'm off work, I just want to go home."

Is there a risk of missing out on more specific content knowledge and applied experience if students have to choose whether to be supported academically or socially/culturally? Organizations like LSAMP, NSBE, and SHPE are helpful for both providing instrumental social capital to succeed in STEM (developed through direct relational transactions) and space for narrative identity work, but what would it look like for students to be given space to both take care of the needs that are met within counterspaces and get the benefits from participation in hegemonic organizations? What could be done to account for the extra time and resources it takes for students to get the emotional and instrumental support they need to thrive in institutions that weren't built with them in mind? Could students be provided with course credit or other currencies for their involvement in counterspaces? Could an anti-racist framework be incorporated into STEM coursework?

Sylvia's experience provides an example of how work within counterspaces can interact with anti-racist curriculum to support sustained motivation and commitment to STEM. Sylvia discussed how she stuck with her conviction to complete a degree in computer science, despite microaggressions she faced as a woman, because she saw a need for more diversity in technology in order to combat algorithmic bias. This was a realization that emerged through her involvement in LSAMP, a women's computing club, and a data science course. The narrative identity work conducted within counterspaces allowed Sylvia to develop resistant capital, which was reinforced by course content that highlighted the way that technology can exacerbate social inequalities. It was encouraging to hear about an effort being made by an instructor to integrate anti-racist curriculum into STEM education – acknowledging the racialized nature of STEM education and the role it can play in challenging race-neutral narratives. Attention to course

content and recognition of the racialized nature of STEM education and STEM fields more broadly can serve to de-center Whiteness.

Institutions should view familial capital as an asset and act accordingly

Consistent with Yosso's findings, several students interviewed for this study described strong bonds with their families and their role in shaping aspirations/motivations as a factor contributing to their success in college. However, participants in this study also mentioned that family responsibilities occasionally detracted time, money, and emotional energy away from their studies. While students themselves saw this as an individual-level barrier that made it difficult to persist in their studies, we argue that a shift in perspective could reframe this as an example of misalignment between CCW and institutional values. In this case, familial capital expressed as a strong commitment to family relationships (and associated obligations) is not valued by institutions of higher education – or is only valued insofar as it conforms to hegemonic cultural expectations of the parent-child relationship. Our educational institutions are not built to value the diverse ways in which kinship networks are structured and intergenerational support occurs within families and communities [27].

For example, Sylvia was approaching graduation with a degree in computer science. Her educational path was supported by the community cultural wealth she carried with her and social and resistant capital further developed in the context of counterspaces. She had a strong relationship with her parents and sister (familial capital). Her parents stressed the value of education as she was growing up and were her primary motivation for going to school, even though they had not been to college themselves (aspirational capital). Her sister helped her enroll in community college and inspired her to pursue computer science as a major (social capital). She felt that her ability to encourage people to come out of their shells and bring groups together set her apart from many of her more "awkward" or "reserved" classmates and was an asset in her education, as was her creativity (linguistic capital). She was encouraged by her dad to always ask for help when she needed it, and she felt that her willingness to ask questions was crucial for getting her through college (navigational capital).

While the community cultural wealth Sylvia possessed and the additional capital developed through her experience with identity-based organizations supported her successful completion of a computer science bachelor's degree, she indicated that she was not planning to pursue a graduate degree because she had an obligation to take care of her aging parents in the wake of her sister's death.

So my parents are elderly. My, well, I don't know if they think they're elderly, but like they're changing now. And my older brothers, they're like 10 and 12 years older than I, so they're kind of like living their own lives. And like I said, one of them has his own family. And so I feel like there's like a responsibility for me to take care of my parents. And actually my sister, like I lost my sister in the summer. So like now it's completely me and I don't really know how to handle that. So I feel like going to graduate school is not feasible until I figure out, you know, how everything will play out. Yeah. So that's pretty much the biggest thing. And I know like people always say, well, maybe you should live your life, but I don't know. It's just like my parents need me, you know.

This is an example of misalignment between the capital possessed by Silvia and the capital valued by the hegemonic academic culture. The rigid and resource-intensive structure required to continue her education prohibited her from pursuing a graduate degree. It was not by lack of will or motivation, but because it was not feasible for her to prioritize it. The field would benefit from her creativity, passion, and perspective. What would it look like for institutions to elevate the value of familial capital? What if Sylvia could get paid the same amount to pursue a graduate degree as she would entering industry after graduation? If education is a social good, shouldn't we be paying students to go to college rather than creating a system whereby it drives people further into debt? Is there a way that both financial and time commitments to family could be factored into aid applications?

Transformational resistant capital and student agency are powerful forces, but anti-racist institutional transformation also requires addressing Whiteness

Counterspaces on college campuses were born out of a need to create a safe haven within White hegemonic institutions [28], and for some, the process of narrative identity work within counterspaces can nurture development of resistant capital and individual agency to make change. Stephanie illustrates her resistant capital as follows:

[LSAMP] has helped motivate me, and not just my academic goals, but like my career goals as well... I was like born and raised here, so I'm used to the low rate of diversity in almost every institution I've belonged to... it's just helped me like motivate myself to like demand like these better systems, whether it's in my classroom and my teachers not really understanding how you can teach history in a different way and speak to two different audiences at the same time and not be as equitable as you could be. Or in the sustainability club, when we want to recruit a new person and we have, you know, 60% of our club is white males and we want to recruit another white male, I mean, maybe we could talk about it. I'm not saying that they're not qualified, but maybe there are other candidates... in the workforce too and like the positions, there's not a lot of women in conservation science or sustainability in general. And so then having women of indigenous backgrounds or women of color who have different perspectives as well is something that I'm interested in finding out more about and being part of that conversation.

Case and Hunter [4] explain that counterspaces are sites where students can express resistance to the dominant culture in two ways – through both individual expression of their own identities in ways devalued by hegemonic culture, and by creating opportunities to critique the oppressive conditions under which they live. Similar to prior research derived from resistance theories, which center the role of human agency in both constructing narratives about the impact of social structures on individual experience and transforming those same social structures [24], Marcus described the power of marginalized students to drive institutional change. He argued that a focus on the persistence of institutional racism, while important for continuing to improve the educational experience of students from groups minoritized in STEM, can sometimes obscure student-driven change that *has* been made:

Marcus: I think that the university likes to identify themselves as like a place with diversity and inclusion... I think that just demographically maybe the message that [my university] is putting to other people is not what you see here... I don't

know the amount of hype that they give themselves matches the amount that the majority of students see. And there's a flip side to that too, where a lot of students don't see the things they are doing.

Interviewer: Do you have an example of that?

Marcus: I think, like, people criticize. They criticized- like, there was a speak out my freshman year, 2015, where students of color kind of had enough and decided they were going to speak out about their experiences. And from that, the university listened, and they established the office of institutional diversity, which we have now, which is an entire office built to tackle some of those problems. And I don't think that students know that, kind of, because it was a long time ago. I think people would just kind of assume that that's just there and they don't do anything. But that was built from student speech, like students made that happen. There's a lot of other things where the students have brought up some kind of something and the university has made it happen, and I think there's just, it's just very cloudy.

Marcus's comments are in-line with prior research that shows how resistant capital developed within counterspaces can be a powerful force. For example, Solórzano and Delgado Bernal explain how awareness of social justice and critiques of oppression developed within Latinx communities and alongside transformational mentors contributed to students' ability to choose "the margin as a site of resistance and empowerment" [24, p. 336].

While these examples provide a promising glimpse into the potential for students to drive change, we must also acknowledge the constraints on agency imposed by educational institutions. As Ray [10] argues, racialized organizations constrain the agency of people of color – students' capacity to influence institutional processes is restricted by how much time they have and organizational expectations of how they use it, differential distribution of resources, and behavioral/emotional expectations. Narrative identity work and development of resistant capital are important process that counterspaces can nurture, but even as students come to see themselves as change agents, the weight of institutional transformation cannot and should not be on the shoulders of students from groups that have been systemically marginalized.

Benitez argues that we need to "move beyond the traditional conceptualization of meeting the needs of minoritized groups on university and college campuses" [28, p. 120] and assist White students in grappling with challenges to their White identity brought on by increased diversification of college campuses. Because of the racialization of existing power structures, anti-racist institutional transformation must not rely entirely on the efforts of people of color. For example, Ray [10] explains how the development of Critical Race Theory by scholars of color was able to take hold in the broader academic community, in part, because individual White professors used their position within racialized power structures to provide mentorship and physical space to support the collective action of critical scholars. It's important that spaces for minoritized students on campus are accompanied by efforts to change the climate and engage White students, faculty, staff, and administration in the process.

White students are increasingly aware of the critiques levelled at educational institutions for their White supremacist tendencies, whether or not they agree with these assertions. Benitez argues that culture centers on college campuses can serve "as possible spaces for the social

deconstruction of “Whiteness” and racial superiority” [28, p. 124]. What might it look like for anti-racist White students, faculty, and staff to be in conversation with counterspaces? How can critical pedagogies that challenge White supremacy be incorporated into the fabric of higher education [29]?

Budget decisions reflect institutional values, and without changes to the financial investments, commitment to anti-racist transformation is just lip service

Students interviewed for this study described a scaffolding of supplemental support provided throughout their educational careers, not only in counterspaces on college campuses. Programs like TRIO and MESA serve to connect students with support further upstream that will help encourage engagement and persistence in STEM. This scaffolding of support and the connections students made with mentors early-on provided social and navigational capital that helped them in college. However, supplemental programs to support students from systemically marginalized groups are limited in resources and serve as Band-Aids for a fundamentally broken system.

To be clear, we do not expect that programs like LSAMP, which are already stretched thin and operating beyond capacity, to take up the mantle of driving systems change. However, these programs can provide valuable insights into the levers of institutional change that would most benefit students from marginalized groups. What can be done to continue sustaining/expanding these programs with institutional financial support rather than expecting grants to fund these programs? How can institutions simultaneously address the organizational and state policies that produce the problems these programs are aiming to solve?

One major area that has been the focus of research on educational inequality since time immemorial and has yet to be resolved at the policy-level and could help reduce (though not eliminate) the need for student-focused interventions is the issue of inequalities in funding [1], [30]. This is true across the board – in the distribution of funding across K-12 districts, the absence of universal free postsecondary education, the allocation of merit-based scholarships, the paltry funding for HBCUs, and the list goes on. In order to truly change the face of STEM, it is crucial that institutions that have made public statements committing to combatting racism back this up both through the way their internal budgets are allocated, and for state-funded college and universities, in their pivotal role as mediators between individual/group change agents and state governments [10].

Future research

The ideas proposed in this preliminary exploration of interview data will inform future research involving students, faculty, and staff on PNW LSAMP campuses. Focus groups with LSAMP students will allow us to further examine the role of student programs like LSAMP in fostering counterspace processes, and missed opportunities within student programs and the university as a whole to recognize/value/amplify the community cultural wealth possessed by students from minoritized groups. Further specification of the misalignment between student assets and institutional policies will feed into research-to-action forums in which students, faculty, and staff come together to discuss research findings and brainstorm strategies for change that could be achievable within their institutional context.

Questions for Conference Attendees:

Our paper has identified several areas where we imagine anti-racist institutional transformation could occur – but our view is limited, and we have yet to identify specific recommendations to offer to university faculty and administrators who are committed to backing up their words with action. We would love to hear from those of you reading this paper and/or attending this conference about other areas of misalignment we have missed, examples of institutions that are really getting things right with regard to anti-racist institutional change, and what practical suggestions you have to address the institutional barriers we’ve identified here. The following questions will be posed (time permitting) during our paper presentation, and are also available on the following Google Form if you are interested in sharing your thoughts/reflections to help us take this paper to the next level: <https://forms.gle/6fJJctCRbMuxoaqx9>

- 1) What are ways that you think institutions could reduce bureaucratic hoops that students have to jump through or streamline process for things like financial aid, registration/enrollment, and community college transfer?
 - a. Do you have examples of ways that institutions are making it really easy for students to navigate the logistics of college, particularly for students who aren’t as familiar with the “hidden curriculum”?
- 2) What could be done to account for the extra time and resources it takes for students to get the emotional and instrumental support they need to thrive in institutions that weren’t built with them in mind?
- 3) We explained an instance in which anti-racist course content was incorporated into a data science course a student took – are there other examples you’ve seen where issues related to equity and inclusion are incorporated into engineering curriculum? How can critical pedagogies that challenge White supremacy be incorporated into the fabric of engineering education?
- 4) What would it look like for institutions to elevate the value of familial capital? Is there a way that both financial and time commitments to family could be factored into aid applications?
- 5) What do you see as the potential for universal free higher education, so students don’t have to choose between family and education, and education doesn’t drive people into debt? What is/should be the role of university actors in pushing for these types of change?
- 6) What might it look like for anti-racist White students, faculty, and staff to be in conversation with counterspaces?
- 7) Has your university made any public statements/declarations regarding institutional racism or commitment to advancing equity over the past year? If yes, how have you seen these statements reflected in budget/policy decisions? Who is or should be holding institutions accountable for putting their words into action?

Positionality

(Author 1) As a middle-class, able-bodied, White, cisgender woman, I bring certain perspectives and assumptions to my work related to dismantling systemic racism and other forms of oppression both within STEM and in the world more broadly. It is important to acknowledge the ways that these perspectives, shaped by both my background and my social identities, influence my perception of the root causes, consequences, and strategies for addressing inequity in STEM education. My race and gender have afforded me the ability to enter and move through spaces

without being perceived as a threat. My class has afforded me access to social capital and high-quality formal education, and the privilege of never fearing that I'd lack any of the essentials I need to survive. My upbringing in a "liberal" family within a politically and culturally conservative region of the country motivated my commitment to social justice but exposed me to a very narrow view of what social justice entails. My knowledge about systems of oppression and understanding of critical theoretical frameworks for interpreting our social world have expanded through engagement with activism and learning about oppression and social inequality within the context of academia, at both a small women's college and a large research university. However, my perspective lacks knowledge gained from lived experience as a member of a marginalized group. I believe that all intellectual pursuits are value-laden, and I approach my work with the intention to use my positions of privilege to challenge White supremacy and contribute to building a more just world. In doing so, I acknowledge the risk that my own blind spots and persistent biases could surface in my research, and invite continued discussion of research findings and their implications with this in mind.

(Author 2) As a non-disabled cisgender non-heterosexual Japanese man born to a lower-middle-class family in Japan, a country in which 97.7% of the total population are Japanese, I bring particular perspectives and assumptions to my research activities. As such, I acknowledge that my research is always incomplete and partial. Some of my social characteristics provide me with privilege, while other characteristics marginalization, and this may vary based on the social-institutional contexts of where I am located, such as living in Japan as a Japanese who speaks Japanese as the first language and living in the United States as an Asian who speaks English as the second language. Using my positionality, my research projects aim to decenter universalized knowledge produced in the studies undertaken in the particular socio-cultural contexts of Western societies and offer an alternative understanding based on a non-Western perspective. I am committed to using my privilege such as being a cisgender man, my experience of marginalization such as being non-heterosexual, and my socially constructed status as the majority in one setting and a minority in another setting to describe, explain, and disrupt systemic racism and other systems of oppression across societies.

(Author 3) As a middle-class white cisgender heterosexual able-bodied (for now) woman, I bring certain perspectives and assumptions to research and evaluation work. My class has assisted me in gaining a university education. My university education introduced me to feminist and anti-racist concepts that have informed my commitment to social justice. My race has granted me the privilege of not increasing my cognitive load when I interact with others in the university. My gender is usually non-consequential in my work, it has sometimes resulted in missed opportunities and changes in the ways others work with me. It has sometimes decreased my feelings of safety in broader society. I understand that my reading and listening and feeling the experiences of others will never let me fully understand the lived experiences of people with marginalized identities. I am committed to doing work that pushes boundaries that will result in societal change to improve justice for systemically marginalized people.

ⁱ Underrepresented Minority is the terminology used by NSF. We prefer the term racially/ethnically minoritized in order to draw attention away from minority status as a static trait and signify the importance of institutional forces in excluding certain groups from STEM

ⁱⁱ We recognize that Asian students are a heterogeneous group both in ethnic identity and experiences of marginalization. Unfortunately, data submitted for NSF reporting purposes do not allow for further disaggregation of this.

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Appendix A: Interview Protocol

Introduction:

Thank you so much for being willing to participate in this study. My name is Emily, and I'm a research scientist at the Center for Evaluation and Research for STEM Equity at the University of Washington. As I mentioned in my email, we're partnering with PNW LSAMP to conduct research over the next 5 years that aims to understand factors contributing to persistence in STEM for students who are from identity groups that have been historically and systemically marginalized in STEM. By that, we mean students who identify as something other than white, cisgender, heterosexual, able-bodied, and/or men.

Our interview will last approximately one hour. I will ask you questions about your upbringing/background, interest/motivation for pursuing studies in STEM, your experience in STEM and at the University as a whole, and your strategies for overcoming challenges (both academic and social).

Do you have any questions or concerns about the interview or about the consent form that you signed? You're welcome to skip any questions you don't feel comfortable answering.

We will be recording the interview. You are welcome to listen to the recording and read the transcription following the interview if you'd like, just follow up with me by email. We can redact any information that you don't want to be part of the study. May I start recording?

Interview:

Background

I'd like to start by asking you some questions about your background and what you thought about your future when you were younger.

1. When you were younger, in middle school or early high school, do you remember what you wanted to be when you grew up?
 - a. What was appealing about that job, from your perspective?
 - b. Were there other people in your family or close community that did that kind of work?
2. When you were younger, did you want to go to college? *Aspirational Capital*
 - a. Do you know what college was? How did you find out?
 - b. Was it something that was discussed in your family?
3. Who do you consider your "family"? *Familial Capital*
 - a. Are these the people you grew up with?
4. How would you describe your family's style of communication? *Linguistic Capital*
 - a. Prompt: direct/indirect, aggressive/passive, confrontational/non-confrontational, loud/quiet, brush it under the rug/air your dirty laundry, etc
 - b. Why do you think your family tends to communicate that way? *Culture?*
Personality?
5. How many languages were spoken in your home when you were growing up? *Linguistic Capital*

6. Sometimes a common experience, language, or way of being leads a group of people to identify as a community. Is there a community or communities beyond your family with which you identify? Which community(s)? *Social Capital*
7. Do you think that being a member of that community influences who you are and what you do today? How so? How did you come to realize that being a member of that community matters/does not matter? *Social Capital*

College Experience

Now I'll ask you some questions about your path to college and what the college experience has been like for you.

8. How did you decide that you wanted to go to college? *Aspirational Capital*
9. How did you decide on your major? *Aspirational Capital*
10. How did your family respond when they found out you wanted to study STEM in college? *Familial Capital*
11. What is your relationship like with your family? How do you think your relationship with your family has affected your educational experience? *Familial Capital*
12. You mentioned that your family [summarize language/communication answer]. Has this communication style followed you into your college experience? How has it affected your educational experience? *Linguistic Capital*
13. Can you think of a specific time when you've struggled in pursuing your STEM degree? What helped you make it through that tough spot? *Aspirational Capital*
14. When you came to college, did you feel like you had a pretty good idea of how to navigate logistical things like registering for classes, accessing library resources, seeking out academic help? *Navigational Capital*
 - a. How do you go about finding the resources you need if you don't immediately know where to find them? Is this something that comes easily to you? *Navigational Capital*
 - b. What kind of resources have been most helpful to you, and what resources do you wish were available that aren't?
15. What kind of connections do you have with other peers in your major? How have these connections affected your academic experience? *Social Capital*
16. How about faculty and staff members? Do you have any faculty/staff that you would consider mentors? What are these relationships like? How have those connections affected your academic experience? *Social Capital*
17. Are you involved in any on-or off-campus clubs or organizations? How has your involvement in these activities affected your academic experience? *Social Capital*
 - a. How would you describe the general atmosphere/environment at your university/in your major?
 - b. What's the place on campus where you feel most at home?
 - c. Where's the place on campus where you feel most out of place?
 - d. What do you do when you're in an environment that feels unsupportive or hostile? *Navigational Capital*
18. Do you engage in social justice/equity-related activities? *Resistant Capital*
 - e. How do your social identities influence (or not) your commitment to engage in solving challenging problems regarding social justice/equity? *Resistant Capital*

Demographics

19. Before we end, I would like to collect a little more information about your social identities. Please just say “pass” if you’d rather not answer any of these questions.
20. How old are you?
21. How do you describe your gender identity?
22. How do you describe your race and/or ethnicity?
23. How do you describe your sexuality?
24. Do you have any disability, impairment, or chronic condition? How do you describe it?

Closing

Thank you again for your cooperation! This is the end of the interview. If you had any comments that you intended to make but missed the opportunity, please feel free to let us know by email. We will email you a \$20 Amazon gift card within the next week.

Appendix B: Participant demographics

Pseudonym	Self-described gender	Age	Major	Number of languages spoken	Self-described race/ethnicity	Self-described sexuality	Self-described disability
Sylvia	woman/female	24	Computer Science	2	Latina/Hispanic	heterosexual	None
Hector	male	22	Physics	2	Hispanic	straight	None
Carlos	male	23	Mechanical Engineering	1	Mexican, Hispanic	straight	None
Melissa	female	21	Geosciences	1	Caucasian, Native American	bisexual	None
Marcus	man	22	Bioengineering	1	Black	heterosexual/straight	None
Stephanie	female	21	Environmental Science	1	African American and Caucasian	heterosexual/straight	None
Alejandro	cis male	27	Evolutionary Biology	2	Mexican American	straight	None
Iris	woman/female	21	Biochemistry	2	Filipino and Nigerian	bi-curious	None
Ali	male	20	Biology	2	Black	heterosexual/straight	None
Jorge	male	30	Electrical Engineering	2	Mexican	straight	hearing loss in one ear
Roberto	cis male	21	Biochemistry	2	Mexican, Latino, Hispanic	straight	None