COMMUNITY-BASED PARTICIPATORY RESEARCH TO IMPROVE ALUMNI TRANSITION FROM AN INTENSIVE RESEARCH TRAINING PROGRAM FOR HISTORICALLY UNDERREPRESENTED UNDERGRADUATES

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Various initiatives for undergraduates from historically underrepresented backgrounds attempt to address disparities in the completion of science, technology, engineering, and mathematics (STEM) degrees and the pursuit of careers in scientific research. Intensive research training programs for historically underrepresented undergraduates may include multiple components, such as authentic research experiences, advising and mentoring, supplemental curriculum, and financial assistance. Following comprehensive support during program participation, the postprogram transition may present a vulnerable period in students' career trajectories. This study used a community-based participatory research (CBPR) approach to investigate the experiences of students completing an intensive research training program to understand and develop recommendations for the postprogram transition process. As a team of program alumni, academic researchers, and program staff, we developed, conducted, and analyzed semistructured, open-ended interviews of recent program alumni and students approaching program completion (n = 11; 55% female, 55% non-White). Applying thematic analysis at semantic and latent levels through a critical paradigm revealed the transition as a bittersweet experience, with feelings of pride and accomplishment mixed with sadness and anxiety. Findings also suggested the transition is described as a narrative influenced by preceding program experiences and adaptations. Financial concerns were prominent, and specific barriers and facilitators of successful transition included aligned mentoring, negotiation of continued research employment, consideration of culture, planning for next steps, and engagement with the scholar community. Collaboratively, we developed recommendations for program improvements potentially relevant to similarly intensive STEM diversity programs. We also highlight the value of a CBPR approach that includes students equitably as coresearchers in program research and evaluation.

KEY WORDS: *community-based participatory research, historically underrepresented students, undergraduate diversity initiatives, STEM research training, financial barriers*

1. INTRODUCTION

For people historically marginalized and underrepresented in science—including women, people of color, and people with disabilities—disparities exist at every level of education and training (Garrison, 2013; Sciences, Engineering, and Medicine, 2011). People from historically underrepresented backgrounds are significantly less likely to complete science, technology, engineering, and mathematics (STEM) degrees and to pursue careers in biomedical, behavioral, and social sciences (National Science Foundation, National Center for Science and Engineering Statistics, 2019). In biomedical research, historically underrepresented minorities are less likely to find employment in the scientific workforce, to enter faculty roles, or to receive major research grants from federal sponsors (Gibbs et al., 2014; Ginther et al., 2011; Mason et al., 2016; Tilghman et al., 2021).

Barriers to successful STEM careers exist on both systemic and individual levels (Pierszalowski et al., 2021; Scott and Martin, 2014). Systemically, career trajectories have been characterized as a pipeline with disproportionate leakage from stage to stage for underrepresented populations (Allen-Ramdial and Campbell, 2014; Jacobs and Simpkins, 2005). Studies have investigated the factors and trends associated with the progression, such as the loss of individuals during their undergraduate education and moving into graduate program enrollment (Meyers et al., 2018; Myers and Pavel, 2011). Yet, few studies have taken a deeper look at the experiences of individuals during key decision points and times of transition in the career trajectory (e.g., Burton and Vicente, 2020; Gibbs and Griffin, 2013; Means and Pyne, 2016).

At the individual level, the reality is more complex than a linear pipeline, with a variety of pathways into and out of education and career experiences (Cannady et al., 2014; Robinson et al., 2018). Many undergraduate research programs for underrepresented students encourage students to proceed directly into a graduate program. However, multiple factors (e.g., interests, opportunities, and constraints) can influence decisions about career goals and ultimate outcomes (Lykkegaard and Ulriksen, 2019; Slovacek et al., 2015; Villarejo et al., 2008). Some students may enroll in graduate school, while others may still be working on their undergraduate degree, may feel compelled to enter employment, or may need to take a break before applying to graduate schools. Noting the significance of such transition points, Valantine and colleagues (2016) state that effective investment in diversity training initiatives "requires that we understand how outcomes at each career stage are influenced by institutional settings and interventions and by individual circumstances and decisions" (p. 3).

To support undergraduate students from historically marginalized backgrounds in STEM education, interventions focus on enhancements to science curricula (Bangera and Brownell, 2014; Zimbardi and Myatt, 2014; Wrighting et al., 2021), meaningful engagement in research experiences (Carter et al., 2009; Hernandez et al., 2018; Lopatto, 2007), and research mentoring (Davis and Jones, 2017; Linn et al., 2015; Thiry and Laursen, 2011). Additionally, programs need to address the psychological, social, cultural, and financial factors that often pose barriers for underrepresented students

(Gazley et al., 2014; Hilts et al., 2018; Hurtado et al., 2007). Research training programs incorporating multiple elements in a comprehensive approach are more likely to support student persistence by promoting motivation and confidence to become a scientist (Graham et al., 2013).

Recognizing both the imperative to diversify the biomedical research workforce and the growing evidence for effective strategies to support students, the National Institutes of Health (NIH) has adopted a systemic approach to support and to study STEM programs for historically underrepresented students at every stage of education and career development (Hurtado et al., 2017; Valantine and Collins, 2015; Valantine et al., 2016). This includes the Building Infrastructure Leading to Diversity (BUILD) initiative to promote the development and testing of innovative research training models for underrepresented undergraduate students in biomedical sciences (National Institutes of Health, 2020).

The current study sought to understand the experiences of historically underrepresented undergraduates upon completing their 3-year comprehensive biomedical research training program offered by one of the grantees funded through the NIH BUILD initiative. We undertook this investigation after recognizing—in part through feedback from program alumni themselves—that completing the intensive intervention and losing its resources could pose challenges at a crucial time in the students' career trajectories. For example, the ending of program services designed to support and sustain students could require significant adaptations for many students lacking sufficient resources on their own. The resulting stressors could be particularly noteworthy in an equity program for underrepresented students that provides access to funding, mentoring, social capital, and camaraderie (Estrada et al., 2011; Gibau, 2015; Hurtado et al., 2007). Consequently, the goal of the program's leadership was to better understand the transition experience and to identify postprogram services or supports for alumni still working to earn their undergraduate degree or planning a period of employment before enrolling in a graduate program.

However, program leadership had concerns about collecting in-depth data from the alumni. As an initiative of the NIH, which views these demonstration projects as research sites for studying effective training strategies, student participants had completed many evaluation surveys throughout their time with the program and complained of research fatigue. Program leadership was concerned that engaging the alumni in additional surveys would be difficult, particularly as the students were no longer in the program. Additionally, research conducted on students by faculty may pose issues related to power inequity. The disadvantaged and marginalized backgrounds of the students, and the fact that faculty had been providing direct, personal support to the students, could have the potential to exacerbate typical power inequities between researchers and subjects.

To help minimize these concerns, program leadership decided to use a community-based participatory research (CBPR) approach. CBPR is an approach to inquiry that places academic researchers and community members as equitable partners in conducting research that the community prioritizes (Israel et al., 2005). A branch of action research developed within public health, CBPR intends to equalize power between academics and minority communities and to help with issues such as recruitment, community trust, and community engagement. In the CBPR paradigm, community members partner with re-

searchers to carry out all phases of the research endeavor, including conceptualizing and designing the study, collecting and analyzing the data, and generating conclusions and recommendations. An explicit goal of CBPR is to foster changes and solve problems that are important to community members (Nicolaidis and Raymaker, 2015). Figure 1 highlights the general principles of CBPR from the perspectives of community participants (top panel) and academic researchers (bottom panel) and depicts the actual collaborative steps involved in development, implementation, and dissemination of this approach for the current study (middle panel). Student alumni who recognized the need for better support around the transition from the program were willing to undertake this type of project, reflecting a strong sense of community identity through their shared experience of the intensive undergraduate program. In fact, M.S., the alumni co–principal investigator (PI) for the project, had posed a similar idea while still in the program.

The objectives of this study were to (1) use a community-based participatory research approach to qualitatively understand the transition experience of students completing an intensive research training program; (2) identify student needs and preferences for postprogram support, and (3) understand, synthesize, and make program-level recommendations to meet those needs based on the findings. We also sought to explore the feasibility and value of taking a CBPR approach in collaboration with students in higher education research, especially with communities of students who come from historically underrepresented and marginalized backgrounds.

2. METHOD

2.1 Intervention Description

BUILD EXITO (EXITO: Enhancing Cross-Disciplinary Infrastructure and Training at Oregon) is one of 10 demonstration project grantees supported through the NIH-funded
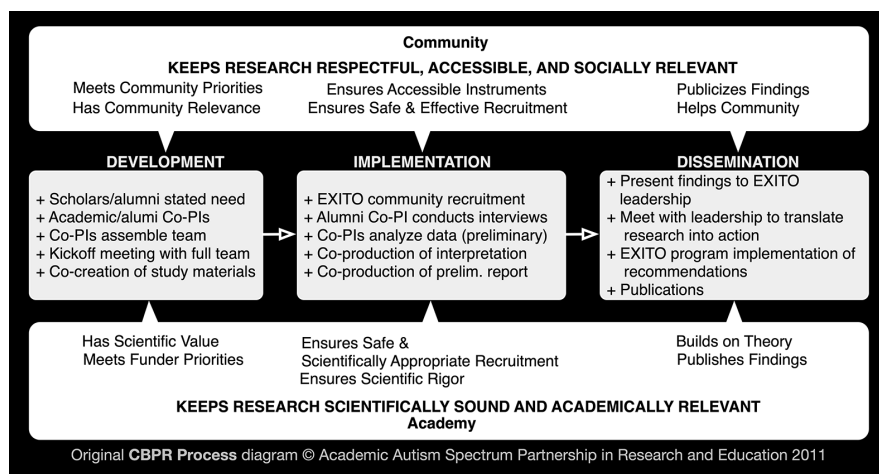

FIG. 1: Community-based participatory research process and procedures

BUILD initiative to develop, implement, evaluate, and disseminate innovative undergraduate research training models for students underrepresented in biomedical science (see Richardson et al., 2017). BUILD EXITO is implemented through a collaborative, multi-institutional consortium led by Portland State University (PSU)—a major public urban university that prioritizes student access and opportunity—in partnership with a research-intensive academic health center, Oregon Health and Science University (OHSU). Our BUILD EXITO consortium network also includes six two-year and three four-year partner institutions of higher education in four U.S. states (Oregon, Washington, Alaska, Hawai'i) and three U.S. territories (American Samoa, Commonwealth of the Northern Mariana Islands, and Guam). Our community college partners recruit and enroll EXITO scholars on their campuses and implement the first year of the BUILD EXITO program before scholars transfer to the primary institution. Scholars recruited to BUILD EXITO at PSU or at a four-year university partner complete the entire program at their home institution.

BUILD EXITO consists of a comprehensive, three-year, developmentally sequenced research training experience designed to accommodate multiple biomedical majors and disciplines (e.g., natural and social sciences), multiple partner institutions, and transfer students. Participants are recruited and selected through a competitive application process from student populations defined by NIH as historically underrepresented in the biomedical workforce (i.e., underrepresented racial/ethnic minority students, students with disabilities, and students from disadvantaged backgrounds; see https://diversity. nih.gov/about-us/population-underrepresented). Over the three-year developmental pathway, the BUILD EXITO training model weaves together multiple program components providing personal, social, academic, and financial supports to promote scholar success leading to graduate studies and research careers. Central components of the training model include an integrated curriculum (coursework, summer research seminars, and professional development workshops called "Enrichment"; see Marriott et al., 2021), a long-term research internship in a research learning community (RLC; an active research lab; see Honoré et al., 2020), multifaceted mentoring (research, career, and peer mentors; see Keller and Lindwall, 2020), a supportive environment (study/meeting spaces, advising, service referrals), and a trainee funding package (including both tuition remission and trainee stipend). At the end of the three years, scholars graduate from the program and transition to graduate school, work, or completion of their undergraduate degree.

2.2 Positionality and Process of Community-Based Participatory Research Approach

BUILD EXITO leadership (T.E.K., a White, male tenured professor and project investigator) approached the first and second authors of this paper (D.M.R., a queer, genderqueer, autistic person who is a research associate professor and BUILD EXITO research mentor; M.S., a White, nonbinary femme program alumna who transferred from a local community college partner and who has continued to work in D.M.R.'s lab) to colead

the study. In building the CBPR team, M.S. and D.M.R. felt it was important to include a majority of alumni, to have a staff member with knowledge of the program's operations and resources, and for the alumni to feel comfortable with the staff representative. M.S. conducted outreach to alumni she knew across multiple program cohorts and recruited A.W. (an Asian woman, who attended university at a partner institution, now in medical school) and D.L.P. (a program alumna who transferred from a Pacific Island partner community college) to join the group. At that stage, the team, along with T.E.K. and program leadership, discussed good options for the staff member. Our original staff member left employment with the program, and R.M. (a program manager) stepped in to complete the majority of the work in this role. Collectively, the CBPR team (D.M.R., M.S., A.S., D.L.P., R.M.) codeveloped the research materials, including the consent forms, fliers, and interview guides; assisted with recruitment; discussed preliminary findings; helped interpret and finalize the findings; and identified key recommendations and next steps. Specifically, the full CBPR team met six times: twice early in the project to refine our protocol and collaboratively develop study materials, twice during and after data collection to discuss and interpret data, and twice to compile the report to the program and to develop a requested conference presentation. All coauthors contributed to the development of this manuscript, with D.M.R. and T.E.K. writing significant portions. Due to the team's geographic distribution, we met through video conference. Figure 1 outlines the tasks of the team at all stages of the research process.

2.3 Research Design

Our qualitative research design consisted of 11 individual semistructured interviews offered in multiple modes to maximize accessibility: in person (if feasible), telephone, text-based chat, email, or video conference. We offered participants $30 in recognition of their time. The constructs covered in the half-hour interview guide included reflections on the transition experience, barriers and facilitators to transition, and resources and supports for transition, both provided and lacking.

2.4 Study Participants

All study participants were from our BUILD EXITO program and not any other NIH BUILD grantees. Study participants were from the first three BUILD EXITO cohorts across multiple partner institutions. Two cohorts (cohort 1A, n = 16, and cohort 1B, n = 58, both entering the program in spring 2015) had completed the program. The third cohort (cohort 2, n = 94, recruited to the program in spring 2016) was in its final term. The first cohort, 1A, completed the program while intervention components were still under development and experienced the first-time implementation. Although other cohorts were actively participating in BUILD EXITO at the time of this study, we recruited only from those cohorts that had experienced, or were about to experience, a transition out of the program.

Study participants were 11 current and former BUILD EXITO scholars from cohorts 1A (n = 2), 1B (n = 5), and 2 (n = 4). The participants had finished the program and had

enrolled in graduate school (n = 3); had finished the program and were still completing the BA/BS or had completed the BA/BS but not gone to graduate school (n = 4); or were nearing completion and transition from the program (n = 4). We purposively sampled participants to cover those three scenarios. Study participants ranged in age from 21 to 41 years (mean = 25.6, SD = 6.3). The sample represented a diversity of genders, sexual orientations, and racial and ethnic demographics, but a majority identified as female (55%), straight (55%), and non-White (55%). A majority also had a background indicating social or economic disadvantage: 64% were first-generation college students and 64% received need-based financial aid. In addition, in the current sample, 55% were transfer students from community college settings, 18% identified as having a disability, and 9% had a history of engagement with the foster care system. On most of these demographic factors, this sample was fairly representative of the overall enrollment of scholars in the same cohorts (n = 167): 70% female, 56% non-White, 64% first generation, 72% financial aid recipients, 38% transfer students, 7% with identified disability, and 11% foster care experience.

2.5 Protection of Vulnerable Populations

The Institutional Review Board at the primary institution approved the procedures for this study. We informed all participants of their rights and obtained informed consent before engaging in the research interviews. The consent materials emphasized that participation in the study would have no bearing on their grades, academic standing, or involvement with BUILD EXITO, and that they could decline to participate, withdraw at any time, or refuse to answer any questions without any repercussions or consequences. Also, consent materials explained that all interview responses would be deidentified and summarized by D.M.R. and M.S. before being shared with any BUILD EXITO investigators or staff. During the interviews, M.S. monitored ongoing consent, including attending to subtle cues that might indicate resistance or disinclination to participate. None of the participants were D.M.R.'s or T.E.K.'s students or mentees.

2.6 Recruitment

The alumni on the CBPR team developed both the recruitment flier and recruitment plan. The BUILD EXITO program's graphic designer helped us to convert it into a graphic suitable for social media, and the alumni provided feedback on the final design. The alumni led a broad outreach and recruitment effort attempting to contact all members of the relevant cohorts by posting materials to the BUILD EXITO consortium-only groups on Facebook and Instagram, email lists, and by word-of-mouth and direct contact with former scholars. The alumni felt strongly that recruitment coming from other scholars would set our study apart and overcome the research fatigue others had complained about. From the pool of potential participants who responded to the outreach and expressed interest in the study, we used maximum variation sampling (Creswell and Clark, 2011), a purposive sampling strategy that aids in increasing understanding by purposefully selecting participants who bring different perspectives. We purposively

sampled participants to maximize diversity within three scenarios of transition out of the program: (1) scholars who had completed the program and had gone to a graduate program, (2) scholars who had completed the program but were still finishing their BA/BS, and (3) scholars who were still enrolled in the program but nearing completion.

2.7 Data Collection

After a brief screening for purposive sampling on population (current scholar, graduate school, completing BA/BS, or work or other), M.S. conducted all interviews via email, telephone, video conference, instant messaging, or in person. M.S. recorded all telephone, video conference, and in-person interviews; D.M.R. and R.M. transcribed them. We deidentified transcripts during the transcription process and created deidentified versions of the email and instant messaging interviews prior to analysis.

2.8 Analysis

We conducted an inductive thematic analysis at both semantic and latent levels (Braun and Clarke, 2006), lensed through a critical (coconstructed, contextualized) paradigm (Scotland, 2012) and framed by our research aims. The co-PIs, D.M.R. and M.S., read through or listened to the interviews and jointly developed a preliminary code set, discussing findings and forming consensus between them, which they brought to the full team for discussion (see Fig. 1). M.S. and R.M. then coded the full set of transcripts using the preliminary codes as a starting place. M.S., R.M., and D.M.R. met multiple times to discuss the emerging themes, reconcile differences of opinion, and develop a set of preliminary themes and recommendations for the program. We then brought the preliminary themes and summary of participant recommendations to the full CBPR team for further interpretation and finalization.

For verification and trustworthiness (Grbich, 2007), in addition to using multiple coders and peer debriefing among coders, the alumni on the team reviewed the findings in a process similar to member checking. We further employed reflexivity and transparency in our discussions, both among coders and with the team. We developed the recommendations described in this report together based on the findings. After completing the analysis and report, we learned that BUILD EXITO had made some changes to transition programming for cohort 2 that could have affected some of our findings. We therefore shared a copy of the report with the two cohort-2 scholars in D.M.R.'s lab and asked them to comment on the findings, including if they found them relevant to their own experiences. The scholars deeply related to many of the findings, and their feedback served as another layer of member checking for the study findings.

3. RESULTS

We asked participants about their experiences during their transition out of BUILD EXITO, the things that made the transition easier or harder, and their ideas for im-

provement. Scholar experiences nearly unanimously reflected themes of *transition is a bittersweet experience*, *transition is a continuous process*, and *financial anxiety*. These themes were present regardless of how smooth an experience the alumni felt they had. Barriers and facilitators connected in participant narratives with ideas for improvement (i.e., typically the ideas for improvement were related to something that had worked well or poorly for them in facilitating a smooth transition out of the program). The main themes related to barriers and facilitators were *successful mentor match*, *navigating principal investigator and lab transitions*, *focused one-on-one mentorship*, *consideration of culture*, *delineation of next steps*, and *scholar community engagement*.

3.1 Transition Experiences

3.1.1 Transition is a Bittersweet Experience

Participants described exiting the BUILD EXITO as a "bittersweet" experience characterized by a mixture of emotions. They identified a sense of pride and accomplishment, and of happiness, at successfully completing the program. Several participants also talked about it feeling good to give back, either to future BUILD EXITO graduates through a continuing relationship with the program, or to the world through their future science career. Overwhelmingly, they described a feeling of gratefulness to BUILD EXITO, including the opportunities it opened up and afforded to them:

> *Before and during, I felt a lot of personal pride and also pride in my cohort-mates for being in the very first cohort to graduate from the program. I was grateful to have been given such a huge opportunity to do unique research.*

However, participants also expressed personal anxieties in relation to their success in completing BUILD EXITO. For example, one feared letting others down if they did not live up to the potential the program expected:

> *I need to do good, otherwise I've wasted my time here, I've wasted other people's resources here, and one of my fears is if I do go to med school grad school whatever I end up doing, uh, I'm kind of—I'm kind of afraid of letting people down or if I don't reach my full potential I'll feel like I've wasted people's time, so that's one of the fears I've had.*

Another described, "I almost felt like a failure for not being as accomplished as other alumni. I could've done more work in my lab and took advantage of the help and support BUILD EXITO had…"

In addition, participants felt sad to say goodbye to friends, social events, the BUILD EXITO community, and their RLCs because of the powerful joy and solidarity found

in the camaraderie formed in their time as scholars. As one participant shared, "It was a real bittersweet feeling. I was happy to finish the program but sad to say bye to some friends who were on to the next stage of life/career."

The intense bond and the strong sense of camaraderie among scholars were illuminated when they expressed their desire for alumni to have a way to keep in contact with their cohort-mates postprogram and graduation. One participant noted, "I definitely think that the camaraderie and that personal connection, getting to know people, um, is gonna be hugely missed, and I think that's part of the reason I am so interested in keeping those connections."

3.1.2 Transition as a Narrative

When asked to "tell a story of their experience transitioning out of the BUILD EXITO program," participants often responded by detailing their experience with BUILD EXITO in its entirety, linking the transition to what had transpired before. In other words, participants described their transition from the program within the context of a larger narrative regarding their journey through the program. It became clear that each milestone experience informed the next and that it was impossible to describe one without also describing the other due to their deep connection. For example:

> *Completing the program was a major milestone of my time at Portland State. As a nontraditional student coming into college without any experience in research, watching my progression as a scientist from start to finish was incredible. There were definitely moments during the program where I either questioned my ability to engage in research or was feeling burnt out, but the relationships that I built in the program with other students and faculty kept me motivated. Finally graduating from the program showed myself that I was capable of contributing productively to STEM.*

When describing the transition out of BUILD EXITO, participants transferring from community college partner institutions often detailed their move to Oregon and/or Portland State University, how they acclimated to the new culture, and how asking for help or knowing how to ask for help was not intuitive. These instances formed their first transition experience and informed their experience during and transitioning out of the program. Sometimes these experiences generated a positive experience all the way through to transition:

> *When I first started...I had a really good lab and a really good support system there, and they kinda helped me transition from me having to move out of my mom's house for the first time in my life...and I had a pretty good support system up in my lab how to do research, how to have a really good work-life balance,...basically what the culture of...research is, and then I also have some*

good friends that [I] made through EXITO who—we all share deep mutual understanding or strength for one another because we all know that we did what we need to do and we're all here to help each other out [after transition from the program].

Other times transitions left participants lacking resources for their unique needs (e.g., cultural, familial, financial, linguistic, etc.). Lacking these resources also contributed to and informed the scholars' experiences with transition. For example, one participant earlier had described leaving all of their social and material resources behind on the Pacific Islands to engage with the program:

The last term...really scares me because [it's] like coming out of nowhere...and like packing all my stuff and moving here without family I don't know who's supposed to, uh, I feel scared that, like, I'm like homeless or something, because it's only me that can like help myself but obvious so I have to like go around and like ask people for help.

3.1.3 Financial Anxiety

Participants also related financial anxieties, describing financial stressors as making the transition more difficult. These anxieties included not knowing how to talk to their RLC research mentor (i.e., lab PI) about continuing to work in the lab, difficulties figuring out financial aid after losing tuition remission due to the transition, reverting back to out-of-state student status and having to "go through hoops" to obtain financial aid, and general anxiety about how to pay for the final term or year of education. One participant explained:

[I've been] just talking to a bunch of people on how I can be able to afford for the upcoming term…because EXITO's ending and there's no funding that means, like, something that I never worried about coming in here, now I have to worry about [it].

Conversely, connecting to new financial support was helpful in a smooth transition. This included retaining paid positions in RLCs, connecting with financial aid, and having sufficient time to prepare for the loss of financial support, since all scholars know at the start of the program that financial support will end before their final term. Participants highlighted gaining and maintaining employment after the RLC portion of BUILD EXITO ends as vital to a smooth transition out of the program and on to their next step, noting that they were grateful or felt "lucky" to have the financial piece in place. As one participant shared, "I just was super lucky I had a fulltime job after graduation…like straight out of college you know, and so that is a luxury that a lot of…students who are way better than me don't have."

3.2 Barriers and Facilitators to Transition

3.2.1 Mentoring Matters

Connecting with mentors is an important aspect of the BUILD EXITO experience. Participants talked about how both the nature of their relationships with mentors and the content of mentorship sessions influenced the smoothness of their transition experiences. This theme is comprised of three subthemes: (1) success of mentor match (i.e., did the scholar have any mentors they felt a connection with); (2) focused one-on-one mentorship (i.e., direct interactions tailored around the scholar's specific transition concerns from any of their mentors); (3) navigating PI (research mentor) and lab transitions (i.e., experiences specifically with the mentor connected with financial and work transitions).

3.2.1.1 Success of Mentor Match

Many scholars reported feeling that support from one or more of their assigned BUILD EXITO mentor(s) was invaluable. Those who self-reported a smooth transition also reported having a mentor who matched within their interest areas, was flexible, was available and present for meetings, and provided continuity throughout the program and sometimes beyond it. For example, one scholar described a mentor who demonstrated a very intentional focus on the transition, "My research mentor did a really good job at sitting down with me and talking about my experience, what could be improved for future scholars, and what I wanted out of life in the future." Sometimes having a great mentoring experience made exiting the program more poignant, as noted by another scholar: "I will miss my lab the most! I did not know how it was going to go for me, my family never did research, but my PIs welcomed me and made me feel right at home!"

In contrast, having a poor mentor match was considered a barrier to the overall experience and smooth transition, mainly because continuity and intersecting interests were so vital. One scholar specifically stated that having different paths and backgrounds didn't allow for their mentor match to be as beneficial as it could have been, "I found my mentors helpful and trustworthy, but, of course, my past and path is different compared to theirs. If I wanted a different career or education choice, they wouldn't be my go-to person for specific details about it."

3.2.1.2 Focused One-to-One Mentorship

Many participants talked about how focused one-on-one mentorship was or would be a facilitator in the transition out of BUILD EXITO and out of their undergraduate career. These focused meetings were specific, individualized preparatory meetings with an assigned (e.g., career, research, or peer mentor) or nonassigned (peer-to-peer, staff member, lab member, etc.) mentor. Those who did have focused one-on-one mentorship spoke about how the meetings with a well-matched mentor and a focus on individual-

ized preparation paved the way for a smooth transition out of the program and on to their next step. One scholar said:

> *I found that routinely meeting with a couple specific faculty members was extremely helpful. Specifically, my career mentors [redacted]. Both faculty members were instrumental in my success in the program and getting into medical school. I would meet with both on a regular basis to discuss medical school admissions and the steps I needed to take to become a competitive applicant.*

In the same vein, participants agreed that BUILD EXITO could provide more structured opportunities for individualized meetings with a mentor who took a similar path to theirs after graduation. For example, a scholar planning to take time off and work would be able to meet with a mentor who also took time off after undergraduate school to work. Ideally, these meetings would take place both before and after their transition. This is especially important for scholars who have different needs from the majority of their cohort, who may not have met regularly with their career mentor, or who are planning to go into a STEM field that is markedly different from that of their assigned mentors. As one scholar shared:

> *I think most of [the program staff] understand that the majority [of scholars] are biomedical so there might be a sense that 'everyone's on the same page' when in reality there are the outliers [in] environmental science or like physics or like all these other majors that might not be in the same mindset as all the biomedical people. So [having mentors to] just kinda check-in and be like, kind of fill that void...*

3.2.1.3 Navigating PI (Research Mentor) and Lab Transitions

A scholar's relationship with their lab PI—typically their research mentor—can be a barrier or facilitator of success, not only with achieving goals within the program, but also with their transition out of the program. When scholars transition out of the program, their relationship with their research mentor also transitions; alumni go from being undergraduate research scholars to potential employees. Scholars often described the relationship with their PI or research mentor becoming complicated by financial anxiety and difficulty communicating within the new relationship context. Scholars who experienced smooth transitions had healthy relationships with their research mentor and were able to have straightforward conversations with them about their future in the lab:

> *Because I have [a PI] that communicates so clearly that I do have a really good relationship with, it was a really easy conversation [about staying on in the lab]. I felt wanted, I feel valued, and I know that not every relationship between the scholar and the PI is that way.*

Scholars who did not have a relationship with their PI or research mentor that allowed for that type of conversation described increased anxiety around finances and employment next steps, and difficulty navigating the new relationship with their PI. One person noted, "My PI actually was the one who ended up approaching me on the issue. Had he not, that conversation may never have occurred, and I wouldn't have been fairly compensated for my time and efforts." Another participant described the confusion around navigating the new relationship with their PI, "… [Talking to your PI is] one of those hard things that if you don't know you don't know, so how can people who don't know how [to] ask for specifics?"

3.2.2 Cultural Considerations

Being a program focused on students from marginalized and disadvantaged backgrounds, cultural competency has been a priority for the BUILD EXITO program. However, for some the program fell short of this goal. For example, Pacific Islander scholars who experienced barriers to a successful transition related communication, language, and culturally based expectations. Here a scholar explains difficulties associated with communication and language, and how their culture impacted those experiences. For example, one participant provided the following insight:

> *Because of my culture (being respectful and shy—not asking people for help because we feel they are too busy or we feel uneducated), I didn't feel comfortable expressing my concerns. Coming to the states was like a whole new world for me. I didn't know how to fit in or to voice out to people who talk fast, and I felt expected to know what I wanted to do right after graduating....*

Specifically, Pacific Islander scholars reported a sense of extreme loss (family, friends, home, etc.) on top of having to learn how to navigate a new place and system. Participants highlighted the need for BUILD EXITO to pay more attention to factors such as the pace of communication, the use of scientific or programmatic jargon, and unclear expectations for students acclimating and adjusting to their new journey at PSU:

> *There's just so many things I didn't know how to do even just like alone, just surviving, and just surviving by myself because I'm just out here by myself and I didn't have family or friends with me so that was the hard part.*

Another scholar details how their rough transition from their island home and from a semester to quarterly schedule caused them to need another year of school:

> *I feel like another barrier was like, coming from Pacific Islands, like I said, our education standards and everything is so different, it's like my first year I really struggled because I had like a semester and then here everything is like quick and everything is like, um, just everything here is just quick, and I and for me*

> *like back home because I didn't have like much resources, like my first year I had to figure out everything, and because there were so many trial errors in my first year I feel like it took me an extra year.*

These cultural challenges were a pervasive part of the scholars' experiences from the start of the program, as illustrated by the theme *transition is a continuous process*, and influenced the options available to scholars after completing the program.

3.2.3 Delineation of Next Steps

A majority of participants identified that having their next steps explicitly delineated acted as a facilitator to their success in the transition out of the program. Next steps might include employment, graduate school, medical school, a year break, etc. It was important to identify the concrete actions the scholar had to take to get to that "next step." A scholar describes their experience and provides commentary on having a next step plan:

> *I have a next step and that's helpful because I know kind of what's coming where I'm going. And as I'm listening to other scholars [and] what I notice is people who have that next step, maybe they're just a little bit more calm, which makes sense.*

Conversely, participants described not having that next step planned out as a barrier to a smooth transition, increasing uncertainty and decreasing confidence. Some participants suggested that if a scholar still needs to complete a year of undergraduate work after transitioning out of the program, they may need additional support regarding next steps during their final year, even if they are no longer a BUILD EXITO scholar. For instance, one participant said, "I knew I had different options when I graduated, but I didn't know how to navigate the system. I didn't really know specific steps to get into grad school and specific steps to seek financial support."

3.2.4 Maintaining Engagement with Scholar Community

Multiple scholars described how retaining a connection to BUILD EXITO as an alumnus helped create a smoother transition. They cited multiple ways in which they retained that connection: becoming a peer mentor, continuing to work in their RLC, receiving reassurance from the BUILD EXITO staff that future contact was okay, continuing meetings with career or research mentors, and staying in contact with friends in the program. One scholar who had become a peer mentor stated, "I never really felt like I had left the program because the support network was still there for me if I needed it."

Scholars had a more difficult transition experience if they were less sure of how to retain a connection with the program or peers, did not realize they could still contact staff, or felt like their labs and mentors abruptly dropped them. One scholar summarized

the need for processes to facilitate exit from the program and structures to maintain the connections established:

> *I think it'd just be cool to know that there's still, like, alumni support in terms of, like, so you didn't get into grad school what do you do now thing… It's like these are resources that are still available to you that we can share with you. Like, for a moment [it] feels like you're done with them, that you're cut off from all the BUILD EXITO, it's like you've been with them for those—that long, and you've had constant connection with them and access to resources. So, when it ended it was like—it just felt very sudden.*

3.3 Recommendations

To complete the CBPR process, the research team generated a set of conclusions based on the findings that were presented in the form of recommendations for program improvement. These recommendations are summarized as follows:

- Offer a structured off-boarding process in the final stages of the program.
- Ensure supportive and culturally relevant mentoring for all scholars, especially for transferring students.
- Coach both mentors and scholars on discussions about the possibility of continuing research/employment opportunities.
- Communicate clear expectations regarding level of continuing access to mentors and program supports.
- Support continuing connections to the program through creation of an alumni network and alumni newsletter.
- Incorporate more intentional preparation for the transition process into enrichment workshop sessions.

4. DISCUSSION

The goal of this study was to better understand the experiences of historically underrepresented students exiting an intensive undergraduate research training program and to identify areas for program improvement and postprogram services and supports. This study is one of the first to investigate the phenomenon of transition and adjustment after completion of a STEM research training program for undergraduates. Scholars reported a "bittersweet" experience of ending the program—proud of their achievement and grateful to the program but also sad to leave friends, support structures, and labs behind. Scholars also expressed financial anxieties and were worried about letting the program down after it had invested in them. They also made it clear that transition wasn't something that happened at the moment of program completion but was a continuous process, with early experiences greatly influencing their eventual experience of graduation. Facilitators to a smooth transition most frequently involved retaining a connection to the

program, quickly securing new financial support, having a strong positive relationship with at least one mentor, and making use of existing ongoing program supports. Barriers to a smooth transition most frequently involved financial stress and lack of preparedness or sufficiently customized transition resources and skills (including culturally customized). Another challenge was difficulty navigating how to ask for assistance, either because they did not realize they could ask or because they did not feel comfortable asking or know how to ask. In general, scholars deeply missed regular connections with their peer cohorts and with their labs.

Our findings further and deepen what is known about transitions from an intensive STEM undergraduate diversity program and are consistent with the notion that pathways through a research career are diverse, complicated, and contextualized (Cannady et al., 2014). The findings also highlight the value of qualitative studies that raise the voices of underrepresented students in STEM intervention programs to understand their experiences within overlapping contexts of achievement, marginalization, and background (Gibau, 2015). Along with their pride of accomplishment in completing the training program, participants in the study expressed a sense of loss, particularly with respect to financial support and program community. These sentiments reflect findings from another comprehensive research program for underrepresented undergraduates in which students reported the two most beneficial elements were financial scholarship and being part of the program community (Maton et al., 2012). Research has identified financial concerns as a factor limiting the STEM education and employment choices of historically underrepresented students (Burton and Vicente, 2020; Pierszalowski et al., 2021). In addition, having strong peer networks and feeling a sense of community within a university are important predictors of academic success and persistence, notably for transfer students in STEM disciplines (Maunder, 2018; Townley et al., 2013). Likewise, being integrated into a social community with shared values regarding science promotes motivation and persistence in STEM (Estrada et al., 2011).

Another important insight from the study participants pertains to the psychic burden of feeling pressure to achieve, to live up to expectations, and to not disappoint. Some participants felt underprepared to deal with future failure or disappointment, such as being uncertain how to proceed if they didn't get into a graduate program. These concerns seem consistent with other students in high-achieving contexts who often experience elevated stress related to performance expectations (Luthar et al., 2019). Furthermore, conscientious, striving, high-performing students from racially and economically marginalized backgrounds can experience a physical toll from the stresses of college, with an elevated allostatic load causing negative health consequences (Gaydosh et al., 2018; Miller et al., 2016). Understanding how a program meant to provide opportunity and encouragement could inadvertently impose extra pressures on participants suggests a need to alleviate expectations through unconditional support. An additional approach is to communicate with scholars regarding a wider range of postgraduate pathways, including those available through the systemic continuum of NIH training programs for each stage of career development (Valantine et al., 2016). For example, students from undergraduate programs who don't plan to enter graduate school immediately can be

linked with postbaccalaureate training opportunities, such as those afforded by the Post-Baccalaureate Research Education Program (PREP) mechanism.

Our findings suggest that experiences during participation in a research training program shape the nature of the transition out of the program, particularly for students who may have transferred from a prior institution to participate in the program. A substantial proportion of BUILD EXITO scholars begin the program at local community colleges or more distant partner institutions in Pacific Island territories. Such students may experience "transfer shock" that requires adjustment to different institutional norms and expectations associated with academics, interactions with faculty, and level of independence (Elliott and Lakin, 2021). Moving into different academic and community contexts can have significant implications for the development of science identity, especially when overlaid with sociocultural background and family history (Zuckerman and Lo, 2021). For example, underrepresented students may lack a sense of inclusion and belonging within the culture of a predominantly White institution (Maramba, 2008). For transferring Pacific Islander scholars in particular, loss of familial supports, adapting to a new culture and education system, and dealing with language differences reflect the challenges of international exchange students (Constantine et al., 2005; Wu et al., 2015). Leaving BUILD EXITO may be unnerving to those who relied on the support structures and community of peers the program offered them as incoming transfer students. In addition to adapting to new settings, transfer students have a shorter period to establish networks to sustain them through the transition from the program.

Study participants also emphasized the significance of mentoring relationships in supporting the transition out of the program. BUILD EXITO implements a multifaceted mentoring model in which each scholar experiences peer mentoring, faculty mentoring, and research mentoring. By design, each mentor has a different functional role, and analyses have confirmed that each type of mentor provides a distinctive pattern of support (Keller and Lindwall, 2020). For example, peer mentors address scholars' personal lives, academic skills, and connections to campus programs and services. Career mentors focus on advising related to academics, academic progress, and careers. Research mentors primarily engage scholars in research-related training activities, although they also can provide career advising and address personal circumstances.

Forming strong relationships with these mentors and having a good mentor match were often pivotal in the transition experience. These findings resonate with previous research regarding the value of culturally relevant mentoring that provides socioemotional support and professional socialization for underrepresented students in STEM (Haeger and Fresquez, 2016; Thiry and Laursen, 2011). Our findings suggest the importance of a connection with at least one mentor who has personal experience relevant to the scholar's individualized trajectory at transition, which is consistent with research indicating student preferences for mentors with shared backgrounds, values, and experiences (Atkins et al., 2020). Sometimes participants encountered challenges in establishing strong relationships and negotiating expectations, particularly regarding what would happen at the end of the program, which are issues found in other career development settings (Keller et al., 2014). One particular issue for scholars was how to discuss continuing

employment with their research teams following conclusion of stipend support from BUILD EXITO. Navigating such discussions about employment is another reason why it may be especially beneficial for undergraduate researchers to have frequent interaction with project PIs in addition to mentoring from other lab members (e.g., postdocs, graduate students) (Aikens et al., 2017). Our findings also suggest value in expanding the role of peer mentors beyond the original mentoring model (Keller et al., 2017). Research indicates that near-peer mentoring in STEM has benefits for the mentors as well as the mentees, enhancing their sense of belonging, science identity, and self-efficacy (Trujillo et al., 2015). Alumni serving as mentors could help current scholars understand and prepare for transition, simultaneously enabling alumni to remain engaged with the program and supporting their own transitions.

Several recommendations for BUILD EXITO and other undergraduate research training programs flow from these findings regarding the experience of exiting the program and facing post-program challenges. The opportunities for program adaptation and improvement identified through the CBPR approach focused on enhancing information and support to scholars in preparation for the transition process and providing more structures for maintaining continuity and connections following program completion. Some recommendations pointed to creating new program features, such as a structured off-boarding process to guide scholars through the transition process, and an alumni network and newsletter to help scholars stay in contact with the program and their peers. Other recommendations emphasized incorporating intentional support and planning for the transition process within existing program components, such as mentoring relationships and regularly scheduled enrichment workshops. Finally, other recommendations called for more effective communication regarding the implications of program exit for scholars and their research placements, with the opportunity to clarify what program supports would remain available and whether financial support would be possible through continued work in the research lab. Although focused on our particular diversity research training program, we believe our findings could be informative for other intensive education diversity programs interested in how to better support students at the time of their transition. We recommend that other programs consider customizing these recommendations to their needs and circumstances to better support their own students.

Although the focus of this study was on the transition experiences of scholars, it provided a demonstration of the power of using a community-based participatory research (CBPR) approach with students from historically underrepresented communities. Reflecting on the work together, A.W. shared a feeling of delight in seeing her own experiences with the program reflected in the participants' interviews. The alumni coresearchers expressed a deep appreciation for BUILD EXITO and were committed to improving the program as much as they could; in other words, they felt this collaborative research project was a way to keep paying it forward. M.S. reflected that just as BUILD EXITO empowered scholars throughout their undergraduate journey, this project extended that empowerment by using scholar voices and experiences to inform the evolution of the program to better fit the needs of incoming and future scholars. As a member of the BUILD EXITO community but not an alumnus of the program, R.M.

was impressed by how CBPR influenced the structure of the project itself; for example, that having near-peer M.S. complete the interviews with scholar participants allowed us to gather complex and rich experiences from all scholars, including the Pacific Islander scholars. D.M.R., the academic PI, who has been conducting CBPR with disability and mental health communities for years, found that the approach translates easily into a student context. We strongly believe that CBPR is a feasible and powerful approach with benefit for community coresearchers—whose voices are so often excluded from studies about their own lives—and for the quality of the research itself.

4.1 Limitations

Our study has limitations that should be noted. It was a small, qualitative study conducted in a unique undergraduate program. As a qualitative study, we did not design it for statistical generalizability or to test a hypothesis, but to obtain in-depth understanding from a small number of key informants. The recommendations provided by participants are specific to the structure, resources, and culture of the BUILD EXITO program, and some may have limited transferability outside of the program. Despite these limitations, we feel that similar diversity programs, or programs that use similar components, may find our findings relevant. More broadly, the strengths of using a CBPR approach to conduct research with communities of diverse students, particularly within the context of a diversity program, are transferrable to other program contexts.

4.2 Implications and Future Work

As a type of action research, CBPR explicitly seeks to create change to solve problems that communities would like to see addressed (Nicolaidis and Raymaker, 2015). As noted, the current project generated a set of concrete recommendations for program improvements. Program leadership has taken several steps consistent with these findings and recommendations and has commissioned R.M. to oversee the implementation of new program initiatives to improve the experience of scholars as they exit BUILD EXITO. Program changes being implemented are presented in Table 1. Many of these efforts in response to the current project follow directly from the formal recommendations. Others seek to address the issues and challenges identified through this research, including the financial concerns of scholars leaving the program and the need to support transfer students with immediate connections to social networks and culturally sensitive mentors. As with the general recommendations based on the study findings, these initiatives reflect the circumstances of our particular diversity research training program, but we encourage similar programs to consider how these examples might be relevant with adaptations for their distinctive student populations.

We also recommend more research into understanding the experiences of traditionally underrepresented students at transition points along the STEM career pipeline. Although the pattern of attrition is well identified, it is only through an in-depth un-

TABLE 1: Changes implemented to enhance postprogram transitions

Facilitating the transition process

Developing a structured checklist to guide an individualized "off-boarding" process with each scholar to assist with a more consistent transition experience. The scholar designates a mentor or staff member to discuss the various items on the checklist and to develop a post-program plan. Extending three months of access post program completion to the program's services (e.g., academic advisor, career mentor, writing support for resume/CV/cover letter, and access to program staff for specific questions/concerns).

Addressing financial concerns

Securing an agreement from the university that all scholars transferring to the primary institution from a community college partner receive two full years of in-state tuition. This policy greatly alleviates the financial pressures on scholars both during and after participation in the training program.

Providing better information to RLC mentors about the timing of program completion and the potential to hire scholars and encouraging mentors to discuss potential employment opportunities with their scholars.

Building support networks

Providing protected time for a professor with Pacific Islander heritage to serve as the career mentor for all scholars transferring from the Pacific Island partner institutions (6–8 per cohort). This "supermentor" makes an immediate connection to these scholars upon their arrival, organizes group activities to maintain their camaraderie, and links the scholars to Pacific Islander organizations on campus and in the community.

Hiring a graduate assistant (a Pacific Islander alumnus) to provide both general alumni transition support and specialized transition support for Islander alumni.

Creating near-peer interest-based groups, each with a near-peer scholar alumni mentor, for junior and senior cohorts (previously only sophomores had peer mentoring).

Maintaining connections

Establishing an alumni network (newsletter, social media) to provide a forum for graduates to stay connected with each other and the program.

Recording the personal stories of alumni regarding their transition experiences and lessons learned to share through the alumni network with scholars in subsequent cohorts.

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derstanding of experiences that specific intervention solutions and mechanisms may become clear (Palmer et al., 2011). For example, participants in this study referenced concerns about being able to meet the high expectations for achievement and success following completion of the program. It would be worthwhile to investigate whether this performance pressure is a widespread phenomenon, to learn more about its connections to a sense of obligation from investment in training and from social comparison among peers, and to explore if these feelings are associated with impostor syndrome (Chrousos and Mentis, 2020). Another avenue for research would be to further explore the ways in which transfer students, particularly those from distant locations, navigate the practical and cultural challenges associated with a transition between institutions (Elliott and Lakin, 2021). Lastly, we strongly recommend using a CBPR approach when working with historically underrepresented minorities in any setting, including with students in the

context of higher education diversity programs. CBPR is a well-developed approach for improving equity and the quality of research with marginalized populations. We hope our work here shows its feasibility and value in the context of public higher education settings.

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