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This writing sample is an example of one study I would like to propose, and it relates to my research interests stated in my research statement, which was researching new methods in empowering K-12 students to pursue computing through community engagement. It is an extension of my proposed research project in my research statement.

Constructing Computing Education Spaces for Minoritized K-12 Students Through Community Centers

In higher education, computer science lacks racial and gender diversity, where generally there is a predominant demographic of white and Asian cisgender and gender-conforming men. The lack of diversity reinforces a hegemonic norm which discourages minoritized groups from participating in computing spaces [10]. This discouragement begins from an early age, where children are often socially conditioned to engage or disengage from technology based on their race and gender. Girls are especially affected by stereotype threat, where they feel discouraged to confirm another person's negative stereotype about them engaging in computing [3, 4]. This leads to harmful psychological effects, where they feel a lack of self-belonging in computing spaces [4, 5].

Prior work in computing education about diversity indicates that recruitment through educational programs are essential to promote inclusivity and sense of belonging among minoritized K-12 students in computing spaces [1, 3, 5]. However, many existing programs still pose inequities that prevent minoritized students from thriving caused by structural and environmental barriers [12]. Increasing diversity in CS requires an intervention in K-12 students because negative social conditioning and stereotype threat will prevent students from pursuing CS later on [3]. While previous literature focuses on minoritized groups facing stereotype threat and stigma in CS by using afterschool programs and summer enrichment programs [1, 2, 3, 5], little work has been done on using community centers as a platform to engage minoritized youth into computer science. A previous case study led by Rahul Bannerjee used community centers as a medium to support English-language learning (ELL) children, where he designed a coding platform to support K-12 ELL student learning, which successfully empowered ELL students [9]. Furthermore, more research needs to be done to understand community centers as a CS learning environment, as it has the power to connect and empower underrepresented communities in computing. A structured approach of creating community centers as a learning environment for computing education could offer new opportunities for underrepresented youth in computing spaces.

Intellectual Merit: Previous literature on K-12 diversity in computing spaces is often focused on creating educational spaces through school programs and summer enrichment programs [1,3, 5, 6], while comparatively little work has been done on using community centers as a learning environment for computing. Since CS is a predominantly white and cisgender male educational environment, my research goal is to moreover provide space for K-12 students of color by

creating computing learning environments in community centers. I propose a research study investigating the following questions.

RQ1: What makes community centers a unique learning environment among minoritized youth?
RQ2: How can we create a culturally responsive pedagogy to create computing educational environments in community centers?

To investigate RQ1, I propose a qualitative study that interviews minoritized K-12 students who have attended community center programs and schools. I plan to contact different community centers and also different schools in predominantly minoritized communities. Then, I plan to interview K-12 students of color using Linda C. Tillman's culturally sensitive research approach that outlines the best practices for understanding the experiences of minoritized students, particularly Black students [7]. I then plan to interview these students in small focus groups to foster both solidarity and validation, where I plan to ask them about their learning and overall experiences between community center programs and schools. I hypothesize that sharing personal experiences will reveal the differences in learning environments between the schools that the students attend, and the learning environments experienced in community center programs. The interviews will also address students' interest levels in computer science. Asking about students' interest level in computer science will help construct a pedagogy that is culturally responsive to the environments of community centers. I hypothesize that this study will uncover intersectionality between students' gender, race, ethnicity, and sexuality manifest in the interest (or lack thereof) in student participation in computing spaces.

After gathering and analyzing data about minoritized students' experiences in community centers and schools, I will construct a new supportive pedagogy that supports computing educational spaces in community centers (RQ2). This pedagogy will be created through a second mixed-methods (qualitative and quantitative) case study, where I plan to adapt a new pedagogical approach using Scratch to facilitate creative computing in a classroom-like setting within community centers, where laptops will be provided. These learning spaces in community centers will utilize Jean Ryoo's culturally responsive teaching strategies in connecting computer science to students' lives and communities [8]. I will also utilize Rahul Banerjee's recruitment and procedural strategies in offering computing learning environments in community centers [9]. I plan to construct a collaborative support space for students in this environment, where students will be explicitly asked to collaborate with one another and support each other in learning computing. While Banerjee's study was focused on creating a new platform for English-Language Learning (ELL) in community centers [9], my study will focus on using existing platforms such as Scratch for minoritized students with the intent to learn more about community center learning environments. I will draw on Linda S. Hirsch's approach in interview protocol and best practices in interviewing minoritized and female K-12 students on their identity's representation in CS [5], and Tia C. Madkins' approach in designing a culturally relevant computer science pedagogy [11]. There will be a pre-survey, mid-survey, and post-survey during their learning at the community center, asking students of their interest level in programming, confidence in programming, sense of belonging in computing, sense of belonging in their community using quantitative Likert scales. The last survey question will include a qualitative exercise in drawing what their perception of a computer programmer looks like to them. I hypothesize that supporting new learning environments in community centers will

stimulate new interest in computing in groups who are historically underrepresented in computing. I also hypothesize that students will undergo stereotype threat, especially with viewing their own identities' belonging in CS. I will measure the success of this learning environment by investigating the change in students' sense of belonging in both computing spaces and their community, their confidence in computing as related to their initial confidence, and also if they show more interest in computing overall, which can be interpreted from observing classroom engagement.

Broader Impact: Conducting this research will have direct implications, where there will be increased engagement of minoritized and historically underrepresented students in CS by offering them a culturally responsive computing learning environment in their local community centers. Current structures in computer science favor white and Asian cisgender and gender-conforming men, which reifies masculinity and racial hierarchy as the hegemonic norm of computing spaces [10, pg. 80]. This research will be a contribution to the dismantling of this system by introducing diversity in computing through community action. Younger students, especially in K-12, are an important audience to provide programming opportunities because they will be future leaders. Student discouragement from computing will reinforce those hegemonic norms that computing currently suffers from. Students who experience this program may feel more support by their peers to pursue computing, and there will be generally more interest and recruitment of other minoritized students through a welcoming community. This research will also potentially connect community centers to computing, which has the benefit of bringing CS to minoritized communities as an alternative to existing afterschool programs and summer enrichment programs. All these discoveries will provide new strategies for CS departments to recruit minoritized students through community action. Ultimately, this research will lead to a more diverse computing community, and help dismantle systemic inequalities that perpetuate hegemonic racial and gender norms in computing as a whole.

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