Broadening Participation in Computing (BPC) Plan: Standalone

We describe two planned BPC-related activities involving PIs Head and Pierce during the period covered by this proposal.

REU Student Mentoring

1. **Goal and context:** REPL ("Research Experiences for undergraduates in Programming Languages") is a recently-funded Penn-hosted NSF-REU site that will catalyze the next generation of programming languages research by preparing students for PhD programs in programming languages and by increasing the number of underrepresented persons in our field. To do this, REPL integrates undergraduates with "PLClub", Penn's research group in programming languages.

   The existing REPL program focuses on students with interests in PL and currently has funding to support 8 such students each year. As part of the proposed work, we will expand this program by funding and supervising two additional students per year, recruited from the somewhat distinct population of HCI-focused undergraduates with a potential interest in PL.

   The budget for the proposed project includes support for 10 new REPL students over the course of 5 years. See the Budget Justification for details.

2. **Intended populations:** The undergraduates we select will come from institutions across the US, and we will emphasize hiring students whose backgrounds are underrepresented in programming languages research. We will focus on expanding representation of female, Black, and Latinx students, who are particularly underrepresented in our groups [7] relative to the Pennsylvania population as a whole (the US Census Bureau estimates PA is 51% female, 12% Black, and 8% Hispanic or Latino). The program will support eight students each summer, for three consecutive summers, with a possibility of renewal after three years.

3. **Strategy:** Over the course of 10 weeks, the students will do research, master prerequisite knowledge, read and analyze papers, understand ongoing research trends, and learn how to prepare competitive PhD applications.

4. **Measurement:** REPL project leaders will work with the Computing Research Association's Center for Evaluating the Research Pipeline (CERP), which is an evaluation center that has been contracted by NSF CISE to provide evaluation for REU Sites and REU Supplements. CERP's evaluation work will focus on measuring the impact of REPL on students' self-perceptions (e.g., self-efficacy; scientific identity), academic development (e.g., research productivity; skills proficiency) and professional aspirations (e.g., intentions to pursue graduate school; career goals). At the end of data collection, CERP will provide a report that summarizes evaluation results alongside a comparison group of responses collected from similar REUs. Demographic data and other student characteristics will be provided in the report with an intersectional lens when possible, enabling the project team to understand the impact of the project on different types of students. A designated liaison will be responsible for distributing the surveys and communicating with the CERP team, providing any information related to this project that is necessary for data collection and reporting.

5. **PI Engagement:** Both PIs plan to work with REPL students. Concrete tasks where these students can contribute are listed in Figure 6 in the Management and Coordination Plan.

TA Demographics for the Introductory CS Course

1. **Goal and context:** The intro computer science course for CS majors at Penn, CIS 1200, is taken by about 750 students each year from across the university. Mixing functional, imperative, and object-oriented programming in OCaml and Java, the course is heavily assignment based, which requires a large staff of undergraduate TAs to lead recitations and respond to questions on the class discussion board.

2. **Intended populations:** The CIS 1200 instructors have for years set a goal of hiring a team of TAs that at least matches the diversity of the students taking the course. In recent years, we have had success expanding representation of women, Black, and Latinx students (see "Measurement"); we will continue to do so. Our hope is that underrepresented students are influential and visible members of the teaching staff, to increase the likelihood that students see themselves in the teaching staff and that we represent students equitably in course decision-making.

3. **Strategy:** TAs are hired at the end of each semester, for the following semester. We cast a wide net to get as many applications as possible—inviting people in the current semester to apply if they think they might enjoy it (even if they don't think of themselves as "typical TAs"), asking every current TA to encourage individuals (especially diverse individuals) to apply, posting repeated announcements, etc. A sizeable subset of applicants are invited to interview (paying attention to demographics already at this stage); then a meeting is held to decide on who to hire, again with diversity metrics explicitly in mind.

4. **Measurement:** Measuring success in this effort is relatively easy. In Fall 2022, for example, Pierce taught the class with 51 TAs, including 26 women and 5 URMs (Black or Latinx). By comparison, Penn's undergraduate population is 53% female and 18% self-identified Black or Latinx; i.e., we did pretty well on gender balance and we still have work to do on ethnic diversity. We will use the same metrics during the period of this grant.

5. **PI Engagement:** PI Pierce (along with Penn colleagues Stephanie Weirich and Steve Zdancewic) designed the CIS 1200 course content, and he continues to teach it regularly.