Collaborative Problem-Solving Workshops for Improving Confidence and Paving Pathways for Research Careers in Computer Science

Shanon Reckinger
Department of Computer Science
University of Illinois at Chicago
Chicago, IL 60607
Email: shanon@uic.edu

ABSTRACT

A workshop was designed and run to motivate and inspire female undergraduate students studying computer science (CS) to explore careers in research. Key activities include peer mentoring, alumni mentoring, graduate student mentoring, faculty mentoring, problem solving skill building (through collaborative competitions), hands-on work, and session topics about graduate school and research careers. The evaluation criteria for the workshop include building community, improving skills, instilling confidence, and motivation and inspiration. The workshop was attended by a total of 74 participants, all of whom were undergraduate women pursuing degrees in computer science (and related fields). This poster will present the design of the workshop, which was unique in that it included problem solving activities in addition to exploration of careers in CS research. Quantitative and qualitative data collected before and after the workshop will be presented in the poster, but are not described in the extended abstract due to length restrictions.

I. MOTIVATION

The workshop presented here is part of a larger group of similar workshops [1] that seek to investigate distinctions for women and Women of Color that motivate and support the pursuit of CS research. They also shed light on the practical aspects of supporting the inclusion of women from all ethnic backgrounds. Thus, these workshops are designed as Intensive Research Experiences (IREs), a variation of the more common undergraduate research experience (URE). The distinguishing feature of these workshops is that the length of the experience is much shorter with increased capacity for community. The workshop presented here was designed by a CS faculty member and builds off the overall goals and features of an IRE. One way this workshop is novel was through the problem solving competitions, which were more inclusive and collaborative than a traditional hackathon. The choice to make this workshop technical was important, as many students have expressed the interest in working on technical problems with other women.

978-1-6654-4905-2/21$31.00 ©2021 IEEE

II. ABOUT THE WORKSHOP

The workshop was led by a female CS faculty member and was attended by a total of 74 participants, all of whom were undergraduate women pursuing degrees in computer science (and related fields). The event was structured as a series of events over an academic year, offering hands-on research opportunities, discussions, and panels designed to build community and open pathways into computing research. Key activities and topics included peer mentoring, graduate student mentoring, faculty mentoring, skill building, hands-on work, and session topics about social/psychological well-being, graduate school, research careers, and a graduate student panel. The workshop also placed an emphasis on problem solving as a means for motivating student participation. The problem solving component allowed the workshop to include collaborative, hands-on problem solving competitions, which in turn brought more student interest to the event.

The workshops had three components: (A) Research Outreach (B) Collaborative Problem Solving Competition (C) Networking. More details are provided below.

A. Careers in CS Research Outreach:

The main goal of this portion of the workshop is to provide exposure to and education about careers in CS Research, in addition to holistic advising in navigating this path. CS faculty, CS graduate students, and CS Alumni led this portion of the workshop. In order to accommodate students attending both the Fall and Spring workshops, the content for this component was unique for each instance of the workshop.

Small Group Warm-Up and Panel - "What types of career opportunities are available with a BS, MS, and PhD?": At each table, there were 5-6 participants and a volunteer (graduate student, alumnus, or faculty). Each table was provided flyers, job announcements, pamphlets, and information from academia, research labs, and industry (all collected at the Grace Hopper Celebration's job fair). There

were also fun things laying on the tables such as CRA-W stickers, university temporary tattoos, etc. This time was used to give students a chance to warm up to the idea of talking about what different career opportunities are available with different levels of education. After the table discussions wrapped up, a panel followed. The panel was made up for one new female CS PhD student with industry experience, one female PhD CS student very close to graduating, and one female CS faculty member.

Small group discussion - "How does Grad School Work?": Senior female CS faculty members, CS graduate students, and CS alumni, were placed in small groups with the participants. Discussions followed and each table had a list of questions to start their discussion, a few examples include: "How do I prepare for the graduate school application process? Are test scores required?", "How much does graduate school cost? How do I get funding for Masters/PhD programs?", etc. It was vital that the students were provided guidance for the small group discussion questions. Most students expressed that they were not sure what questions they had or what to ask. Thus, the question prompts provided support and led to productive discussion.

Games - "Exploring CS Research Areas": A matching game was used as a warm-up activity. Students were given a list of CS research areas (Computer Vision, Theory of Computation, Artificial Intelligence, Augmented Reality, Security and Privacy, Computer Architecture, Human Computer Interaction, Natural Language Processing, Robotics, Machine Learning, Computational Biology, and Data Science) and a separate list of short (one to two sentences) descriptions of each of the research topics. They worked in small teams to match them up. Each team was given a university CS tech sticker when they finished (donated by the department). Next, the students were each given a Bingo board that was created based on the experiences of the CS faculty volunteers, CS graduate student volunteers, and CS alumni volunteers in the room. For example, one of the Bingo squares stated "Find someone in the room who does research in AI." Once a student found a volunteer that meets the requirement, they would listen to a 1-minute explanation of why the volunteer met that requirement and then follow it up with a related question. If the volunteer approved of the question as relevant, the volunteer then signed off on that square.

B. Collaborative Problem-Solving Competitions

Competition I: Problem Solving Speed-Dating on the Whiteboard: Pre-Competition: Students were split up into two groups, (1) students who have already completed Data Structures and (2) students who have not taken or are currently taking Data Structures. Post-Data-Structures students, referred to as *coaches*, received a problem prior to the start of the workshop that they solved (each student had a different problem). Pre-Data-Structures students, referred to as *participants*, were given a written set of instructions and tips for the competition.

During Competition: Coaches were set up around the room at whiteboards and tables. Each coach had a sign with their problem written on it. Participants were allowed to go up to any coach for which they wanted to attempt to solve their problem. The coach explained the problem and then the participants worked at solving it. The coach was there to help guide the student through the problem without giving the solution away. After the participants solved the problem or wanted to move on, they could leave that coach and go to another one. They continued this process of finding new problems/coaches for one hour.

Post-Competition: Participants rated their coaches as they went through the competition. They rated their coaches based on the support they received on building their problem-solving skills. The top three ranked coaches then presented their solution on the white board in front of the entire group. The volunteers voted on first, second, and third for the top three coaches who then all received a prize. During the competition, coaches also ranked participants based on grit, attitude, hustle, etc. The participants were not rated on how well they solved the problems or how many problems they solved. The top two participants based on the coaches ratings won a more modest prize (like a water bottle).

Competition II: Unwrapped Collaborative Problem Solving on the Whiteboard: During Competition, students were placed in mixed groups of four, half were Pre-Data-Structures and half were Post-Data-Structures. Teams were named after notable female computer scientists: Team Ada, Team Grace, Team Katherine, Team Margaret, Team Adele, Team Stephanie, Team Megan, Team Annie, Team Anita, and Team Ida, in commemoration of Ada Lovelace, Grace Hopper, Katherine Johnson, Margaret Hamilton, Adele Goldberg, Stephanie Shirley, Megan Smith, Annie Easley, Anita Borg, and Ida Rhodes, respectively. Each group member was then assigned a role. The roles "unwrapped" the problem solving process but also made the collaborative aspect of the competition more explicit. Teams were given a packet of problems to solve on the whiteboard and the top three teams won prizes.

ACKNOWLEDGMENT

Thank you to Google Research for funding this workshop and project.

REFERENCES

[1] A. Rorrer, S. Moghadam, B. Spencer, and T. Sun, "ecsr: Creating intensive research experiences that cultivate community for undergraduate women and women of color. ieee," *Research on Equity and Sustained Participation in Engineering,Computing, and Technology. RESPECT 2020.*, 2020.