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Board 51: Utilizing Technical Competitions to Enhance Diverse Workforce Recruitment and Retention

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Utilizing Technical Competitions to Enhance Diverse Workforce Recruitment and Retention

Abstract

Recruiting top talent is a challenge many organizations face, including our own. At the Johns Hopkins University Applied Physics Laboratory (JHU/APL), a University Affiliated Research Center (UARC), we consider opportunities to broaden our talent pool through targeted activities in inclusion, recruiting, and retention. In the search for a novel, inclusive, and informative recruitment tool to engage future interns and new hires, our team of representatives from various internship programs across our organization designed a hackathon-style, engineering competition called Net-Hack. The intent of Net-Hack is to address these challenges by providing students with networking training and professional development, followed by facilitating introductions between interns and staff through technical talks, mentoring, and workshops. Net-Hack saw participation from over 75 college interns who were assigned to small, interdisciplinary and cross departmental teams of 4-5 students. Teams were formed based on challenge interests to develop a research proposal similar to an internal research grant, demonstrating both interest and capability. Throughout the weekend, interns attended technical presentations and workshops hosted by staff; the weekend culminated in a poster presentation to experienced staff, hiring managers, senior leadership and executives' gallery walk where prizes were awarded. Our goals are to grow participants' confidence in networking, technical communication, and exposure to the JHU/APL and impactful research topics through this immersive experience.

Students developed communication skills in STEM topics, competitive presentation experience, and professional networking opportunities, while gaining direct access and exposure to over 30 technical staff members, including 16 day-of volunteers/mentors, 10 technical talk speakers, and 8 gallery walk judges. A majority of the intern participants (over 85%) attended technical talks and gained exposure to cutting edge technologies and relevant topics (including hypersonics, natural disaster response, anti-gravity machines, and 5G networks). Many of these interactions directly informed the students' project brainstorming sessions and eventual final proposals. Students who responded to the survey stated that they met and interacted with on average three or more staff outside of technical talks and approximately 46% stated their confidence increased after participating. With intentionally removing the barriers of needing prior technical skills and providing professional development trainings for students such as networking, Net-Hack was able to provide a supportive and accessible space for participants regardless of background. Our approach has the potential to be used as a non-conventional recruitment tool for organizations.

Introduction

We seek to address national workforce challenges for the STEM community, focusing on issues of inclusion, diverse recruiting, and retention. Our United States labor force is facing two intertwined challenges: 1) an aging labor force and 2) a decreasing talent pool entering the labor force[1]. In the search for a novel, inclusive, and informative recruitment tool to engage future interns and new hires at JHU/APL in an increasingly competitive environment, our CIRCUIT (cohort-based integrated research community for undergraduate innovation and trailblazing students) internship program and our ATLAS (APL Technical Leaders and Scholars program for

HBCUs/HSIs/TCUs) program leadership teams brainstormed how to better introduce JHU/APL's culture, benefits, technical capabilities, and future opportunities to potential program candidates[2,3]. Inspired by "SXSW Battle of the Brains," an HBCU based hackathon[4], and the hundreds of early career, multi-day hackathons across the world, the CIRCUIT and ATLAS teams believed that an intern hackathon would prove to be an effective way to engage students. Additionally, this event would provide students with meaningful experiences that directly benefit JHU/APL hiring, inter-department collaboration, and more[5].

The primary goal of this event was to identify and prepare potential candidates on JHU/APL's culture, benefits of working at JHU/APL, and technical capabilities. During these events, prospective interns/new hires worked together to develop an innovative proposal to solve a critical challenge similar to an internal research grant. Students were required to first participate in various workshops to help them develop their idea, attend technical talks and workshops to learn about JHU/APL's critical work and gain exposure to various sectors, and engage with staff during workshops focused on preparing the candidates in technical communication and networking skills. The outcome of this event was to prepare students for a competitive workforce interview process and provide them with direct access to hiring managers to support more intentional hiring practices at JHU/APL.

Event Overview and Methodology
The main theme of Net-Hack 2022 was "Networking," which was infused into every aspect of the event. Net-Hack was composed of five team challenges centered on cutting-edge research areas, such as neuro-imaging, machine learning, and others [Appendix A]. Interns were instructed to declare their top challenge preferences prior to the event. Students were then assigned to cross-sector teams of approximately five interns based on indicated challenge interests to collectively form an innovative solution to their challenge problem. Each team was expected to develop a project/research proposal, similar to an internal research grant, to present at the culminating poster session. Furthermore, students had the opportunity to participate in various technical training and professional skills workshops throughout the weekend. A focus of the hackathon was to expose students to topics related to computational neuroscience, as part of a scientific engagement effort. Following the end of Net-Hack, winning teams were recognized and awarded with certificates and a prize.

Prior to Net-Hack 2022, students were given a pre-survey to indicate their challenge preferences, demographic information, and self-reported imposter phenomenon (IP) and self-efficacy scores. Demographic information was laid out in open form questions and imposter phenomenon and self-efficacy questions were presented in a Likert scale. Self-efficacy, or the belief in one's capability to achieve their goals, and IP, feelings of fraudulence and doubt in terms of an individual's achievement, greatly impacts a person's ability to break into the STEM field[6,7]. A post-survey was distributed on the third day of the hackathon to assess changes in self-reported thoughts related to the program and IP. The IP portion of this survey was used for another study, but questions related to networking with various staff and specific research topics were also presented in the results section to assess exposure to our work at, networking opportunities resulting from the event, skills obtained, and more[8].

Compared to traditional hackathons, the Net-Hack has a different structure, and facilitates collaboration in a different, yet similar way. In traditional hackathons, students are meant to show a prototype of an idea at the end, a work script, or piece of code that demonstrates a solution to a problem. For Net-Hack, we asked students to be creative, to ideate, and express their different thoughts and solutions on a variety of topics through a project proposal rather than a hardware or software solution. Each team's end product was a poster to be presented to judges, who are staff, rather than a working prototype or demonstration. This created an environment that allowed students to actively contribute regardless of their academic disciplines or institution, and encouraged new ideas from diverse voices and perspectives outside of previous opportunity spaces[9]. Participants had significant opportunities to engage with staff members for advice during the ideation phase.

Throughout the event, interns participated in technical talks from various staff, many of whom were junior staff that presented their areas of work/research and facilitated a Q&A immediately following their presentations. Students were able to then use these topics to inspire their topics, provide students exposure to new technologies, and provide networking opportunities with staff. Technical talks listed below with asterisks were topics that directly helped to shape participant projects. The topics included:

- Using Brains as Networks*
- Getting Up to Speed on Hypersonic Defense
- Cloudless Media: The Web without the Internet
- 5G Improvements to Mobile Networks
- On-Premise, Cloud, and Gaming Multiplayer Networks
- Using Network Science to Design Equitable Post-Disaster Solutions*
- Social Network Analysis for clinical Public Health*
- Honey I turned off the Gravity: Planetary Geology Creating Experiments in Parabolic Flight
- Semi-Conductors to Grids

Spaces were provided for the interns to work, brainstorm, and create solutions to the challenges that they were trying to solve. In addition to working on their challenges, students received training in pitch-making, networking, and various skills to more effectively share their ideas and market themselves as future new hires through mini-challenges and team-building activities.

At the end of the event, interns developed posters to express their findings. They presented during a gallery walk the following week, where submitted efforts were judged by staff, including hiring managers interested in recruiting top talent. We decided that students would produce posters for their concept, rather than a software or hardware based prototype, to provide a more inclusive hackathon by allowing students to collaborate across educational disciplines and backgrounds. A sample event schedule can be found in Appendix B.

Results
The inaugural Net-Hack event saw participation from over 75 interns from across the JHU/APL, 16 day-of volunteers/mentors, and 8 judges (a total of approximately 25 JHU/APL staff members). There was a diverse representation of race and ethnicity, with the majority of students identifying

as Asian and Black or African American. This reflected the high participation of students from the CIRCUIT and ATLAS internship programs. Survey responding students identified as 56% male, 40% female, and 4% other/prefer not to say. Academic disciplines represented by students were diverse, unlike traditional hackathons which often see participation primarily from software-oriented majors.

Table 1: Represented Academic Majors at Net-Hack 2022

Academic Majors Represented		
Aerospace Engineering	Computer Engineering	Neuroscience
Applied Math and Statistics	Computer Science	Psychology
Biochemistry	Electrical Engineering	Public Health
Biology	Engineering Physics	Spanish
Chemistry	Information Systems	
Cognitive Science	Mechanical Engineering	

Students were placed on multi-disciplinary teams of three to five participants to tackle a challenge area based on their interests, with minimal modifications to teammate placement once the event started. Students took part in initial training sessions in design thinking, networking, and brainstorming. Challenge areas were merged based on similar project topic areas to make a total of 5 challenges. These merged areas are denoted with an asterisk below:

- Cyber Security and Misinformation*
- Pandemic Response and Reconstructing Diseases*
- Emerging Tech & Preservation of Resources*
- Identity Theft and Protection
- Mental Health and Neuroimaging

A majority of the interns (over 85%) responded that they participated in technical talks and gained exposure to cutting edge technical work being conducted at JHU/APL (including hypersonics, natural disaster response, anti-gravity machines, 5G networks and more). These talks were developed by ten professionals across four different sectors and departments. These interchanges helped inform student project brainstorming sessions and eventual final proposals. Day-of volunteers mentored and provided feedback to students on their projects and poster designs. Students were offered additional training on selling their ideas and storytelling techniques.

A post-survey showed that the majority of students gained critical skills for technical communication such as presentation skills, communication confidence, and poster design (See Figure 1). In addition to communication skills, many students gained skills in networking. It is estimated that each student had on average three to four one-on-one interactions with staff they had never met prior to the event, and some students met and interacted with as many as ten new staff members. Students also responded that they gained teamwork collaboration skills as well as technical skills in various relevant networking topics most-frequently in neuroimaging and machine/learning.

Figure 1: Self-reported newly-formed skills as a result of the hackathon

Out of the original fifteen student groups, fourteen elected to participate in the final report out gallery walk to share their ideas. Eight judges graded and judged student projects. Final projects were graded on JHU/APL relevance to the challenge area, content, design, sources, knowledge, presentation quality, and participation. Many staff also attended to review the students' final projects (including section supervisors, day-of mentors, and hiring managers). The final abstracts included topics ranging from biometric data management to data-informed agriculture to benefit farmers and food production.

Table 2: Final Project Winners

Category	Project Topic
Cybersecurity & Misinformation	**The Locker**: High Security Biometric Password Management System
Pandemic Response & Reconstructing Disease	**Redesign Vaccines Digitally**
Emerging Tech & Preservation of Resources	**DIRT (Data-Informed Restoration of Terrain for Improved Agriculture)**
Identity Theft/Protection	**Data Security through Meta Data Wiping Application**
Mental Health & Neuroimaging	**Using Deep Transcranial Magnetic Stimulation (dTMS) to Treat Post-Traumatic Stress Disorder (PTSD) in Animal Models**

Overall Net-Hack 2022 had a strong impact on the students and staff who participated and was a successful proof-of-concept innovation event for interns across the Lab to effectively network and brainstorm solutions to critical challenges of interest to the Laboratory.

Neuroscience Focus
This event specifically aimed to expose students to topics related to neuroscience, and to encourage further learning on related topics. Two challenge areas reflected this focus, including "Mental Health & Neuroimaging" and "Pandemic Response & Reconstructing Disease." Design thinking and ideation trainings had specific neuroscience related sessions to further reinforce exposure. Lastly, an optional technical session regarding neuroimaging techniques was held in the evening after the other technical talks. Staff members with subject matter expertise remained onsite for much of the program to provide answers to questions as they arose.

After the event, students were evaluated on their new exposure to topics related to neuroscience and whether or not they learned anything. Of responding participants, 60% of students said they at least learned a "little more" about neuroscience and roughly 31% said they learned a "moderate amount" to a "great deal" about neuroscience. This reflects the broad topic areas and previous mix of experience in these areas.

Organizational Impact & Discussion
Conventional recruitment for internship and full-time hiring in STEM fields often relies on resume reviews, and emphasizes specific technical experiences rather than the general work experience and potential of students. The goal of Net-Hack looked beyond technical background (skills often learned through previous internships and experiences) by intentionally removing the barrier of requiring technical skills to compete in the hackathon. This was accomplished by focusing cohort output on a research proposal rather than an actual prototype, and providing professional development trainings for students (e.g., networking). Net-Hack was able to provide a supportive and accessible experience for participants regardless of academic background or previous work experience. Our approach has the potential to be used as a non-conventional recruitment tool for organizations, specifically for early career staff, by applying traditional, proven hackathon procedures, with the added element of inclusion.

Students: The purpose of this event was to expose the next generation of the best and brightest to solve sponsor relevant problems and evoke innovation, all while ensuring the growth of our hiring pipeline. This event was advertised using an internal tool tracking attendance, so students/staff were credited as participants in the event on their JHU/APL resume. As an example of impact, pilot student participants noted that the experience allowed them to interface with staff and interns from different sectors, providing them an enhanced perspective of the work conducted at JHU/APL.

Staff: Participating staff received the opportunity to participate in outreach and STEM recruitment efforts. Technical presenters, workshop hosts, and volunteering staff were credited as a presenter/volunteer for this event (analogous to a conference) on their resumes. This is particularly beneficial to junior staff, as they gained experience presenting their work to new audiences.

The Lab: The final presentations and judging was open to hiring managers or their equivalents and was designed to showcase the talents of the interns to various groups across the Lab searching for new hires. Hackathons are becoming more popular tools for major technical and non-technical companies for hiring, recruitment, and talent acquisition, and JHU/APL can similarly leverage these ideas for more diverse recruitment. When these events are hosted by large companies, they also serve as promotional opportunities for potential hires at the students' universities[10]. As talent acquisition in technical organizations becomes more competitive, it is imperative that we consider modern and non-conventional recruitment tools to raise brand awareness, new-hire interest, and exposure to new schools.

Future Work

Given the positive outcomes of the hackathon on both students and staff, we plan to continue developing this model. During Net-Hack 2023, our plan is to integrate observational sensing and research into student groups using biometric data (e.g., posture, conversation length, participation) to evaluate student engagement and confidence levels in students (following institutional review board policies). In addition, we will include more hiring managers in the judging process and insert additional technical mentors for each challenge area to provide feedback to students.

In future years, our goal is to use Net-Hack as a novel, inclusive, and informative recruitment tool for external interns and new hires to our organization.

Acknowledgement

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Appendix A

Past Challenge Topics:

Challenge 1: Misinformation Prevention: Social media has become a big part of everyday life, but misinformation is a major issue that is rampant and difficult to deal with. How can we avoid the spread of misinformation?

Challenge 2: Pandemic Impact and Mitigation: In the past few years, we have gone through major difficulties due to the pandemic. Using Lessons learned from this last pandemic what can we do better for the next one?

Challenge 3: Emerging Technologies: Technology is moving really fast and constantly what we can do to be up to date or to bring up to speed those who still haven't been able to catch up.

Challenge 4: Identity Protection: Technology being used on everything safeguarding your personal information is becoming more challenging. How can we avoid compromising our identity and what can we do if it does?

Challenge 5: Preservation of Resources: Every day the environment and natural resources are being impacted negatively by overdevelopment and poor infrastructure planning. How can we use technology to alleviate that or what we can do to fix the damage done?

Challenge 6: Mental Health and Neuroimaging: Mental health has been an area that the scientific community has struggled with. A lot of scientist believe that mental illnesses are due to chemical imbalances. Can this be proven? What can we do to improve mental health and treat illnesses?

Challenge 7: Cybersecurity threats: As we become more reliant on technology the more vulnerable we are to cyber threats. We have seen a big rise on malware and vulnerability attacks. How can we become more resilient and mitigate these threats?

Challenge 8: Reconstructing diseases: We encounter many diseases that evolve and can become more dangerous. Using technology, can we predict or simulate this danger using the data we can get from current threats?

Appendix B

Sample Event:

Day 1 - Friday, 5 PM – 9 PM
- Opening Talk
- Announcement of Challenges
- Rapid Brainstorming Sessions
- Design Thinking Workshops
- Idea Sparking Fun Activities (Targeted Trivia, Karaoke)

Day 2 - Saturday, 8 AM – 9 PM
- JHU/APL Based Technical Talks
- Pitch Making, Networking, & Presenting Skills Workshops
- Networking Mini Challenge
- Idea Sparking Fun Activities
- Open Office Hours for Challenges
- Open Working Times

Day 3 - Sunday, 8 AM – 12 PM
- Idea Sparking Fun Activities
- Open Working Times
- Open Office Hours for Challenges
- Event Conclusion, Posters Due August 1 for Print

Following Week – Afternoon Poster Session 3pm-5:30pm
- Judging Rubrics Provided for Judges
- Poster Presentation Sessions
- Announcement of Winners