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Executive Summary

To meet ongoing Science, Technology, Engineering, and Mathematics (STEM) workforce requirements, the Department of Defense (DoD) needs to inspire, cultivate, and develop future talent. For many STEM professionals, their initial work experience (e.g., internships, fellowships, and postdoctoral positions) was critical for their professional development; and these activities are also an important way for the DoD to recruit and develop STEM talent. For this evaluation, DoD STEM within the Office of the Under Secretary of Defense for Research and Engineering asked the Institute for Defense Analyses (IDA) to analyze the DoD's portfolio of "work experience programs" (WEPs). These programs feature two defining components: (1) an experiential component where participants engage in meaningful work and (2) an educational component where they acquire skills and knowledge. This report presents findings from Phase II of a multi-year study of DoD WEPs.

Taken together, Phases I and II of the WEP analysis provide a description of the portfolio of programs. Phase I involved cataloging WEPs across the DoD, and performing an initial portfolio analysis to understand program goals and characteristics (Kolodrubetz et al., 2021). Phase I highlighted the wide variety of STEM WEPs, reaching across the Services and Fourth Estate agencies. The objective of Phase II was to engage DoD program representatives and participants to assess how programs operate in practice (e.g., recruiting, and mentoring) and to gain a better understanding of outcomes (e.g., future education, hiring, career interests). The intent was to learn about common practices across the portfolio of WEPs, identify lessons learned and strong practices that could be shared across the portfolio, and recognize challenges that could be addressed in an effort to improve programs.

Method

This evaluation included complementary data collection efforts: (1) semi-structured non-attributional interviews of WEP managers and mentors for the programs' perspective, and (2) an anonymous online survey to gain the participants' perspective.

Using programs identified in Phase I, IDA developed a sample of WEPs addressing three key program features: mix of relatively short (e.g., summer internship) and long (e.g., year-long or longer work experiences) programs; mix of programs with or without an explicit mechanism for hiring participants post program; and mix of programs with or without a specified diversity, equity, inclusion, and accessibility (DEIA) mission. This

broad sample did exclude programs that focused on high school students or active military members. Initial contact with all DoD WEPs was through an email from the DoD STEM Director, then IDA followed up to schedule interviews with programs selected for the sample. IDA conducted 35 interviews across 22 different WEPs, a broad and purposive sample of almost half of all WEPs identified in Phase I. The interviews were performed virtually using ZoomGov, with a notetaker and audio recordings (in 33 of 35 interviews) to capture interview content. The interview notes and transcripts were analyzed in Nvivo, a qualitative analysis software package, using a coding framework (i.e., a hierarchical topic structure of higher-level topics and sub-topics) to categorize content and derive findings.

The perspective of WEP participants was acquired through an anonymous online survey from a broad sample of participants across a diverse set of programs. IDA developed an initial draft survey in coordination with DoD STEM. In March 2022, the survey was submitted to Office of Management and Budget (OMB), who reviewed it and provided final approval in July 2023 (OMB Control Number 0704-0668). The survey was administered through Qualtrics, an online survey platform. To recruit survey participants and preserve anonymity of respondents, the DoD STEM Director asked program coordinators to forward an email invitation to program participants. Therefore, IDA did not have direct knowledge of who received survey invitations, which made calculating a response rate impossible. Although the sample should not be viewed as statistically representative, it can be considered broad in its distribution across the DoD STEM WEP population, in that 275 respondents representing at least 19 programs provided responses.

Findings and Recommendations

Overall, the general findings portray positive WEP experiences and outcomes, with some opportunities for improvement. Therefore, the recommendations should be considered as suggestions for ways to maintain or improve upon the strong work that DoD WEPs are already doing.

Recruiting

Programs used varied communication methods to reach potential applicants and to encourage them to apply. These included a combination of one-way communication methods (e.g., email blasts, job postings) to reach a large audience and two-way communication methods (e.g., in-person events) to provide more details and answer questions. Also mentioned as a means used to enhance recruitment was involving strategic intermediaries who are familiar with programs and/or candidates. These methods mirrored how participants indicated they learned about the program and decided to apply. Therefore, programs should continue balancing one- and two-way communication methods to reach potential applicants and leverage strategic intermediaries to enhance recruiting.

Program representatives mentioned a wide range of characteristics they seek in candidates. These include explicitly stated criteria such as academic levels, majors, and performance that tended to be objective; and some implicit factors such as determination, enthusiasm, and professionalism that may be more subjective. To refine selection processes, programs should clearly lay out the characteristics the program seeks in candidates in their recruiting material, and further develop methods to assess candidates based on them.

WEP representatives also discussed challenges to getting enough applications, with some programs struggling to increase program awareness, particularly for candidates from historically underrepresented communities (HURCs). Additionally, competition with the commercial sector has been a challenge for programs. These challenges are informed by participants' perspective on whether to apply; the top three concerns were (1) benefits to longer-term goals, (2) uncertainty of acceptance, and (3) having appropriate STEM skills. Also, financial concerns (e.g., stipend, housing assistance, or relocation costs) were likely to be mentioned by individuals from lower socioeconomic backgrounds. To attract strong applicants, programs should leverage knowledge of students' long-term goals and explain benefits and accommodations for program participation, potentially with examples of how the program can lead to long-term success.

Experience During WEPs

In general, both participants and program representatives agreed that mentorship was an important component of WEPs. Most participants had positive mentorship experiences, but some findings suggested opportunities for improvement. Most participants reported that they met with their mentors weekly or more frequently, but about a quarter indicated they met with their mentor less than once a month and almost a tenth of participants indicated they had no mentors. These findings suggest that most programs provide adequate and quality mentorship, but there are instances where it could be improved. To reduce instances of inadequate mentoring, programs should ensure that all participants have at least one clearly identified mentor they meet with frequently, and train mentors on best practices, such as ensuring that participant goals are being addressed.

Across WEPs, about two-thirds of the participants only worked on-site, while the remaining positions were a combination of hybrid or remote. Program representatives acknowledged that having to come to a laboratory site, may keep some prospects from applying to a program or accepting an offer. However, while offering hybrid/remote work options may increase the applicant pool, it may also decrease networking opportunities or limit work options, factors that should be considered if hybrid/remote options are used.

Participants also indicated that communication was sometimes lacking, particularly in terms of introductory and orientation information near the beginning of the program. Topics where participants felt they did not receive clear communication included stipends,

task work, paperwork/reporting requirements, network and facility access, tax implications of funding, and future job opportunities. Therefore, programs should work to provide timely and relevant information to participants. Also, for information with legal implications (e.g., taxes, future work commitments), standardized information vetted by a lawyer should be provided to participants.

WEP Impacts on Participants

WEPs can have a long-lasting impact on participants, such as increasing career awareness, gaining perspective on working for the government, and developing professional capabilities. The most mentioned impact by WEP participants was learning to work in a professional environment, in that for many this was their first work experience in a professional setting. This aligns with the program representatives who described how programs helped participants learn skills such as teamwork and professional etiquette. Additionally, building a professional network was also seen as an important benefit to participation with some participants requesting more networking events during programs. Therefore, programs should continue or increase activities to facilitate building professional networks.

In general, participants reported strong growth in their STEM skills with hands-on learning leading to new skills. This growth was a stated goal for many programs that sought to foster participants' STEM skills through working alongside DoD STEM professionals. However, some participants reported that assigned projects did not match their skills or interest, and some participants suggested that the option to change or rotate project teams may improve opportunities. To optimize benefits to participants, programs should work to match participants' interests and skills with their assigned projects.

WEP Impacts on Organizations

From the program's perspective, WEPs positively impact organizations by supplementing their workforce, facilitating future hiring, and building communities more broadly. Specifically, many WEP representatives discussed how WEPs help with long-term hiring through increasing interest in government jobs, helping agencies filter participants as the WEP functions as an extended interview, and reducing the onboarding burden. Conversely, some program representatives reported hiring challenges, such as a lack of open positions for WEP participants after graduation. To address this, some managers may tell participants about positions outside their agency, but there is no systematic mechanism to link WEP participants with available positions. DoD should create a centralized pool (i.e., marketplace) of WEP alumni so that successful participants can be recruited and hired by any DoD agencies that need talent, not just the ones where the WEPs were conducted.

Another challenge to post-WEP hiring that was identified from the survey results is that the majority of WEP participants were returning to school after the WEP. Given that, there may be a period of time between the end of the WEP and when the participant may be ready to look for a full-time position after they graduate. Nearly all survey respondents indicated that STEM was in their future plans, with either additional education or jobs. Therefore, programs should stay in contact with participants they may wish to hire in the future and should reach out closer to graduation with available job openings.

Also, both program representatives and participants discussed how competition with the private sector, particularly monetarily, may reduce interest in the government sector. However, both participants and program representatives recognized that the government sector may be stronger in other aspects, such as job security and benefits. To address competition for talent with the commercial sector, DoD agencies should emphasize positive features of their jobs such as benefits and job security.

Diversity, Equity, Inclusion, and Accessibility

Supporting HURCs and addressing DEIA was an important consideration for many programs. Program managers discussed a range of challenges that can limit HURCs' abilities to access the program, fully engage in WEP activities, and apply what they gained from WEPs toward post-program activities. To address these challenges, some program representatives also shared potential solutions for consideration and possible adoption by other WEPs. Most of the practices that program representatives shared revolved around equalizing access to WEPs. That said, program representatives also offered several ideas on how to address barriers that may be limiting participants' WEP experiences and post-program outcomes. Leveraging these ideas, programs should consider expanding efforts to support social equality by including greater consideration on how participants fare both during and after the WEPs.

Potential Next Steps

This study aimed to understand nuance and detail across a broad range of WEPs. A strength of the study was its multi-methods design, with interviews of program representatives to identify program issues and a survey to gather participants' perspective on their WEP experiences and outcomes. This enabled a comparison of programs' and participants' perspectives across the DoD portfolio. Based on the study's findings, there are some additional efforts that the DoD STEM community may consider, such as the following:

- **Pilot a WEP employment marketplace.** A key recommendation of the current study was to create a marketplace to match DoD WEP alumni with available DoD jobs and opportunities. A pilot employment marketplace project would

involve an initial set of implementation options and an assessment of their feasibility.

- **Identification of WEP participants' paths.** The DoD STEM community could share participant registration information for long-term (multiple years) tracking of a sample of WEP participants across a representative selection of programs, both educational and work force development. This tracking as they transitioned across programs and/or employment would provide insight on the pathways towards STEM careers.
- **Deepen understanding of connections between WEPs.** Assess the informal and formal connections between different WEPs and other STEM programs through interviews of WEP program representatives. Results could be used to further develop WEP communities and strengthen existing and new connections.

WEPs are important mechanisms for recruiting and developing quality STEM talent for the DoD's science and technology agencies. Continued evolution of WEPs will enable the DoD to better compete for valuable STEM talent that will allow it to maintain its technical superiority into the future.

Contents

1. Introduction

The Department of Defense (DoD) has an imperative to inspire, cultivate, and develop current and future Science, Technology, Engineering, and Mathematics (STEM) talent to meet workforce needs in the near-, mid-, and long-term. Work experience programs (WEPs), including internships, apprenticeships, fellowships, and postdoctoral programs, provide a bridge between education and the workforce. We define WEPs as having two required components: (1) an experiential component where participants engage in meaningful work and (2) an educational component where they acquire skills or knowledge. WEPs are an important strategic tool for developing the large number of STEM professionals needed to meet science and technology workforce requirements. With approximately 300,000 DoD civilian STEM professionals,[1] there are always positions to fill for those who have left or retired, or to gain new capabilities as the DoD strives to maintain technological superiority. This report presents the results of an analysis of DoD WEPs from the perspective both of students who participate in them and organizations that manage and conduct them.

This effort was part of a two-phase study to assess the scope of opportunities available through the DoD's STEM WEPs. Phase I (Kolodrubetz, et al. 2021, Belanich, et al. 2022) included identifying and cataloging programs across the DoD and performing an initial portfolio evaluation to understand their goals and general characteristics. Phase I highlighted the wide variety of WEPs at DoD science and engineering (S&E) organizations and facilities, addressing all facets of STEM, and reaching across the Services and Fourth Estate agencies. These programs allow participants to enhance their STEM skills and abilities, expose them to DoD careers, gain valuable experience, and learn how to effectively contribute to an organization or team.

This Phase II study built upon the first effort by engaging a sample of both program representatives and participants from DoD WEPs to discover how programs operate in practice and to gain a better understanding of their outcomes. The evaluation included two complementary data collection efforts: (1) semi-structured interviews of WEP leaders and managers, and (2) an online survey of WEP participants. The purpose of the semi-structured interviews was to gain the perspective of program managers and mentors to better understand program recruiting, activities during the program, and indicators of success and potential barriers to achieving it. The purpose of the participant survey was to

[1] https://dodstem.us/

gain the perspective of participants to better understand what drew participants to their program, what they got out of participation, and their future plans post-WEP. By gaining the perspective of both the programs and the participants, we could then also identify how those perspectives compare or contrast.

A. Background

Phase I revealed that DoD STEM WEPs reach a large number of participants, with an estimated 5,000 or more per year across all programs (Kolodrubetz et al., 2022). The WEPs were oriented toward a variety of goals, to include increasing interest in STEM, reaching underserved populations, increasing domain interest, identifying people to hire, early career growth, and creating a geographic or regional community. The study examined 54 programs across the DoD through the analysis of publicly available program information, interviews with some key stakeholders, and analysis of program-generated data. From the information gathered in Phase I, five areas of interest emerged to provide a foundation for understanding how WEPs work and how we could analyze them in Phase II: (1) recruiting and bringing in participants to WEPs; (2) WEP activities and content; (3) program outcomes and post-program options; (4) barriers to participation or success in WEPs; and (5) post-WEP employment and education policy. In each of the subsections below, we address the topics with a description of national data or trends from published reports, followed by aspects identified in Phase I, and then end with how we addressed the topic in Phase II.

1. Recruiting and Bringing in Participants to WEPs

Employers across the United States use a wide variety of methods to attract talent. Methods for attracting participants to internship and co-op programs is a topic covered in a survey done annually by the National Association of Colleges and Employers (NACE).[2] The results in the 2019 report show that the most used and useful methods closely track one another (National Association of Colleges and Employers 2019). In contrast, results in the 2022 report emphasize the effects of COVID-19's pandemic sequestering on recruiting (National Association of Colleges and Employers 2022). According to the 2019 survey, the list of recruiting methods (i.e., pre-COVID) was topped by career/job fairs (97% used) and job listings on websites (96%), although other methods (e.g., referrals from current or former participants; on-campus recruiting and information sessions) also are used by close to 90% or more of employers. When asked to rate the effectiveness of such techniques, the top rated recruiting techniques included on-campus recruiting, career/job fairs, and corporate website job listings. In the 2022 report, there still was heavy use of recruiting

[2] Note that the publication year reports data from the prior year (i.e., the 2020 report included data from 2019).

techniques like job listings on corporate websites and referrals from current employees, but new to the top of the list was virtual career/job/internship fairs and virtual recruiting. Overall, the effectiveness in 2022 during the pandemic was rated lower than in 2019. This comparison of the 2019 and 2022 reports shows a shift from in-person techniques to more virtual and internet-based methods for recruiting.

IDA's Phase I analysis of DoD STEM WEPs revealed that they have several ways to maximize access to talent pools (Kolodrubetz, et al. 2021). Open source information about programs showed that approximately 75% of the programs are open to participants from a national pool with the remaining focusing on a specific state or local community. There is also a wide geographic distribution of where programs are conducted, with DoD WEPs taking place at DoD labs and research facilities as well as other settings that conduct technical work. Many DoD programs also strive to broaden participation in STEM with efforts to address diversity, equity, inclusion, and accessibility (DEIA). To recruit underrepresented and underserved populations, DoD WEPs approach the concept of diversity with a broad definition that includes racial and ethnic minorities, residents of rural areas, low-income students, first-generation college students, people whose second language is English, people with disabilities, and gender discrepancies in certain STEM fields.

To expand the Phase I analysis in the Phase II study, we leveraged insights from program representatives to understand the processes through which WEPs identify, attract, and select participants. In addition, the analysis will address the methods by which students indicated that they learned about the DoD WEPs. This understanding of what methods WEPs use to increase awareness of and interest in their opportunities, and how participants may learn about programs may inform the DoD on how to adjust recruiting and outreach efforts.

2. WEP Activities and Content

Two national surveys provide perspective of what interns do during their internship. NACE provides an employer's perspective while a survey by the Center for Research on College-Workforce Transitions (CCWT)[3] reports students' observations. In the NACE 2019 study, 262 respondent employers reported that interns perform project management and analytical/problem-solving duties more than half of their time on the job (National Association of Colleges and Employers 2019). Almost one-third of their time is spent working on logistical tasks and communicating. Additionally, employers report that only a small amount of student time (less than 10%) is spent on non-essential, administrative, or clerical work. The results are similar to those reported by NACE in its annual 2022

[3] Housed at the University of Wisconsin–Madison

Internship & Co-op Survey (National Association of Colleges and Employers 2022). Employers clearly are reporting that interns do meaningful work.

A CCWT pilot study (Hora, et al. 2021) shows that about a third of respondents (67.9%, n = 1,769) say that they seek internships to gain experience in a planned career as a profession and not just to "try out" different options. The students also report about their impression of the quality of mentoring, a critical part of an internship. On a 5-point scale, they gave a generally positive (mean of 4.3) rating of their supervisory support for well-being/satisfaction/respect and appreciation of effort. Task-specific mentoring scored a mean of 3.45 (i.e., mildly positive). The CCWT results mostly reinforce what employers report in the NACE studies.

DoD WEPs, as found in the Phase I study, emphasize activities that create opportunities for students to grow their abilities as STEM scientists and junior professionals. Participants can join or even lead STEM projects that support the hosting agency's mission, working closely alongside government professionals. They contribute their ideas and perspectives to some of the most pressing challenges in the DoD. Many participants also develop and practice communication skills presenting their respective projects to the host agency and affiliates. In general, the activities engage participants in a broad set of STEM content areas and fields, engage participants at most stages of educational development, and offer participants programs of varying duration.

As a companion to the Phase I analysis, Phase II explored how WEPs design programs to help participants achieve their goals as well as the participants' perspective on what they gained during their WEP experience. This insight into the value of program activities and content may inform how to structure future WEPs to optimize student gains.

3. Program Outcomes and Options

An enduring question is what value employers and participants associate with WEPs. The NACE survey of employers lends support to the utility of internships for student employment. Results from the employer organizations for 2018–2019 were relatively similar to 2021 data as shown on graphs in the 2022 report (National Association of Colleges and Employers 2022).[4] They show that about 70% of students who intern with a company are offered full-time, entry-level jobs at that same organization. This leads to a conversion rate (i.e., accepting an offer and converting from intern to employee) above 50%. While the participants gain from obtaining employment, the employers also gain from WEPs by finding young talent that the organization wants to hire. The NACE survey also revealed that internships positively affect employee retention rates. In general, the retention rates of employees who interned at the company where they are currently

[4] The data for 2020 are skipped because of likely distortions from the COVID-19 pandemic.

employed (internal internship) are the highest, slightly exceeding the retention rates of those who interned at another company (external internship). Retention rates are lowest for employees who were hired with no internship experience. While the retention rate differences between those with internal or external internships or with no internships are modest, they are consistent over years, and the year-to-year fluctuations indicate that there are also exogenous factors (e.g., unemployment rates) that may have a considerable role in retention rates.

Another 2019 survey by NACE (National Association of Colleges and Employers 2019) included an analysis of the impact of students' internships on their transition from college to work. The focus was on the experiences of the 3,952 graduating seniors from 470 NACE-member colleges and universities. Three highlights address the value of internships:

- Students that had a paid internship experienced nearly 50% more job offers as compared to those with either an unpaid internship or no internship.
- Students that had a paid internship expect to make $10,000 more annually than those who had unpaid internships and those who were never interns.
- Most students across both paid and unpaid internships stated that their experience improved their levels of professionalism, teamwork, communication, and critical thinking/problem-solving skills.

A study that both reinforces and extends the NACE results is the Baccalaureate and Beyond Longitudinal Study (B&B, a nationally representative examination of students who completed the requirements for a bachelor's degree in a given academic year (Thomsen 2020). A recent report uses B&B data as well as a survey of 3,452 students who completed their bachelor's degree in 2015–2016 at four-year institutions (Torpey-Saboe, Leigh and Clayton 2022). There were four findings about work experience:

- Paid work-based learning (29% of graduates) are linked to getting higher paying first jobs after graduation; unpaid experience (31% of graduates) are not.
- Individuals that experienced work-based learning show greater career satisfaction and are more likely to report that their education helped them to achieve their goals.
- Paid or unpaid experience is linked to higher levels of self-confidence but those students who participated in a paid internship indicate greater levels of knowledge, confidence about career opportunities, and confidence about success in the job market.
- The benefits of paid experience are not statistically different across demographic groups, but Black and Latino students, women, low-income, and first-generation students are less likely to be paid.

In IDA's Phase I study, the analysis provided a sense of both the post-WEP opportunities for participants and for the organizations that host them. For participants, the programs that serve a variety of education levels and the duration of WEPs provide ample opportunities to stay in a STEM developmental ecosystem. There are three primary strategies that promote staying in the ecosystem: (1) formal organizational networks where there is an explicit link from one program to another program, (2) informal program connections where participants in one program may learn about other DoD opportunities, and (3) programs that explicitly encourage student participation in continued education. The incentive to continue with STEM, to possibly include a STEM career, lines up with how private industry often uses internships.

As with private industry, one objective of DoD WEPs is identifying and hiring new talent into the DoD. For hiring, several Phase I programs used WEPs as a way to assess participants for permanent positions immediately after graduation or at a later time after further education. Some of these programs have formal hiring mechanisms and designated hiring authorities through which successful participants are placed into full-time positions within the DoD. The benefit to the DoD can also include when talented participants become employed by DoD contactors as an essential contributor to the Department's mission.

Phase I also highlighted objectives in addition to employment such as increasing interest in STEM, increasing domain interest, creating geographic/regional communities in cooperation with city or state agencies, educational institutions, and employers, as well as increasing matriculation and graduation rates. Overall, WEPs help to build professional communities and the DoD views their success broadly as hubs that strengthen both the supply of and demand for STEM professionals.

IDA's Phase II study explored what program managers and participants say about the gains of having WEPs. The analysis focused on how programs work toward their goals such as hiring participants and helping participants develop post-participation plans. This insight into the subsequent impact of WEPs may inform the DoD in how they may structure future WEPs to optimize program goals and participants' future plans.

4. Challenges and Barriers to Participation and Success in WEPs

While participation in WEPs can be beneficial for both the participants and organizations, there are barriers in industry programs that may make it difficult for some people to participate at all or if they do participate to gain the full potential benefit. The Wisconsin survey of students (Hora, et al. 2021) provides some insight into problems that students face. It found that a large percentage of students (67.3% or 6,407 students) that did not complete internships had wanted to participate, but could not due to a variety of obstacles. The most frequent obstacles included the lack of knowledge about how to find internships (59.4%), a heavy course load (55.9%), cancellation due to the pandemic (44.2%), a lack of internship opportunities (41.3%), and the need to work a paid job

(40.1%). Interestingly, the lack of internship opportunities differed by major as shown in Table 1, with majors where internships have been traditionally more commonplace, there are more opportunities available to students.

Table 1. Percent of Wisconsin survey of student respondents that identified lack of opportunities for internships as an obstacle, by major.

Major	Lacked Internship Opportunity
Engineering	34.5%
Business	35.4%
Physical Sciences, Mathematics, and Computer Science	38.1%
Biological Sciences, Agriculture, and Natural Resources	43.2%
Health Professions	43.6%
Social Sciences	44.9%
Arts & Humanities	48.7%

In the 2022 NACE report, there are additional data about the diversity of students in internships (National Association of Colleges and Employers 2022). For example, while the college population is about 59% female and 41% male, the percentage of those with internships is only 43% female and 57% male (note, less than 0.5% of respondents identified as non-binary). Of those participants, the conversion rate was higher for females (55%) than for males (49%). Across ethnic/racial categories, comparing the percentage of interns to their respective student populations, found that Black and Hispanic students were underrepresented in internships while White and Asian-Americans participated in internships at a higher rate than their population percentages would suggest. On a somewhat more positive note, the data show relatively higher percentage conversion rates for Black (53.1%) and Hispanic-American (56.4%) versus the overall average of 51.8%.

For employers, according to the 2019 NACE report, a challenge for converting interns to employees is competition within industries, fighting for the most sought-after talent (National Association of Colleges and Employers 2019). This problem of converting interns into full-time employees is also documented in the 2022 report where the market for interns has become competitive in terms of pay, business reputation, and recruiting earlier to secure interns (National Association of Colleges and Employers 2022). Other challenges employers report they face are finding the right candidates who are interested in the employer/industry, diversifying their program, and addressing housing and location issues.

In IDA's Phase I analysis, there was no demographic or minority representation data regarding participation or barriers to participation in DoD WEPs. However, the study did identify programs with a specific focus on diversity. Data showed that the portfolio of

WEPs approached the concept of diversity in a variety of ways, including membership in racial and ethnic minority groups, people living in rural areas, and first-generation college students.

IDA's Phase II study expanded the Phase I findings by exploring how programs address potential barriers to participation and how they address DEIA. Also, the study explored potential barriers to participation from the participant's perspective as well as what program features may reduce barriers. This insight into barriers to participation may inform the DoD about program features to help it increase the opportunities for participation.

5. Post-WEP Employment and Policy

As an adjunct to our analysis, government policy and changes to it have an essential role in how well and easily WEPs link to a DoD workforce. Although many federal agencies have had internship programs for years, officials reported that they struggle to convert participants into applicants for federal employment (Weisner 2023). The fiscal 2019 National Defense Authorization Act (NDAA) strengthened options for converting students and recent graduates to positions within the DoD (115th Cong. 2018).[5] Furthermore, the fiscal 2021 NDAA sought to empower the DoD through scholarship and employment program coordination (116th Cong. 2021).[6] These changes allow agencies to make time-limited appointments directly into the competitive service of post-secondary students (i.e., individuals who are enrolled or accepted for enrollment in an institution of higher education and pursuing a baccalaureate or graduate degree at least part-time). The rule also allows these students to work full time, as in a WEP, pause their work to study full time, or take a short break. Perhaps, most importantly, an agency may hire a student as a permanent employee without competition after the degree requirement is complete and the job's qualification standards are met.

In the Phase I analysis, IDA did identify DoD and Office of Personnel Management (OPM) hiring authorities that can be leveraged by programs to facilitate post-program conversion from participant to employee. However, the study did not detail the specifics about how programs use those policies. The Phase II study explored if and how programs use hiring mechanisms for transitioning participants to full-time employment. This insight into the use of hiring mechanisms may inform other DoD programs on how to more effectively pursue full-time employment options for the talent identified through WEPs.

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5 The NDAA for Fiscal Year (FY) 2019, Section 1102 extended direct hiring authority for DoD agencies.

6 The NDAA for Fiscal Year (FY) 2021, Section 251, directs the Secretary of Defense to coordinate scholarship and employment programs.

B. Current Study

As described above, much of the research about WEPs has primarily come from non-DoD programs. In Phase I, we began to understand the important features and factors that might influence program impact. In Phase II of IDA's study, we continued to increase our knowledge and information about DoD WEPs and topics, including recruiting and bringing participants to WEPs, WEP activities and content, post-participation outcomes and options, program challenges, and some potential barriers to participation and success in WEPs. The intent of this study is to better inform the DoD about program strengths and where attention may be needed to optimize program impact for the agencies that use them and the participants that may benefit from them.

The findings of this report are presented across multiple chapters. The findings from the interviews are divided across Chapter 3 that covers the program's perspective of recruitment and outreach, Chapter 4 that covers benefits of the programs to participants and the internship organization, and Chapter 5 that covers how programs supported DEIA issues. The results from the survey of participants are covered in Chapter 6. The comparison of programs' and participants' perspectives is covered in Chapter 7. The final chapter includes a conclusion section with key findings and recommendations as well as a description of study strengths and limitations as well as potential next steps for further study of DoD WEPs.

2. Methodology

Phase II built on Phase I by engaging with DoD STEM WEP representatives and participants. The intent was to use mixed methods to collect both the participants' and the programs' perspective on a range of topics, some of which overlapped so they could be compared to one another. The program perspective was collected through non-attributional semi-structured interviews with program personnel (see Appendix A). Semi-structured interviews were used so that we could get detailed information about programs. It also allowed for the flexibility of asking follow-up questions when additional information was needed on a topic. The topics in the interview covered how programs recruit participants, the activities during the program, potential for hiring participants, and aspects of DEIA. Separately, the participant perspective was collected through a survey (see Appendix B). The survey included items about participants' educational and professional development before the program, what they feel they gained from being in the program, and how they think programs may be improved for future participants. A survey was used so that we could get the perspective of a large number of participants across many programs.

Because both participant and program perspectives were collected, they could be compared when similar topics were addressed. Because different methods were used for each perspective, direct data comparisons were not possible but thematic or topical comparisons were. The following topics were covered in both the participant and program data collection efforts:

- Recruiting medium and methods
- Factors influencing candidates to apply
- Challenges/barriers to participation
- Benefits to participants
- Mentoring
- Post-WEP opportunities
- Job/Career factors

A. Interview Component – the Programs' Perspectives

A semi-structured interview was used to collect the programs' perspectives from program representatives (see Appendix A for the full interview protocol). The use of a standard protocol for all the interviews enabled the interviewers to acquire similar

information across programs, thereby enhancing reliability of the findings when multiple programs identified similar issues. The protocol also allowed flexibility for interviewers to explore unique aspects of particular programs that emerged during an interview. In addition, the interviews were non-attributional to facilitate open and candid responses from the interviewees.

1. Interview Protocol Development

IDA developed the interview protocol to address a wide variety of topics related to how WEPs recruit and develop participants, including the following:

- Program Summary—a high-level description of the WEP.
- Recruitment and Program Access—participant characteristics the program recruits; how these individuals are sought; how selections are made; and any relevant challenges.
- Program Activities and Participant Development—how participants are expected to develop through participation; how programs foster development, such as mentoring practices; how programs assess outcomes; and challenges with ensuring development and why some participants may struggle.
- Descriptions of Success—indicators of post-WEP impact; expected "next steps" for individuals after the program; potential hiring pathways for program participants; and any obstacles that may impede post-participation success.
- Perspectives on DEIA—opportunities throughout the interview for respondents to discuss challenges to recruitment and development efforts relevant to DEIA issues; and a specific question near the end of the interview that invited respondents to comment on DEIA and their program.

The interviews also included a few questions to collect basic background information on the respondents (e.g., demographics) to describe them and provide context to responses.

The interviewers collectively reviewed the interview protocol and discussed the process to help standardize how the interviews would be conducted. Next, to pilot test the protocol and data collection and analysis procedures, each interviewer conducted at least one practice session with IDA personnel, with additional members of the study team observing the interview. The interviewed IDA personnel were involved in IDA's summer internship program with similar functions (e.g., program manager, division coordinators, and mentors) to the WEP study's interviewees. Discussions amongst the IDA study team helped to standardize the process across interviewer. Also, over the course of the data collection period, weekly sessions with all interviewers were held to bring up any issues that occurred during data collection sessions and to ensure that they were handled similarly.

2. Sampling

The WEP interview sample was selected from programs identified in Phase I as having one or more of three key features: whether or not the program was relatively shorter (e.g., summer internship) or longer (e.g., year or longer work experiences); if the programs had or did not have an explicit mechanism for hiring participants after the program; and if the programs did or did not have a specified diversity, equity, and inclusion mission. These features were determined through discussions with the DoD STEM community. The intent was to build a purposive sample based on relatively even distribution of program features across the sample. IDA also made a concerted effort to include programs from each Service as well as those that served multiple Services and Fourth Estate organizations. Table 2 below shows the number of programs with each feature or characteristic in the sample.

Prior to contacting organizations for potential interviews, the DoD STEM Director sent out a widely distributed email announcement to DoD WEP points of contact indicating that IDA may contact them to request an interview. Additionally, IDA presented the Phase II research plan at multiple DoD STEM community meetings saying that IDA may contact them. IDA then began contacting WEPs selected from the sampling procedure by email to request interviews with individuals who could represent the WEP and provide either a program manager or a mentor perspective. If an individual program did not respond to IDA's request,[7] IDA replaced the WEP with a similarly featured program. Table 2 shows the number of programs in the final sample of programs with each of the features. The sum of the different values for each feature (e.g., shorter or longer for duration, with or without a hiring mechanism) add up to 22, the total number of programs in the sample.

Table 2. List of programs with specific features that were involved in the sampling procedure.

Program Feature	Feature Values	Count in Sample
Duration	Shorter	9
	Longer	13
Hiring	Hiring – Primary Objective	8
	No explicit hiring mechanism	14
DEIA	DEIA Mission	11
	No explicit DEIA in Mission	11
Service/Organization	DoD-wide	3
	Air Force	8
	Army	2
	Navy	7
	Fourth Estate	2

[7] Eight programs did not respond to our requests for interviews, so they were replaced with programs that shared similar features.

When potential interview respondents initially were contacted by IDA, they received a description of the purpose and scope of the study and the handling and protection of interview data. This email included a request to set up a date/time for an interview. In addition, the email had a request that if the addressee was not an appropriate program representative to interview, that they would introduce us to someone who was appropriate. In total, IDA conducted 35 interviews across 22 different WEPs. This accounted for almost half of all the programs identified in Phase I and was considered a broad and purposive sample of programs. The roles of those interviewed, as they described themselves, included 23 program managers, 11 mentors, and 1 who characterized their role as human resources professional.

3. Data Collection and Analysis Procedures

The interviews were performed virtually using ZoomGov, and respondents were asked for one hour of their time for completing the semi-structured interview protocol. At the beginning of the interview, interviewers introduced themselves along with another IDA researcher who functioned as a notetaker. Additionally, the respondents were asked if it would be okay for the audio of the interview to be recorded. These notetaking and audio recordings provided comprehensive interview data for analysis. After each interview, the person who conducted it and the notetaker met to discuss the session and clear up any aspects that needed clarification.

The text corpus for analysis consisted of the transcriptions of the interviews along with the notes. The audio recordings collected from the interviews, which most (33 of 35) respondents agreed to allow, were transcribed using an automated transcription service (Amazon Transcribe). For the non-recorded interviews, the notes were the sole source for inclusion in the text corpus for analysis. Prior to analysis, the corpus was reviewed and cleaned up by IDA researchers who corrected misspelled words, spelled out acronyms, inserted appropriate punctuation to facilitate reading, and clarified incomplete text. When needed, the IDA researchers who cleaned up the transcripts referred to the audio recording for clarification. The goal of transcript cleaning was to provide complete and clear information for analysts to code.

The interview corpus was inserted into Nvivo, a qualitative analysis software package that enabled IDA researchers first to code (i.e., systematically categorizing excerpts from the interview), and then to organize and analyze the coded interview data. There were three researchers who coded the interview data, and they met repeatedly to first gain consistency into how the codes may be applied and to continue to check with each other if there were any questions as to coding. Analysis of interview data relied on a coding framework (i.e., hierarchical topic structure of higher-level topics and sub-topics) which categorized pieces of information according to key issues and themes. These themes were guided initially by

the research questions, and ultimately evolved through an inductive approach using a recursive study of the data that allowed discovery of categories not previously known.

The coding framework was used to label text excerpts within individual interviews so they could be analyzed across the full corpus of interviews. Example descriptions of some codes used include description of participant characteristics sought by programs, explanation of program planning activities, information relevant to the application process, description of mentoring activity, information about the professional development activities during the WEP, challenges for individuals or programs, identification of best practice or recommendation, and description of hiring mechanisms. Some of these codes may be broken down to further distinguish the interview excerpts, such as 'challenges' being broken down further to include 'challenges for recruiting,' 'challenges during the WEP,' and 'challenges for post-WEP hiring.'

By applying a standard set of codes to the text within Nvivo, IDA researchers could then analyze topically related instances of text across interviews. For example, with Nvivo, the IDA researchers could view all similarly coded excerpts across interviews at the same time such as all instances where interviews discussed mentoring. By doing this, the researcher could analyze across all interviews to identify commonalities (e.g., all programs indicated that mentoring was positive when …) or differences (e.g., two-thirds of programs trained mentors through … and the other third by …). This allowed IDA researchers to identify distinct themes that cut across interviews. The analysis included determining if themes were associated with other factors or program attributes (e.g., longer/shorter programs, with/without a hiring focus, with/without a DEIA goal). This framework for thematic analysis is the foundation for the interview findings that are presented in Chapters 3, 4, and 5 of this report.

B. Survey Component – Participant Perspective

The perspective of WEP participants was acquired through an online survey. This survey enabled the collection of data from a large number of participants as well as provide for anonymity of respondents (i.e., no personally identifiable information was collected). The survey was structured and implemented to collect similar information about DoD STEM WEPs from a broad sample of participants across a diverse set of programs.

1. Survey Development and Approval

The survey (see Appendix B for the full survey instrument) was designed to gain the participant's perspective of DoD STEM WEPs on a range of topics, including the following:

- Basic educational information (e.g., current academic level, current major, characteristics of school attending)

- The WEP a participant was in (e.g., how they heard about the program, mentoring, work location characteristics, skill development, and program impacts)
- Future plans (e.g., education plans, expectations for a STEM career, factors for deciding on a job offer)
- Basic demographic information

IDA developed an initial draft of the survey based on coordination meetings with DoD STEM. A formalized survey was then created and submitted as a packet to Washington Headquarters Services (WHS), who determined that the survey would require Office of Management and Budget (OMB) approval to proceed. WHS then submitted the survey packet to OMB in March 2022. The OMB approval process included a 60-day and a 30-day public notice that the survey would be administered, followed by three IDA revisions in response to WHS's or OMB's questions or direction that IDA needed to revise particular items or procedures. The final approval was granted on July 7, 2023, with OMB Control Number 0704-0668.

2. Survey Administration and Collection

IDA used Qualtrics, a well-established online survey platform, to administer the survey. The process for developing the survey included inserting the items into Qualtrics, in-house pilot testing by IDA to determine if the items were displayed properly, and a check if data were recorded appropriately for later analysis. After making minor revisions based on piloting the survey, a final collection version was posted to Qualtrics. A web link (uniform resource locator web address) was generated for participants to access the survey.

To recruit survey participants, IDA developed an invitation email for WEP program coordinators or managers to send to their participants. Based on the comprehensive listing of WEPs and program contacts that IDA developed during Phase 1, the DoD STEM Director engaged program coordinators by asking that they send the invitation via email to program managers informing them of IDA's study and requesting that recent program participants complete it. With the request coming from program managers/coordinators, IDA did not have any direct knowledge of who received survey invitations to preserve anonymity. Additionally, the survey expressly stated that respondents should not include any personally identifiable information in their open-text responses. Also, the results were only presented in aggregate to further ensure individual anonymity.

The survey was available for completion by respondents between August 14, 2024, to November 10, 2024. While collecting data, IDA reviewed the initial responses and suggested that the DoD STEM Director should contact particular types of programs to remind their managers about sending the invitation email to participants. This process resulted in collecting data from a broad sample across various types of programs. However,

the actual composition of respondents was not pre-determined because the OMB required that recruiting of participants was separated from data collection. Therefore, the sample should not be viewed as statistically representative but could be considered broad in its distribution across the DoD STEM WEP population and provides useful information about the general perspective of participants. The characteristics of the sample and the number of respondents that answered any specific question will be described in further detail in the findings section.

3. Data and Analysis Procedures

The survey included a combination of closed- and open-ended responses, and how each of those was analyzed is described below.

a. Close-ended Items

There were several formats used to capture closed-ended information (i.e., predefined response options) that included selecting items from a predefined list of options (e.g., academic major, race), selecting radio buttons that indicated a specific level of a variable (e.g., degree level of education), and slider bars that indicated values along a scaled metric (e.g., importance of job factors from not at all to very important; program impact from big decrease to big increase).

We used descriptive statistics for the questions where it was appropriate. Based on the question asked and how the finding might best be described, multiple types of analyses were conducted. These include standard counts of specific responses for categorical data, percentages of responses across item response options, and measures of the mean response value and standard deviation for items that could be rated on a numerical scale.

b. Open-ended Items

The open-ended (or free form) questions were grouped in two ways: (1) Responses that were relatively short answers, such as a goal job title or a WEP name, were reviewed by an IDA researcher and any variations grouped into categories. (2) Longer responses with multiple sentences or parts (e.g., describe your program gains; how would you improve the program) were clustered into similar groupings by an IDA researcher, refined after discussion with other research analysts, and then summarized into themes. Because longer participant responses may include multiple pieces of information, there were some that resulted in more than one theme.

3. Interview Results: WEP Recruitment

Recruiting the WEP participants is a crucial step in running a successful program. The program managers and mentors who talked to IDA shared experiences and lessons from various parts of the recruiting process. This chapter focuses on the what the programs were seeking in candidates, the outreach and recruiting activities across WEPs, and the recruiting challenges that WEPs face. Some of the key findings discussed in detail in this chapter are listed below:

- WEP representatives look for a wide variety of academic characteristics, as well as implicit criteria such as determination, enthusiasm, and professionalism.
- Cohort diversity is often a goal of program recruitment, though this diversity could mean demographic diversity or academic diversity.
- Programs use both one-way communication methods (e.g., email blasts, job postings) and two-way communication methods (e.g., career fairs) to reach a wide range of potential applicants at varying level of details.
- WEP representatives saw strategic intermediaries as a key piece in enhancing recruitment.
- Some of the challenges that keep WEPs from receiving enough applications include lack of awareness of the program, wariness of Defense work, program benefits that may not be competitive with the commercial sector, cumbersome application processes, and acute or systemic historical factors.

A. Desired Candidates

Different WEPs have different goals which means that the ideal participant varied by program. In order to understand who program managers and mentors want as participants, IDA asked, "From your experience, what types of people seem to be a good fit for the program? What do you look for?" Interview respondents discussed a wide range of participant characteristics. Overall, these discussions fell into two categories: individual participant characteristics and cohort composition. Individual characteristics (e.g., current academic level, GPA) were those that could be examined on an applicant-by-applicant basis, and were often seen as necessary for each of the people coming into the program. Cohort composition (e.g., range of academic levels across the entire cohort, range of academic disciplines across the cohort) characterized the entire group of participants. Many

respondents talked about both individual characteristics and cohort composition in their responses.

1. Individual Characteristics

Every single respondent brought up at least one individual characteristic that they look for in candidates. Broadly, these included academic characteristics (including academic level, interest, and performance), non-cognitive skills (commonly called "soft skills"), and citizenship.

As expected, academics were an important factor when thinking about who WEPs want as participants. The academic level, or stage of education, stood as a salient consideration. A summary of which academic levels were covered by the programs interviewed is shown in Table 3. Also shown is the percentage of programs reported for each academic level in the Phase 1 report (Belanich, et al. 2022), which gives an approximate distribution across all DoD WEPs.

Table 3. Summary of academic level sought by programs. Programs could serve participants from multiple academic levels.

Academic Level	Percent of Interviews, based on Program features (*N* = 35)	Percent of Programs Phase 1 (*N* = 54)
High School	27%	24%
Community College	23%	11%
Undergraduate	82%	69%
Graduate	36%	48%
Postdoctoral	18%	13%
Beyond Postdoctoral	23%	NA

Responses to the interview show a range of education levels from high school to beyond postdoctoral fellows (i.e., early career researchers). Some people mentioned only one academic level, while others were interested in a few levels or a broad range across the spectrum. As with the DoD WEPs more broadly, the most common response was that WEPs were seeking undergraduate students at four-year universities, with programs for graduate students being the second most common.

One interesting exception to the norm (i.e., undergraduate and graduate programs) is the programs that focus solely on community college students. For these programs, community college students are seen as bringing valuable skills and experience that stand apart from those of traditional four-year university students or graduate students. One program manager explained the reasoning behind this prioritization:

A lot of times they have wonderful work experience already. Like working in jobs that they don't even see as having any value to the engineering or science field… I mean they're working in machine shops. They're working in automotive shops… you get them talking about it, and you're like, wow, they do have these skills.

Rather than sticking to typical estimations of skills coming directly from academic settings, this respondent points out the value of looking at a wider set of experiences that community college students might have, and uses these valuations when considering ideal candidates for program participation. This perspective exemplifies how academic level is tied to trying to find the right skills for a particular WEP. A WEP that focuses on community college students may be thinking about practical skills while a WEP that focuses on graduate students may be looking for subject-matter knowledge and lab skills. Ultimately, the academic levels sought has to agree with the goals of the WEP.

Another important factor for respondents was the candidates' academic interests, or what they are focusing on in school. At least one representative from each program brought up this consideration. The scope of interests varied from program to program, with some looking broadly and some aiming more narrowly. On the broad side, some programs just wanted people who were STEM majors or had STEM coursework. Slightly more narrowly, a lot of respondents mentioned specific subjects of interest. The most commonly mentioned areas were computer science and engineering. Finally, a few respondents talked about programs having specific skills needed on particular projects. In these cases, the descriptions of ideal candidates included those with experience on particular equipment or who otherwise matched a more specialized need. There was a relationship between the academic interests that programs were looking for and the academic levels they were seeking. Generally, programs engaging with community college and undergraduate students tended to have less-specific criteria while graduate programs and beyond used more specific criteria for candidates. Once again, program goals play a role, as those that need specialized skills are going to be looking for more advanced students.

Respondents also brought up academic performance as an important factor when defining desired candidates. Many respondents talked about wanting "good students" who were "bright," and some went on to point to GPA requirements for application consideration. Yet, GPA was not a universal aspect of respondents' definitions with a few pushing back against the use of GPA as a deciding factor. One program manager talked about advocating for students who may not have the best GPA:

They may not have a [particular] GPA…. But if I interviewed them and I say… this person is good, they may have a story behind why their GPA is a certain way … I have to be the advocate to be able to communicate that to … other people that may push back by just looking at a piece of paper like a resume.

For this respondent and similar individuals, looking beyond the "on-paper" academic qualifications to understand more about the candidate and how they will fit into the program is a central part of the selection process. Additionally, this quote exemplifies the importance of what the program managers think about candidates; that is, desired candidates may have an advocate to help get them in the program which can help overcome any shortcomings on their applications.

More broadly, looking beyond academic characteristics was facilitated by factoring in the non-cognitive skills of candidates. These characteristics are any personality traits that could make the candidate a stronger fit for the program. In particular, respondents talked about several different types of non-cognitive skills: (1) hard work and determination, (2) enthusiasm and interest, (3) professionalism, and (4) leadership. These characteristics are often not written as explicit program requirements. Instead, they are relied on as unwritten criteria that are values by program representatives.

More than half of respondents brought up hard work and determination when discussing the types of candidates they want. Many people saw this skill as being at least as important as being smart or skilled. In fact, several people brought this up as a counterbalance to intelligence, pointing out that people who worked hard were more valuable to their program than people who were the smartest. As one respondent put it, "you don't have to be the smartest, but you can outwork people."

About half of respondents brought up enthusiasm and interest as valuable in candidates. In other words, programs want candidates who want to be there. Some people saw this enthusiasm as being just as important as academic characteristics, with one respondent calling it, "really the most critical thing." Others brought up that they were looking for a general interest in unsolved problems and a general enthusiasm for learning. In particular, this type of curiosity was seen as a contrast to the typical schoolwork that candidates undertook before the WEP. These respondents were looking for candidates who were motivated to be at the WEP and wanted to tackle the difficult real-world problems that DoD research entails.

Less frequently (just under a third of respondents), program representatives talked about looking for a level of professionalism from candidates. Respondents recognized that for many of their participants, the WEP would be the first foray in the professional world. So, they looked for skills such as communication, teamwork, and maturity that would help candidates succeed in that professional environment. A few program representatives talked

about wanting candidates with leadership skills or potential. Typically, these programs also had a leadership component to their goals, but it also came up from programs that had a lot of group work and wanted candidates who could potentially take charge of a team.

Notably, these non-cognitive skills were not typically listed as explicit requirements when viewing program information. It is only through interviews with program representatives that the importance of these sought-after characteristics was revealed. Generally, the non-cognitive skills offer a way for selection that uses a more holistic view of candidates with less use of strictly traditional measures of academic success.

As a final consideration, some programs had requirements for U.S. citizenship. Unlike the other characteristics, citizenship was often an agency or site requirement imposed on a program. Respondents typically did not see citizenship as an indicator of candidate quality or fit. Section 3.C discusses further how this particular requirement could be a challenge for programs.

2. Cohort Composition

All of the programs that are part of the sample bring in more than one participant per year. With that in mind, some of the respondents interviewed thought about their desired candidates from the perspective of building a cohort. Typically, this meant thinking about variety across the cohort, and looking for diversity across a range of different factors. The main factors discussed were academic levels, diversity of thought, demographics, socioeconomic status, and locations of schools.

Diversity of academic levels was a fairly common goal, with more than half of the programs having multiple academic levels of interest. As discussed in the previous section, academic levels are also tied to the types of work that the participants are doing, so looking for a range of different levels is appropriate when the participants will be doing a variety of different work.

Another key cohort characteristic was diversity of thought, which was brought up by about half of the programs. Not every respondent used that exact phrase, but this category captures discussions of how they look for candidates who think about things in different ways. For some people, this was looking for candidates who study different academic disciplines. For others, it was a more amorphous desire for people who approach problems in different ways. Several people mentioned that diversity of thought was the key metric of diversity that they were interested in. While these respondents clarified that they do not want to be exclusionary, they also made plain that they did not find other aspects of diversity as being as useful. One respondent said, “I was more about diversity of thought than I was about gender, race, and other things. Because those to me, are surface-level features.” This person was contrasting between the different types of diversity, and indicating that for them it is diversity of thought that comes out on top.

Not every respondent agreed with this way of looking at qualifications. In particular, demographic diversity came up as a goal from more than half of the programs. Racial/ethnic diversity was the most common type mentioned, including from several programs where this type of diversity was an explicit program goal. Racial and ethnic diversity in recruiting was also typically the first subject that someone would address when asked directly about DEIA. Several respondents tied this type of diversity back to diversity of thought. One program manager from a DEIA-focused program pointed to research on the topic, saying,

> *It is shown via metrics when you have a diversified team, you get a better product at the end… When you have people that are like minded that look alike in the same room, you get the same product and you get the same ideas.*

For this respondent and similar respondents, racial/ethnic diversity was not just about checking a box. Rather, they saw the value of bringing together a wide variety of people to make their program stronger.

In contrast, gender diversity was mentioned by less than half of respondents, and typically only as an afterthought. A few people mentioned targeting their outreach specifically to female candidates, but thought of these candidates as something nice to have rather than a specific program goal. Additionally, there was no discussion from the respondents on why gender diversity made their research programs stronger. Overall, demographic diversity was seen as important by a broad range of programs. Typically, this was interpreted as racial/ethnic diversity while gender diversity was not emphasized.

Just a few respondents mentioned other types of cohort diversity. The first of these was socioeconomic status, which a small number of respondents characterized as trying to recruit candidates from lower socioeconomic backgrounds or first-generation students. These program managers and mentors recognized that a lot of the academically top-performing students come from a place of privilege. They mentioned the value of recruiting students with a different perspective from a lower socioeconomic background. One program manager tied this directly to non-cognitive skills: hard work and dedication. This person recounted personal experience as a first-generation college student who came from a tougher background. This respondent saw similar students as more likely to develop a "stick-to-it-ness" that was important for success within the program. So, for this respondent, the socioeconomic status mirrored the contrast between dedication and academic performance that we saw in the discussion of individual characteristics.

Finally, several respondents talked about wanting candidates from a wide range of locations or schools. For some people, this meant looking beyond the top-ranked or Ivy League schools. One person tied this directly to looking at socioeconomic diversity and emphasized that there is no corresponding drop in talent. Others thought about diversity

more geographically and wanted to reach candidates who were located at schools far from the program locations. For at least a few people, this was specifically tied to diversity of thought, as they pointed out how different geographic locations have different perspectives. Generally, about half of the respondents brought up historically Black colleges and universities (HBCUs) and minority serving institutions (MSIs) as a way to increase diversity. For some, HBCUs/MSIs seemed to be a stand-in for diversity more generally, and HBCUs/MSIs were the only topic they brought up when directly asked about DEIA efforts.

Finally, there were a few respondents who emphasized that they do not have diversity criteria. This small number touched on the fact that they focus more on the individual skill sets rather than any considerations of creating a representative cohort. One person spoke to this, clarifying that they were working to understand diversity better, but saying,

> *We really value a skill set over diversity…And so if [an HBCU] has a fantastic clinical psychology program… but we don't have the need for a clinical psychologist then I got to go somewhere else. And that's just the fact. And so we support research. We don't have any diversity quotas. … what I would hope is that we focus more on the student, himself or herself, and less on whether a student meets a certain diversity criterion.*

This program manager saw a conflict between seeking diversity of the cohort and bringing in the skills they need. However, they were the exception in our interviews, and all but a few of the program representatives supported diversity in their cohort from academic level to demographics. And while some people were less specific about what type of diversity they were seeking or exactly why they valued it, the overwhelming takeaway is that they did see benefits and sought a diverse cohort.

Of course, these different aspects of cohort diversity were not mutually exclusive, and people often touched on multiple categories. Ultimately, racial/ethnic demographics, socioeconomic status, and location/school were all tied back to diversity of thought by at least one interview. All of these factors were seen as ways of bringing in people who could look at problems differently and help make the research stronger overall.

B. Recruitment Activities

Program representatives answered questions about recruitment activities and how they go about attracting applicants. Interview respondents outlined a breadth of strategies to reach potential applicants. Some of these strategies involving one-way communication activities that are used in advertising campaigns intended to reach large audiences and two-communication activities that involve activities that allow a back-and-forth dialogue.

These categories are described in detail below. Either type of strategy could rely on intermediaries to connect the programs with the potential applicants.

1. One-way Communication

One-way communication refers to the unilateral nature of the information flow, such as when "mass-blast" type messaging is used to get the word out. The outreach campaigns which characterize one-way communication strategies focus on volume. The vast majority of programs reported employing one-way communication to some degree, and these strategies relied on platforms like social media, job recruitment websites, email list servs, and even ads in scientific journals. Specific services like Facebook, LinkedIn, Instagram, Twitter, Zintellect, Handshake, USAJobs, etc. were referenced as opportunities to get program information in front of as many eyes as possible.

Using online one-way communication methods was described as cost efficient and easier to implement than in-person recruiting. One-way communication does not require changes to existing agreements with universities, which can be required when sending representatives to interact with students. Programs seized upon this efficiency and ease of use by leveraging multiple platforms to host program information; no program described a reliance on a single website or platform alone when employing one-way communication.

While prioritizing volume, one-way communication still can present rich information and be targeted towards people with specific characteristics. For example, some programs took advantage of job recruitment websites to offer blurbs describing the nature of the research project available to an applicant. Another program hosts an online portal with a search function that allows potential applicants to narrow down opportunities by topic. This is especially important for this program where participation opportunities span a wide breadth of topics and locations. The representative for this program suggested how this breadth could initially overwhelm a potential applicant. However, having a centralized and searchable platform meant that a potential candidate could filter this initial flood of information to a more approachable list of opportunities that aligns with their research interests, as well as provide them with the contact information needed in order to take the next step. One-way communication offers a chance for potential candidates to approach and sort through rich program information on their own time, allowing them to make informed decisions about what opportunities may be most applicable to them.

In summary, the true benefit of the one-way communication strategies, according to respondents, is the large number of individuals who could be reached in a short time, with relatively low costs. Additionally, one-way communication can offer rich program information that potential candidates can approach on their own time before deciding to proceed with an application or not.

2. Two-way Communication

Two-way communication stands apart from the prior strategy in that it involves interaction between a program representative and potential candidates. While still frequently mentioned (about two-thirds of programs), this category came up less often than one-way communication. Interview respondents described outreach events such as brown-bag events, career fairs, school STEM nights, information sessions, conference interactions, and professional society meetings as opportunities to meet potential applicants and share details about the program while providing a chance to answer questions and address concerns. Most of these were described as in-person events, meeting potential applicants face-to-face, but programs did mention participating in virtual events as well, especially when dealing with COVID-related restrictions in 2020–2022.

Two-way communication, by nature, grants more opportunity to describe details and answer questions about programs, and to emphasize their benefits. These types of interactions provide more than an impersonal advertisement on a screen distributed en masse. Interviewees described pitching overviews of what their programs encompass, being available for informal conversations with students, and even providing detailed instructions on how to complete the various and sometimes bureaucratic application steps.

But the real-time interactions offered sometimes more than just additional time to promulgate program information. Respondents talked about a different quality of interaction in real-time with potential applicants as opposed to one-way communication. Being face-to-face seemed to add weight to the recruiter's message. One program representative who regularly visits universities to host information sessions spoke about the value of two-way communication for connecting with younger students who may be less sure than older ones about their interests or career pursuits:

> *To me there's no substitute for getting in front of them and talking about what the realm of the possible is, and encouraging them and say that you can make it through here because I did it and so forth. So, I think that's the best way of doing it.*

For this respondent, having a physical presence facilitated personal connections. Being in front of the students and describing the program in detail established the opportunity as something more real and tangible than what students may understand from a flyer or advertisement alone.

The two categories of recruitment activities were not described by program representatives as mutually exclusive, however. More than half of programs reported using a dove-tailed approach where wide-reaching, one-way communication strategies were supplemented with targeted efforts engaging desired candidates using two-way communication strategies. Even in the use of job recruitment websites, the information provided via one-way communication sometimes included contact information for

personnel involved in the research to enable a potential applicant to initiate a conversation about the opportunity. The frequency with which interview respondents brought up both one- and two-way communication examples tells us that in order to maximize recruitment successes, programs are leveraging a combination of strategies in pursuit of their goals.

3. Intermediaries

A unifying theme presented both for one- and two-way communication paradigms was the importance of using partners or allies to reach a desired audience. These partners or allies were already positioned in a relationship network including potential candidates. Almost every program mentioned using intermediaries to aid in recruiting efforts. Importantly, respondents talked about intermediaries in the form of individual relationships as well as organizational ties.

For all but a few programs, interview respondents pointed to intermediaries as individual relationships helpful for recruiting. The individual intermediaries held a variety of roles but all held access to student populations by nature of their position. Some respondents discussed long-standing relationships with teachers and professors who work directly with students and could pass on information about program opportunities. Other respondents described forming relationships with deans and department heads who could act as a channel of information in their administrative roles. Another common example included program alumni who speak to student peers about the value of their experience. One respondent representing a program that focuses on a particular research domain highlighted a few ways that individual intermediaries could help spread the word:

> *We've basically sent letters to professors throughout the country that we know are researching areas of interest to us… [We] ask them to point their best students to us to apply to our program…[Also,] word of mouth happens a lot, particularly if an intern has a good experience and they go back to their own university.*

This program uses a one-way communication strategy to widely distribute information about opportunities in the hopes that the individual intermediaries embedded within the academic institutions will connect the program with desirable candidates. Having a link to candidates with the proper background or training is particularly important given the program's narrow focus. If participating students go on to have a positive experience in the program, this can amplify the recruiting message even further.

Establishing these individual relationships requires time and effort on the part of program representatives. The individual intermediaries need to understand the value of the program for their students. Further, trust needs to be built between the program representatives and the intermediary. One respondent who works within the context of a program serving community college students illustrated the process required to get to this

point of trust. In this example, representatives of the community college had some wariness regarding a DoD-funded program looking to recruit students. In turn, the S&E professionals who would be working as mentors on the DoD side felt hesitant for different reasons, not having worked with community college students before and feeling unsure about their capabilities. The interview respondent, acting as the program champion, initially knew only one contact point and spent years cultivating relationships with contact points in the community:

> *I needed to get in there and to understand the nuances. And then, also, frankly build trust, you know? Because I had people ask me literally, why does [WEP] care about [our] students? It's like, well, you're the future. So, it's taken me this long to get to a place where I know the people, and I can go to schools, and they know that I'm bringing something quality.*

The intermediary in this case proved instrumental in allowing the program to gain a foothold in the community. Part of this process included bringing program alumni back into classrooms to share their experiences and answer questions. Over time, the program came to be seen as a quality opportunity, but only as the result of significant time and effort put into building the individual intermediary relationship.

The disadvantage of utilizing individual relationships for intermediaries may occur if that individual's involvement or employment change. All the hard-earned social capital may disappear if personnel changes. This makes individual intermediary relationships more vulnerable over time.

Organizational ties made up the other form of intermediary mentioned by interview respondents, and came up from just over half of all programs. Contrasting with individual relationships, these types of intermediaries represent more formal connections between organizations, communities, or institutions. Organizational ties manifested in a variety of ways in discussions with program representatives. These intermediaries could be educational partnership agreements, paid contracting organizations, alumni networks, or grant recipient networks, or even formalized connections with other work experience programs.

One of these ties IDA heard about was with a non-profit institution where, in the terms of their cooperative agreement, it is stipulated that the organization would advertise for the WEP at all accredited U.S. universities. Those advertising efforts could involve intermediaries attending conferences, workshops, or colleges; meeting with the deans or business offices at the colleges; and directing them to program websites to look at the opportunities that are available. Organizational ties also proved helpful for a WEP focusing on underrepresented communities, which took advantage of the already existing DoD

electronic mailing list (listserv) of HBCUs and MSIs in order to push out links directly to program websites.

While WEPs may need to surmount bureaucratic obstacles in order to establish organizational ties, this type of intermediary offers an advantage: these ties were more resistant to change in a way that the individual relationships were not. While a given individual at an institution may leave, the mechanisms of partnerships allow organizational ties to remain, meaning that this type of intermediary is less vulnerable to attrition.

Ultimately, intermediaries appeared as force-multipliers for WEP recruitment activities. Individual relationships, for example, permitted word-of-mouth to spread about the program and its value. WEPs often described inviting program alumni or representatives to speak to their university department, give a presentation to their class, or set up a booth at an event. One interview respondent working with a WEP that focuses on a niche domain detailed the process of sending out program webpage links to academic researchers whom the DoD organization has been working with for years, requesting them to push the program information to any bright students who might be interested. Another respondent provided the example of a professor who worked at a DoD lab over a summer and then went back to talk to their students about the experience.

Organizational ties also served as a force-multiplier for recruitment activities. Respondents outlined how these intermediaries allowed information to be passed along to a greater number or more specific group of students. One respondent who works with an apprenticeship program that involves both high school and college students at sites all over the country described the benefit of this type of intermediary. The WEP in this case hired a contractor to determine, on a site-by-site basis, where they are missing potential applicants with their advertising campaign:

> *Where [contractor] comes in is to not only support those local types of marketing but to really identify gaps in marketing and to utilize their resources to fill those gaps. In particular, finding students from disadvantaged communities, or students who have experience in a given discipline.*

In this example, the organizational tie with the contracting organization helps identify and address gaps in recruitment efforts—capabilities that the WEP alone did not have. Benefits for this organizational tie included getting the message out to students who otherwise might not hear about the program.

Intermediaries seemed to aid in recruitment activities for WEPs in two distinct ways: performing functions of either legitimizing or gatekeeping. In the gatekeeping scenario, individuals or organizations separate from the WEP controlled access to a group of potential candidates which could be a particular demographic group or students in a

specific discipline. Through the WEP's relationship with that gatekeeper, access is granted to a program representative to either come and speak about the program or receive contact information for giving potential candidates program information. This could manifest as a contractor that maintains a database of contact information for department chairs at a range of universities, or as a personal relationship with the head of a professional society, allowing a WEP representative to be invited to a meeting and giving a presentation.

Intermediaries also serve a legitimizing function in which individuals or organizations help establish the value and reputation of a program. Hearing about the program through that intermediary individual or organization lends credibility to the message. Potential candidates may pay more attention to information from a credible source or more seriously consider the opportunity. Interview respondents offered the example of a teacher speaking highly about the WEP with their class and encouraging students to apply. IDA also heard about program alumni delivering talks about their experience to groups of peers.

Given the frequency with which individual intermediaries and organizational ties were cited by interview respondents, it is clear that WEPs are not performing their recruitment activities alone. Intermediaries are a vital part of many WEPs' strategy for reaching potential applicants, granting improved access as gatekeepers or legitimizing the program opportunity in the eyes of potential candidates.

C. Challenges in Recruiting Desired Candidates

While WEP program managers and mentors are doing a lot to bring in good applicants, they also face challenges. As part of each interview, respondents were asked to discuss challenges related to "bringing the right people on board." Most of the answers focused on the number of applications, with the idea that as long as you get enough applications, then you are in a position to screen for the best quality participants. Ultimately, respondents encountered five categories of challenges to getting enough applicants: low awareness of the WEP, wariness of Defense work, lack of interest in the program's offer, cumbersome application processes, and acute or systemic historical factors.

The first set of challenges revolved around awareness of the program's existence, with respondents from more than half of the programs expressing awareness-related concerns. There were several factors that respondents identified that may limit potential applicants from knowing about their programs. The first impacted respondents from small organizations within the DoD, who felt that media coverage was uneven across the Department. In particular, they pointed out that certain pieces of the national security apparatus such as the Federal Bureau of Investigation (FBI), Army, or Navy got much more media coverage than the smaller Fourth Estate agencies. A second possible reason for low awareness is that a program or site is new and has not had the opportunity to establish itself as broadly as others. Finally, respondents pointed out that awareness could be low when

the WEP was physically far away from where the desired candidates were living or going to school. Of course, this challenge is the trade-off to recruiting nationally. Local recruiting results in a more limited candidate pool, but makes it easier to increase awareness of a program.

Respondents talked about how awareness was particularly difficult to generate in historically underrepresented communities (HURCs). One potential explanation for this is that students at any two-year colleges are generally less likely to participate in extracurricular activities. In particular, community college is often a transitional experience with students focused on getting through their requirements. That makes activities like WEPs a lower priority and something that may take time away from educational goals. Additionally, this respondent points out that there is less campus life at community colleges, so typical outreach methods such as flyers or working with a career center may not be as effective as at four-year schools.

Respondents brought up a second reason why HURCs may have less awareness of WEPs: they are less likely to have friends or family working at a defense facility. Program representatives particularly saw this as a problem for generating awareness among minorities and candidates from disadvantaged social backgrounds. Ultimately, knowing a person at the WEP facility acts as an awareness multiplier. That person can act as an information channel to share opportunities, normalize the idea of looking for opportunities on base, and introduce the applicant to other people on base with additional opportunities.

There were a variety of approaches that programs undertook to address the challenge of low awareness. All of the recruitment strategies outlined in Section 3.B are attempts to increase awareness. Depending on the types of candidates the program wants to recruit, different strategies could be effective in helping increase awareness.

Once a candidate has heard about the WEP, they still have to decide whether or not to apply. Respondents saw two key considerations in that decision: the work the candidate would be doing in the WEP and the WEP offer. For example, candidates may perceive a mismatch between what they wish to be doing and the actual work. Or, they may misunderstand what the work would be. Respondents from just under half of the programs mentioned that candidates had some misunderstanding of the work. In particular, respondents from each of the services had encountered candidates who thought the WEP was a uniformed position. Respondents thought this was perhaps a byproduct of civilians not realizing how much non-uniformed (i.e., civilian) work the DoD does. A second misconception that respondents reported was that candidates viewed government STEM as contributing less to society than industry because candidates do not understand how the small piece of research that they might be doing could contribute to a bigger national security mission.

Respondents reported that typically candidates who understood the work expected had no problem with the work. However, a few respondents did encounter candidates who had issues with their fit with the work. Some candidates may prefer a different scientific emphasis overall (industry or academia), and others were uncomfortable with the workload. One respondent mentioned that students who had other obligations may not be able to take on the additional workload of a WEP and emphasized that this does not reflect the work ethic of these candidates. Further discussion of how this issue impacts HURCs, in particular, can be found in Chapter 5. Additionally, a few respondents encountered wariness about any work associated with the DoD or U.S. government. As one respondent said,

> *To some folks, that is a deterrent in and of itself. No amount of marketing communications or face-to-face conversation is going to change the fact that we are part of the Army and the Armed Services and the DoD.*

This hurdle cannot be overcome with candidates who do not want to be associated with the national security apparatus. Overall, this challenge exemplifies an important point: the recruitment approach needs to change depending on the particular problems candidates have with a WEP's work. For some candidates who want nothing to do with the DoD, the answer may be to consider someone else. For other candidates, clarifying the type of work or explaining accommodations to allow the work to fit into a busy life may be a sufficient remediation.

The WEP offer was the other important factor that respondents reported as a possible challenge to getting candidates to accept offers. Most respondents pointed out that good candidates are in high demand, and described a number of different incentives and disincentives that might cause a candidate to accept or reject an offer. One important factor was the stipend that participants would earn. Respondents reported that stipend came up often when interacting with candidates, and the survey findings in Chapter 6 also reflect that stipend is an important consideration for candidates. Ultimately, a good stipend could get someone to come to a WEP, but stipend limitations kept some WEPs from being able to compete with industry. Similarly, WEPs could not offer some of the perks (e.g., babysitting, laundry service, and restaurants) that industry leaders such as "the Big Four" (Meta, Amazon, Google, and Apple) could provide. Both of these challenges are essentially financial limitations on the WEPs that are moderated in the private sector.

Respondents from two of the WEPs in the sample brought up the service agreement (i.e., future work commitment) as a disincentive. Some candidates simply do not want to sign up for a future commitment. Finally, the most prevalent disincentive brought up by respondents was the location of the programs. Many WEP locations are far away from where candidates live, a problem for candidates who do not want to move far away from

family or cannot afford a second place to live temporarily during the WEP. Additionally, the location can be an issue itself if it is not considered "attractive" (e.g., it is in a location with poor social options or without natural beauty nearby). Ultimately, which of these disincentives may apply will depend both on the specific program and the specific candidate.

Fortunately, program managers and mentors had incentives that they could employ as counterpoints. About a quarter of respondents touched on specific incentives that their WEP could offer including publication opportunities, medical benefits, generous leave packages, course credit, tuition or loan support, and a path to a permanent job. The path to a permanent job is particularly interesting because some candidates might see a service requirement as a disincentive while others may see a guaranteed job as a strong incentive. Respondents recognized the balancing act between the WEP incentives and disincentives. The survey findings in Chapter 6 further reinforce that participants had similar understanding about which offer factors were stronger in the government vs. commercial sectors. By emphasizing what benefits the WEP can bring, program managers and mentors can try to overcome any hesitation to accept the WEP offer.

Once a candidate has decided that they want to apply to the WEP, they have to prepare an application, and the application process itself was identified by respondents as causing several challenges. The first of these challenges was that certain government eligibility requirements can constrain the recruitment of certain candidates. In particular, respondents mentioned how the citizenship requirements discussed in Section 3.A.1 may limit recruitment from MSIs because of background investigations.[8] Also, drug tests could keep candidates from applying (particularly in states where marijuana is legalized). Ultimately, respondents expressed that there was little they could do about these requirements, though they could clearly explain what was and was not involved in the tests and background checks.

The complexity of the application can also keep desired candidates from applying. Some of the WEPs in the sample had applications that were as simple as submitting a resume and answering a short questionnaire. On the other end of the spectrum, some programs required candidates to write full research proposals co-authored with an expected mentor in order to apply. This application required identifying a potential mentor at the WEP, proposing ideas to that mentor that are acceptable, and then preparing a full government research proposal, which often involves a lot of material and coordination. All of those steps provide more information about the candidate and the potential research, but they also provide more opportunities for good applicants to slip through the cracks. The early steps in particular can be difficult, with one respondent describing the task of

[8] As discussed in Chapter 5, this concern particularly affected first-generation learners and candidates with undocumented family members.

connecting mentors with candidates as "the biggest bottleneck" in their recruitment process. So, it is important that programs match their application to their goals, and not make the application process unnecessarily cumbersome.

The challenges with applications (e.g., length and complexity) were reported as particularly impacting candidates from HURCs. In particular, one respondent talked about how candidates from HURCs are often at schools that are under-resourced and may not have support from local program offices for WEP applicants. Additionally, some HURCs may be less familiar with how to apply. One respondent brought up an example of candidates who were struggling to submit applications because they came from farmworker families, where there is less familiarity with applying for office jobs. This particular respondent had a team that created remedial support to help this community. While application help may not always be possible, it is important that WEPs consider the communities they are trying to reach and any additional help that they might provide to applicants.

A final challenge with the application was timing. A few respondents brought up that their WEP's application cycle ended either too early or too late for students' schedules. If it is too early, then candidates are not thinking about potential programs in time to apply. If it is too late, many of the best candidates may have already committed to other programs.

A final set of challenges in recruiting had to do with historical factors that were beyond anyone's control. Two types of historical factors were mentioned by respondents: discrete historical events and broad historical conditions. Discrete historical events are specific happenings that disrupt the system of recruitment patterns. The main recent disruption was the COVID-19 pandemic, which limited programs in several ways. Normal outreach activities were curtailed by travel restrictions, and restrictions on in-person activities changed the nature of the available work at WEPs. In particular, some candidates may no longer have been as interested in WEPs when obtaining a security clearance for facility access was not a benefit provided. Finally, COVID-19 created an aura of uncertainty which may have led to less interest in extracurricular activities. Ultimately, COVID-19 is the perfect example of a discrete historical event that had impacts on WEPs that were impossible to control. Program managers, mentors, and participants were all struggling to work through a global pandemic, and that naturally had a negative impact on WEP recruiting.

Broad historical conditions also impact recruitment volume, typically in deeper, more systemic ways. About half of the programs brought up supply and demand issues in the STEM labor market as a recruitment challenge. More specifically, these program managers and mentors felt there were not enough candidates who qualified for their programs. This issue reflects a trade-off in how WEPs approach recruitment. As discussed in Section 3.A, WEPs want STEM talent with a variety of characteristics. The more specific a program is about the kinds of candidates they want, the smaller the supply of candidates. If a program

wants any STEM major, the pool will be larger than if they only want physicists. If they recruit from all schools, the pool will be larger than if they only recruit from HBCUs. Stacking different requirements on top of each other simply makes the pool smaller. This narrowing of the pool was seen as a particularly important problem in recruiting HURCs. Ultimately, the limited labor market can exacerbate some of the other challenges. As one respondent put it,

> *The world is their oyster if they're a minority and they have a PhD in physics. And they can go almost anywhere and they may not feel that they need a post doc. They can get a really good job right from the start. Why should they bother with the post doc? It [job versus post-doc] pays more, it's permanent. The benefits are typically better.*

A small labor pool means that there is more competition between employers for the desired candidates. This increased competition exacerbates the challenge of balancing incentives and disincentives when making an offer. It is important that program representatives are aware of all of these challenges and how they interact when coming up with potential solutions.

D. Summary

Overall, WEP recruitment varies widely from program to program. WEP representatives looked for both explicit (typically academic credentials and characteristics) and unwritten (typically non-cognitive skills) characteristics in their desired candidates. WEPs faced a variety of challenges that influenced the application volume. In order to overcome these challenges, the WEP representatives worked to reach these candidates using one- and two-way communication, both of which were seen as important. Also, the use of intermediaries to gain access to or improve messaging to potential applicants seemed to be a positive method to bolster recruiting.

4. Interview Results: Benefits of WEPs

Interview respondents touched on many benefits that the WEPs provide. This chapter explores the benefits of WEPs as perceived by the program managers and mentors. Overall, these benefits were split into two categories: benefits to the WEP participants and benefits to the organization running the WEP. Some of the key findings are listed here:

- Program representatives strive to help WEP participants grow their capabilities, including their STEM skills, insight into the DoD and scientific careers, and soft skills.
- WEPs serve as an opportunity for participants to enhance their marketability by growing networks and strengthening their resumes.
- WEPs positively impact the current work of their organizations by providing a workforce to accomplish research and exposing current staff to new people and ideas.
- WEPs contribute to long-term hiring at their organization by attracting new applicants, filtering to the best applicants, and preparing potential new hires for working within the agency.
- The benefits WEPs provide to organizations are facilitated and magnified by the communities that WEPs help build with other organizations and WEP alumni.

A. Benefits to Participants

Interview respondents had much to share about the benefits that WEP participants receive as outcomes of the program. Discussion of participant benefits aligned with two main categories: building up the capabilities of the participants by improving their skill sets and experiences, or building up the marketability of the participants by improving their connections and qualifications.

1. Building Capabilities

Each WEP provides a unique experience that allows participants to grow professionally and build capabilities that they can use in their careers after the WEP. Respondents noted WEPs benefit participants through improving their STEM skills, giving them career insight, and building their soft skills and self-esteem.

a. STEM Skills

The most frequently described benefit in the category of capabilities involved the development of participants' STEM skills and STEM literacy. Interview respondents from more than half of programs mentioned these benefits as being realized within the context of the hands-on or real-world nature of the projects that participants worked on. A majority of respondents emphasized this context when providing information about participants' project experience.

When discussing the hands-on nature of their work, respondents brought up the opportunity afforded by the WEPs to work alongside established STEM professionals and other STEM students or WEP participants. Most WEPs also provided a mentor that works closely with the participants to give guidance and monitor their progress. Respondents framed these working arrangements as key to the learning that takes place during the program. A few respondents mentioned issues with the mentor/mentee pairing that could keep the WEP participants from gaining the same amount of STEM skills. Challenges in getting the most out of these relationships included mentors simply not having enough time to devote to the participant, or personality mismatches resulting in a less productive pairing of mentor and mentee.

WEPs involve hands-on work, which means that participants often get the chance to handle new equipment or technology that otherwise may not be accessible to them. Learning techniques and using new equipment could be a salient benefit in and of itself. One respondent commented on the improved prospects of participants that get time with a particularly expensive piece of equipment:

> *So, they use microscopes that are million-dollar instruments that you could make an entire career out of if you knew how to use one. I tell them sometimes that there's people in Silicon Valley who can earn $120K just if you know how to use a scanning electron microscope very well.*

Here the respondent is pointing out the benefit offered to participants regarding access to this equipment. Scanning electron microscopes may not be available to work with in the participants' academic program, and it is through their WEP experience that participants get to become familiar with this equipment and the technique needed to put it to use. This knowledge could turn into a career all on its own.

When discussing the real-world nature of their project work, interview respondents pointed towards two aspects of this context which proved particularly beneficial for participants. By getting to work on real-world DoD problems, participants get exposed to various stages of the research and development (R&D) life cycle, beginning with design, to developmental testing, to building and evaluation. By seeing the stages of the R&D cycle, participants are learning about how STEM work actually takes place outside the

walls of the classroom. For example, there is a certain amount of project failure inherent in R&D. One interview respondent highlighted the learning that takes place in regards to the pursuits that don't work out during the WEP:

> *They start in one direction, it's a dead end. They head in another direction: dead end. But then they finally get into something that is very fruitful and they've learned to be a good researcher doing that. Not everything is successful when you do research.*

In this case, the respondent underscores a process that participants undergo which includes encountering dead ends and frustrations, then adjusting and moving on to something that works. These are realities of research endeavors and a part of learning what it means to be a researcher. But that process also includes overcoming those frustrations and getting to something fruitful.

The other aspect of the real-world nature of WEP projects refers to the tangible applications of the STEM subject matter. Participants get to see first-hand the why and the how for their research by understanding DoD needs and mission space. This greater immediacy to the applications of contributions of their research is another point of contrast with classroom learning. WEP participants get a chance to engage in work that feels meaningful by understanding its real-world implications. Academic programs alone may not grant students such applied experience. An added benefit of participation in WEPs was noted by a few interview respondents who talked about students doing better in their academic programs after working on real-world problems in their WEP. Collectively, the combination of hands-on experience with real-world STEM projects was seen as an important developmental opportunity because it built upon the typical classroom experience and helped participants deepen their expertise.

b. Career Insight

WEP representatives brought up benefits of learning about careers just as frequently as they did STEM skills (just over half of programs). This category referred to the learning about what it's like to work in a certain career and whether it is right for participants. In this way, WEPs act as a preview for participants, granting insight into working in a specific domain or technical area, as well as what it's like working day-to-day at a particular place.

WEPs of different lengths can offer this career insight. By spending any amount of time in an actual workplace, participants see the reality of what a particular career might be like and most importantly, if it is right for them. Several respondents clarified how if a participant decides that such a career is not right for them, this is still valuable learning and should be considered a benefit. A few of the WEPs incorporate rotational assignments into the experience, maximizing the chances to discover or preview work opportunities available to participants.

The framing of the work preview varied across interview respondents. Some program representatives talked about the WEP exposing participants to the DoD, at the organizational level. For example, the WEP experience may teach participants about the number of civilian employment opportunities that exist within the Department, dispelling misconceptions about requiring active-duty service when thinking about working for the DoD. Other program representatives talked about the WEP experience as a preview at a smaller organizational level, such as working for a particular Service or Component, and the relevant mission and culture. Still other program representatives talked about the WEP experience as a preview of a career at a specific location, such as a base or facility. In the words of one respondent, after participating in the WEP you will "know what to expect because each DoD laboratory, they each have a different culture."

Other interview respondents framed the work preview granted by WEPs in terms of the domain or technical area that the project work covered. Some respondents talked about the role of the WEP in exposing students to STEM work broadly, while other respondents described the program experience as an opportunity to preview a more particular niche or topic. One respondent talked about this benefit being the most important outcome of the program:

> *I want them to, number one, be able to experience the type of work that we do here and see themselves being able to participate in that type of work. I want them to get experience working a full-time job in a technical area.*

The respondent here raises an important point about the full-time nature of the experience. WEPs offer more than just a 'day in the life' preview. Participants are engaging in project work for multiple weeks and receiving a grounded understanding of what it means to work in a particular career. Sometimes the insight is that a certain topic does not align with participants' interests. Interview respondents occasionally referred to a challenge to succeeding in the program due to lack of motivation on the participant's end, stemming from a lack of interest in the project topic or area. But ultimately, the resulting insight from the WEP experience can help inform participants on decisions about further education or research paths, later program participation, or future job pursuits.

c. Soft Skills

Interview respondents talked about building participant capabilities in more than just the realm of STEM skills and previewing STEM careers. Learning also took place in the domain of non-technical skills. While brought up less frequently than the other two categories, respondents from about one-third of programs discussed more generally applicable professional skills, or "soft skills," that are cultivated during the program. Communication skills were described as being honed through the incorporation of

presentations and briefings. Part of participants' development included practicing the communication of complex STEM concepts to non-technical audiences who may not be familiar with the ideas. One respondent, who works with a program focused on graduate students, described the effort and attention paid to working on this general skill:

> *Our batting rate is pretty high. When they submit a draft conference submission it goes through the team and they get feedback. If they are accepted for a conference, they go through multiple dry runs. They will practice a lot and they will be ready for the conference…That will ensure they are successful.*

The respondent highlights the multi-step process used to ensure this benefit. This program places an emphasis on presenting research and reflects this in the developmental resources devoted to preparing participants for their presentations.

Respondents also brought up collaboration, working with others. While common in the professional workplace, working on teams may be something new for participants. Furthermore, interview respondents discussed the often-interdisciplinary nature of teams working on research projects. This added complexity requires even more learning on the part of the participant. One respondent reflected on the importance of this skill for a career in the DoD:

> *To be successful in the Department, you really have to know how to work nicely with others and figure out how to collaborate. They put people [together] with all different skill sets, you know, they might put somebody that's more electrical minded with somebody that's mechanical minded and computer minded, it's getting all those skill sets in and then seeing the end products.*

The respondent in this case highlights the interdisciplinary teams that take on Department projects and calls attention to collaboration as a non-technical skill that can be improved as the result of participation in the WEP.

Finally, some respondents talked about non-technical skills being improved simply as the result of operating in a professional office setting. For many participants, this may be their first time working in such a context, and there comes a period of adjustment when moving from the academic environment to the lab or applied environment. Program representatives talked about the process of learning professional etiquette, learning how to interact with different levels of leadership, how to find and grow mentoring relationships, or even how to craft emails to colleagues. A few programs offered professional development seminars or sessions that focused on skills used for pursuing jobs after the program. Topics included how to complete applications, how to write personal statements,

or best practices for interviews. These non-technical skills were all discussed in terms of the learning benefits that participants receive from WEPs.

Problems with soft skills could get in the way of receiving the most out of the program. Interview respondents occasionally brought up reasons why participants may struggle, and this included time management. For some participants, participation in the program required a difficult balance of competing priorities, such as project work, academic work, and sometimes a second job or family obligations.

d. Self-Esteem

Interview respondents touched on one final aspect of building capabilities. This theme came up least frequently, but a few respondents felt it was important to remark on how programs bolster participants' sense of self-esteem or self-confidence. Discussion about gains in self-esteem often came up in conjunction with the beneficial exposure to career pathways. In these cases, learning that one has the ability to reach a goal was as important as setting the goal itself.

When interview respondents described challenges to benefits happening on the part of participants, these usually related to participants feeling intimidated by the work and not speaking up to ask questions in fear of looking incompetent. Respondents remarked that sometimes students are used to being the smartest person in the classroom. Being put in a challenging environment surrounded by other intelligent participants could be a shock.

WEPs managed to build up self-esteem in a few different ways over the course of the programs. Respondents described how WEPs provide opportunities for participants to reach for challenges and realize their potential. As part of this process, participants necessarily have to overcome failures that are a natural part of the research cycle. Participants also undergo a period of adjustment to the complex environment of the DoD research enterprise. A respondent who works with a program focused on one technical domain witnessed these changes personally:

> *It's an exciting thing to see an intern come in completely baffled on what we're doing and thinking, 'Why did I come here? I'm in way over my head'…to the end of the summer giving their presentation super confident, [having] really gained a lot of self-confidence and learning a lot. That transformation is a very rewarding thing to see.*

Program representatives also framed the benefits to self-esteem within the context of contributions to something larger than themselves. The work that goes on at WEPs is not just challenging, it is work that participants can stand behind. In the eyes of the program representatives, the fact that participants' efforts are moving forward a 'real-world' project burgeoned their feelings of accomplishment and pride. A mentor who works closely with

university students on engineering projects highlighted what building this capability looks like:

> *Success looks like to me where they feel they can leave the project and they feel that they have personally contributed. They can point to something and say: 'I did that and its works.'*

In the eyes of this respondent, the tangible output of the WEP experience and its applied nature to a DoD problem act as a testament to the capabilities of the participants. This belief in their own capabilities is a necessary step in pursuing educational and professional goals.

Finally, several interview respondents emphasized how the project efforts of participants should be seen as contributions to the country. Respondents understood working with the DoD over the course of the WEP as helping the good of the country, rather than being just an academic exercise. Given that WEPs are addressing existing problems and priorities of the government, this means that the 'final customers' are the citizens of the nation.

2. Building Marketability

In addition to building capabilities, WEPs served another important benefit for participants related to the pursuit of their professional goals. Interview respondents described participation in the WEP as an opportunity for students to enhance their marketability when they look to make their next career step. In particular, they talked about how the WEP helps participants enhance their networks and strengthen their resumes.

a. Networking

Most commonly, respondents discussed gains in marketability coming as the result of participants' expanded networks. Roughly one-third of interviews included comments about networking relationships being fostered over the course of the program, and these professional and social relationships could last beyond the duration of the WEP itself.

Networking manifested in different ways for WEP participants. Peer relationships were cited, meaning that fellow participants received opportunities to cultivate a relationship, either working directly with each other on projects or getting to know each other at the facility or site. By nature of being fellow participants, these individuals share some level of interests and goals, and making connections with such peers holds value for making friendships and building a support network. There is a value to these relationships as participants leave the WEP and go on to make their mark in the world:

I tell them to get to know each other, you know, professionally and socially because you're sitting next to the leaders in academia and industry and government for the next 20 years. You will see these names throughout your career.

This quote touches on the forward-facing nature of these relationships. Allowing participants to get to know each other in the program fosters a better-connected ecosystem down the line, as they become coworkers, colleagues, contractors, or sponsors.

Interviews also revealed networking relationships being built with already established professional scientists and engineers. For many programs, this looked like a paired mentoring arrangement. Mentors served the real-time benefit of guiding project work, but could also become lifelong connections and a source for other professional relationships or letters of recommendation. Besides mentors, interview respondents also mentioned networking being possible with other employees at the WEP locations as participants work on different teams or are introduced to different projects. Connections could also be made with S&E professionals at outside organizations while attending conferences or other events. A well-developed network ultimately means that participants are positioned to take advantage of employment opportunities. One program mentor clarified how this benefit takes shape at the WEP:

We have ways to connect interns to other program managers for full-time jobs, to where if an intern is definitely looking to come back to work full time, I work with them to make sure they've got the right tools and the right people in front of them. By the time they leave for their last summer they pretty much already have an [offer] lined up for full-time employment.

The respondent in the above quote invokes the connections that already exist between this mentor and the other program managers in their network. For the participant, developing a relationship with one individual could mean getting connected with many more scientist and engineers, regardless of whether those others are positioned within the same organization. This quote highlights the ways that connections fostered within the WEP can branch out, paying dividends in professional opportunities for participants.

A few interview respondents pointed out challenges with respect to growing participants' networks. Hosting WEPs in the wake of COVID-19 meant that sites had to move much of their work online, with participants interacting virtually. In the opinion of several respondents, this came with the loss of some opportunities to make new professional connections. Similarly, as conferences were cancelled or moved online, WEP participants were offered fewer chances to interact in-person and expand their networks.

b. Strengthening resumes

The last way that interview respondents described building the marketability of WEP participants is through association with the program itself. At the end of the program duration, participants have a new entry on their resume and increased credentials, and this benefit of marketability came up in about one-third of programs.

Some WEPs, especially those focused on graduate students, place an emphasis on publishing and presenting research, and such accomplishments add lines to the vitae of participants. But there is also something to be said about the sheer association with the program or the organization. WEPs are selective in who they bring on board, and being accepted into and successfully completing one of these programs is itself an indicator of the quality of the participant, an indicator which can be recognized by employers down the line.

B. Benefits to the Organization

While all WEPs want to provide benefits to the participants, it is also important that they have benefits for the organization that hosts them. Respondents touched on several types of benefits that they saw the host organization receiving from having the WEP. In particular, they talked about how the WEP could improve current work being done at the organization, help with hiring after the program, and build connections with other organizations.

1. Improving Current Work

A key benefit that came up in all but a few interviews was improving the current work at the organization, including both accomplishing useful research and supporting the existing workforce. The first way that WEPs did this was simply by bringing in labor. Respondents from about half of the programs mentioned how the labor provided by WEPs is helpful for the organization. One respondent from a summer program that focused on community college students summarized this benefit nicely:

> *We of course need the helping hands for research. You know, the more hands we can get on our research, the better for accomplishing our goals.*

The focus here is on getting people in to help, filling the needs of the lab. Importantly, this also connects directly to the lab goals, which ultimately is to accomplish research. Some respondents also talked about how this labor can be a more affordable option than some of the other funding streams available, and a good opportunity to bring in qualified people in a way that does not harm the overall budget.

There were a couple of potential challenges to seeing the benefit of the participants' labor. First, the participants are temporary workers, and their contributions can be lost when they leave. A few programs emphasized methods for making sure that the labor has a lasting impact. One example emphasized documentation through the creation of a wiki where participants wrote up their research where all staff can see it. Other programs used end-of-program presentations to share research results more broadly across their organization.

A second challenge to participant labor helping the current work is that individual participants may struggle to fit in to the lab and contribute immediately. This challenge was mentioned by only a few respondents. One potential solution that program managers turned to was making sure they were available to the participants early to head off any potential problems before they grew. Additionally, respondents did not see this as a huge challenge because it impacted only a small number of participants each year.

The second way that WEPs helped improve the organizations' current work was through exposing the agency and its current staff to new people and new ideas, which came up from just under half of programs. Respondents who were focused on new ideas talked about how they want participants to be more than "hired help." These program managers want the WEP participants to bring in their own knowledge and skills, which was a more common refrain for programs that focused on graduate students or postdocs. In quite a few programs, respondents emphasized how much they appreciate the new ideas that participants come in with. One respondent from a postdoctoral program even went as far as to say, "to really distill it, the whole idea is to bring in new blood and new ideas." For this program, the new ideas that the participants bring in are not just a side benefit, but one of their main goals. These new ideas could include things like new techniques that the participants have been taught that the current staff at the organization are not familiar with. However, they also include just different ways of thinking, and several respondents mentioned how the WEP participants ask questions of their mentors that can make the mentors think about problems in a new light.

Respondents also talked about how these new ideas can help when research gets stuck or an intended method does not work. WEP participants have the ability to move the research in new directions. Several respondents brought up that their WEP participants had the right combination and flexibility of work capabilities and freshness of perspective to be able to identify and follow new avenues for the research.

Several people also talked about how these new people have a direct impact on the mentors working with them, in particular increasing the mentors' enthusiasm. Program managers and mentors talked about how participants bring in a joy in research that can rub off on the mentors and reinvigorate them. Two of the people who spoke about this were talking from personal mentoring experience. For these individuals, and similar mentors, working with students was exciting and motivating, and brought them a renewed sense of

purpose in the work. While a few respondents brought up isolated cases of personality clashes, which were detrimental to both the participant and the mentor, and can happen when new people entered an established environment. However, far more respondents talked about how the participants help the research staff and program be stronger and have access to methods and ideas it might not have otherwise.

WEPs also helped via specific trainings that made current research work more effective. A few respondents mentioned specific mentor or staff trainings as part of the WEP, including some trainings that focused on mentorship skills such as leadership, responsiveness, and listening. A couple of programs with DEIA-related goals brought in experts to discuss DEIA issues with the mentors.

One program was particularly attuned to how trainings associated with the WEP could help their current staff grow. First, they brought in outside vendors to do professional development with the mentors. Second, they expanded their WEP participant trainings to their full workforce. This program, which was DEIA focused and brought in undergraduates for a summer internship, had technical trainings that they provided to their participants. When they got good feedback from the participants on the trainings, the program manager realized those trainings could be helpful for everyone at the agency. The leaders of this WEP are thinking strategically about how their WEP is part of their broader organization. As they put it, the WEP,

> *Opens up the door on professional enhancements and development, so that we can continuously learn and kind of enhance our skill sets as we grow as employees within the organization.*

This quote shows an understanding of the WEP as part of the larger organization. This respondent has more holistic view of the WEP as being more than just a way to bring in or teach talented participants. The mentors are a key component, and this program understands how the mentors and other agency workers can develop through the program as well.

2. Contributing to Hiring New Talent

The next key organizational benefit that respondents talked about was hiring after the program. Almost all programs touched on hiring, though that hiring could be specifically into the organization or the DoD more broadly. A few respondents worked on programs where near-term hiring was not an emphasis. This is particularly true for programs that focused on students with a few years before they may graduate versus those that might be graduating within a year, as they did not hire many of their participants and did not track future hiring numbers. These programs were more focused on preparing students for continued education or the next academic level with the potential goal for the future that they would be good employees. For the programs that did talk about hiring, the focus was

on specifically hiring the right people rather than just general hiring. Per the respondents, there were three distinct ways that WEPs helped with hiring: attracting new applicants, filtering to the best applicants, and preparing new hires for working within the agency.

In order to have WEP participants eventually become permanent employees, the WEP program managers and mentors had to work to increase their interest in government jobs and attract them to apply (either to their agency or the DoD more broadly). An important role that WEPs play in this is simply making participants aware of job openings and application mechanisms. One respondent, who was from a program that reaches a wide range of academic levels, discussed communicating with participants about the government's website listing job openings, USAJobs, and other application avenues. This respondent emphasized that this communication creates awareness about job opportunities for a whole new group of potential candidates who may not otherwise know about those opportunities. That benefits the organization and the DoD by bringing in more high-quality people from a wider range of backgrounds. In other words, the WEP serves as an introduction to the world of the DoD, and lets more qualified people know about different pathways to stay in that world.

In order to discuss those pathways, program managers have to understand what opportunities are available. Programs had various mechanisms of hiring; some could hire directly, some had guaranteed spots (like scholarship for service), and some required competitive hiring (often through USAJobs). Interestingly, the same program may have included multiple mechanisms, as what they used changed from year-to-year or across different parts of the agency.

A common challenge with the hiring was making sure spots were available. Quite a few respondents mentioned that there were regularly no billets available for turning WEP participants into permanent hires. This makes it impossible to hire these candidates, even when they are strong talent and the perfect fit for the organization. Another challenge respondents talked about is that participants may not be interested in government jobs. Participants may have learned through the program that they are interested in different work. Ultimately, this outcome is probably good for both the participant and the organization, as the participant will not get a governmental job that they are a bad fit for. Finally, competition with the private sector, particularly monetarily, is a challenge that can keep people from being interested in the government sector.

Program managers and mentors mentioned they do whatever they can to counter these challenges. They emphasize available opportunities to participants who would be a good fit. For programs with students who were ready to move into the workforce, this often meant telling participants about jobs earlier to give them a leg up. For programs with students who were not yet graduating, a few respondents mentioned telling students to apply for Science, Mathematics, and Research for Transformation (SMART) or other opportunities that would give a guaranteed position at the end. For further information

about what the participants see as important factors in the jobs they apply for, see Section 6.E. Program managers can use that information to target how they present job opportunities to candidates.

The next way that WEPs helped with hiring was filtering out the best candidates from the pool of participants. Specifically, respondents from about half of the programs talked about using their WEP as an extended interview of candidates. One respondent, who came from a program that focuses on potential hiring after the WEP, said that a benefit of the program is that they get a "good long look" at the candidate and how they work. The mentors and program managers see the candidate throughout the WEP and can let the people in charge of hiring know about the candidate's abilities. Plus, since WEPs have a work component, they already know how well those abilities apply to the agency's work. This advantage is a big benefit over a typical application. Program managers and mentors talked about how they become advocates within the competitive hiring process. They talk to hiring managers within their agency to promote the best participants and make sure they have a leg up in the hiring decision. Overall, WEPs offer the opportunity to get a good picture of how well each participant would do as a full employee and gives the program managers and mentors the information they need to advocate for the right hires.

The final way WEPs help with hiring is preparing participants to become full-time employees. Respondents from about half of the programs touched on how WEPs help pre-train new staff and lower onboarding time. Sometimes this referred to specific technical training, but other times it was the benefit of simply acclimating the participant to the agency culture. One respondent (from a program that brings in undergraduate students) emphasized the time-saving, saying,

> *They actually hit the ground running and we kind of eliminate that six-month curve that we typically get from a new fresh hire out of college.*

According to this person, because WEP participants are already a part of the agency and part of the team, transitioning them to a full-time role is much smoother. Basically, instead of supporting the new hire during their ramp-up as a permanent employee, the WEP does the heavy lifting in making sure that they have the correct technical skills and appropriate knowledge of the agency. Ultimately, this training works together with the filtering of candidates to make sure that the right people are coming into permanent positions within the agency. These agencies can hire people who are better fits and better prepared to start working immediately.

3. Building Communities

The final key benefit to organizations is how WEPs help build communities for the organizations, which came up from about one-third of the programs. The first phase of this study revealed that a key goal shared by some WEPs was building communities (Belanich,

et al. 2022).[9] The respondents talked about several different types of communities that were built through the WEPs. The first of these was an ongoing connection with program alumni. Typically, this relationship was informal, with certain mentors or program managers just trying to keep in touch with alumni. However, at least one program formed an "alumni council" that gave the opportunity for alumni to stay engaged with the program long term. Other communities were formed through ties to organizations. Universities were important community partners, and had both formal and informal relationships with WEPs. For example, a few program managers reported recruiting a lot of students from a nearby university. Finally, a small number of respondents talked about the WEP creating a connection between the organization and the private sector. Each of these various types of community can amplify the benefits the WEP provided the organization, including both improving current work and the hiring goals.

For improving the current work, these community connections help keep DoD research on the cutting edge, and provide opportunities for staff to collaborate outside of the DoD. One respondent from a program that focused on postdocs said,

> *I think that really allows for a good collaboration effort with DoD Scientists and non-DoD Scientists. so that we can continue to invest and do research in high risk, high reward areas for the maximum impact globally and for our war fighters and for the safety and protection of our nation.*

Ultimately, this person sees the collaboration partners as key for making sure that the DoD can continue to fulfill its mission. This sentiment was echoed in other interviews, several of which emphasized that it is important to maintain access to the good ideas that originate outside of the DoD in order to make the research program stronger.

For the hiring piece, the alumni were seen as a very important recruiting tool for the WEP itself, as they spread the word about the WEP to classmates and colleagues (see Section 3.B). One respondent also touched on how the WEP helps them build connections with people to potentially hire. This program focuses on postdocs, and due to the in-depth nature of their application, they bring in outside experts from a variety of organizations to review the WEP applications. The representative of this program talked about how some of those outside reviewers eventually became permanently affiliated with the WEP organization. Overall, the communities that WEPs build can have benefits beyond the border of the program itself. These communities give the organization's staff access to more different people with more different ideas, which can be used to make the agency stronger as a whole.

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[9] Typically, the WEP goals referred to regional communities of technical expertise as a domain hub. Here, the communities could be broader.

C. Summary

The interviews revealed a wide range of expected benefits from WEPs for both participants and organizations. WEPs worked to help participants grow their STEM and soft skills. These programs were also a way for participants to gain insight into possible careers and grow their marketability in order to transition into those careers. From the organization side, WEPs help the current work of their organizations as WEP participants can participate in research and bring new ideas to the current staff. Future hiring can also benefit from WEPs as they are an opportunity to attract new applicants, filter to the best candidates, and prepare potential new hires. Communities with other organizations that were built through the WEPs helped facilitate and magnify these organizational benefits.

5. Interview Results: How WEPs Support Diversity, Equity, Inclusion, and Accessibility

A. Introduction

The U.S. government (USG) has long been recognized as an institution of upward social mobility. Following World War II, the rapid expansion of the public sector and the implementation of equal opportunity hiring practices helped pave the way for women, African Americans, and other HURCs to secure government jobs (Laird 2017).[10] The USG also provides extensive funding for research, programs, and other initiatives that promote DEIA. Each DEIA initiative focuses on one or more communities (e.g., racial/ethnic minorities women, military veterans) that may disproportionately face barriers, which can limit equitable participation in important opportunities such as jobs or educational programs.

In this chapter, we examine the role that DoD STEM WEPs play in supporting broader USG efforts to promote DEIA. Specifically, we identify (1) the types of DEIA challenges that emerge when operating WEPs and (2) how WEPs have attempted to address these challenges. Insights are drawn from the semi-structured interviews that IDA conducted with program managers and mentors. Each respondent was asked a direct and open-ended question specifically about DEIA: "A topic receiving attention in STEM education and development is supporting diversity, equity, inclusion, and accessibility. What are your thoughts with respect to these types of issues and your program?" IDA broached the topic of DEIA using an open-ended question because this allows respondents to speak to whichever issues are most relevant for their respective programs and participants. For example, one respondent could focus on diversity from the perspective of recruitment, while another may be more focused on creating an equitable experience during the program.

The analysis drew upon respondents' answers to IDA's direct question, as well as any other unprompted remarks that respondents shared about DEIA at any point during the interview. Since there are many ways of being a minority in STEM, IDA employed a broad and inclusive definition of what it means to be from a HURC, to include race and ethnicity; gender; sexual orientation; economic status; veteran status; citizenship status; resident in rural area; religious affiliation; disability status; and so forth.

[10] For example, as of 2016, African Americans were employed at a higher rate in the federal workforce than in the civilian workforce (U.S. Office of Personnel Management 2018).

Analysis results were then organized by the types of DEIA-related challenges that were indicated. The groupings that emerged from the data corresponded to three standards for evaluating "social equality" (Conley 2008): (1) who has access to opportunities (i.e., getting into WEPs), (2) how people fare when engaging opportunities (i.e., experiences during the WEPs), and (3) what people gain from opportunities (i.e., post-WEP outcomes).[11] While each standard of equality represents an ideal that cannot be fully achieved in a literal sense (e.g., it would be impossible to ensure that each participant has the exact same experience during a WEP), these three aspects of social equality offer a useful set of benchmarks for programs to strive *towards* when seeking greater equity.[12] In each section below, IDA introduces the types of barriers that WEPs encountered for each aspect of social equality, along with the practices that they implemented in an effort to create a more equitable playing field. Throughout, IDA integrates previous research to provide broader context on some of the challenges that DoD STEM WEPs have faced. At various points, IDA also offers reflections on the various solutions that WEPs have employed, as well as ideas for possible next steps.

Overall, findings suggest that WEP representatives dedicate greater focus to getting people into WEPs ("accessibility") than to ensuring equity during ("experience") and after the WEPs ("outcomes"). Some of the additional findings that will be explored in this chapter are as follows:

- Barriers that may impede HURCs from applying, being accepted, or accepting an offer include a lack of program awareness, historically rooted government mistrust, relocation constraints, hidden costs of participation, application requirements, and potential bias among evaluators.
- Barriers that could make it harder for HURCs to fully participate in their WEPs' activities were unfamiliarity with office decorum, misaligned approaches to interacting with authority figures, technical experience, and competing obligations.

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[11] Conley (2008) uses different terms to describe these three standards of social equality. He defines access to opportunities as "equality of condition," the ability to engage opportunities as "equality of opportunity," and what people gain from opportunities as "equality of outcomes." We have opted to use more general terms in anticipation of a broader audience.

[12] Many people confuse the terms "equality" and "equity." "Equality" may be thought of as exact sameness; for example, all participants receive exactly the same gain from a WEP. Differently, "equity" may be thought of receiving comparable sameness, with the requirement that whatever goods that were distributed were done so fairly and justly; for example, all participants receive similar gains from a WEP, though there may be some variation based on how hard they worked during the program. Essentially, the concept of equity allows for some degree of imbalance in whatever goods are distributed, as long as the imbalance is not due to unfair or unjust conditions. For a useful review and thoughtful critique of the terms, see Espinoza (2007).

- Participants from HURCs may struggle to develop a sense of inclusion if they encounter misunderstandings about their identities and abilities from mentors or other participants.
- Participants from HURCs could struggle to reap long-term benefits from WEPs due to differences in aspirations of possible goals and the knowledge needed to pursue various goals.
- Many of the same barriers that HURCs encountered when pursuing WEPs may continue to pose challenges during whatever post-WEP educational programs, learning opportunities, and jobs that they explore.

B. Equalizing Access

One way of striving for equality is to address socially based imbalances that may be impacting access to important opportunities. With respect to WEPs, what kinds of factors may make it more difficult for otherwise qualified applicants from certain social backgrounds to get into the programs? What are WEPs doing to help address these barriers?

1. Low Awareness

The first barrier that WEPs had to overcome was people not knowing about their programs. As discussed earlier (Chapter 3), respondents spent considerable time trying to increase awareness of their WEPs in an effort to generate a high volume of applications. Respondents felt that awareness was particularly low among students from HURCs for several reasons. One respondent thought that community college students were less likely to have heard about their WEP because two-year programs were more likely to be seen as transitional:

> *Community college students…they're different than four-year university students. They're not as engaged in campus life…they can be older, you know, reentry students. They're coming and doing their coursework. They have goals to transfer and move forward. But they're just not as engaged in campus life, so they don't hear about all these opportunities.*

Since many community college students are focused on completing coursework as quickly as possible in order to move onto the next step (e.g., a four-year program), there is comparatively less awareness of and interest in extracurricular opportunities like WEPs.

A couple of respondents thought that HURCs were less likely to have heard about WEPs because HURCs were less likely to know someone (e.g., family member, friend) who works in the government. As one respondent shared,

> *All the nice areas, these people normally have parents or friends or family members that [work on base] … They're gonna hear about the [program]. Whereas in some of the poor communities, you're just not going to hear about it [as you might when] you're working on base or part of that community.*

Ties to government employees are important from an informational standpoint, in the sense that current employees may hear about a WEP at work earlier than people outside of the government. Current employees may then relay this information throughout their personal networks, creating an additional mechanism through which certain students can hear about the WEP. Differently, awareness among students without ties to current government employees exclusively relies upon WEPs' formal recruiting efforts (Chapter 3), which are typically constrained by available resources.

Only one WEP did not attempt to address low awareness among potential applicants from HURCs. While both the program manager and mentor that IDA interviewed acknowledged that it would be nice to have more diversity in their cohorts, they preferred prioritizing applicants from certain majors that, as it were, had few racial and ethnic minorities. Differently, at least half of the WEPs spent considerable effort trying to increase awareness among HURCs. The primary strategy that they used was focusing recruitment efforts on schools that were well attended by one or more types of HURCs. Many respondents tried to increase the number of applicants who identified as racial and ethnic minorities by recruiting at HBCUs and MSIs. For example, when discussing how his program recruited a diverse cohort, one respondent said,

> *A lot of it has to do with where you recruit, right? So are you only recruiting at Colombia [University] or these expensive private schools? Or are you recruiting at the state schools or the HBCUs? Are you even reaching out to the really bright people at the community colleges? That is a big way that you can get diversity into the workforce.*

In other words, if you limit your recruitment to expensive private schools, where there are typically fewer HURCs, it will be difficult to cultivate a diverse participant cohort. The respondent thus made sure to recruit at HBCUs, state schools, and community colleges—places where the racial and ethnic minorities are more likely to be.

Other WEPs similarly worked to increase awareness by being strategic about selecting schools for recruitment. One respondent talked about recruiting in low income areas, to increase awareness among economically disadvantaged students. Another respondent talked about focusing on smaller schools, since they may have less general awareness about government funding opportunities. Lastly, one WEP worked to increase

awareness by partnering with another government program that specialized in serving HURCs and had established information channels that could be leveraged.

2. Government Mistrust

Another potential barrier that WEPs may encounter when trying to recruit HURCs is wariness about anything having to do with the DoD or the government as a whole. For example, a respondent from a program focused on HURCs recounted about how potential applicants could react to the word "Army" in the WEP's name:

> *To some folks that is a deterrent, in and of itself. No amount of marketing communications or face-to-face conversation is going to change the fact that we are part of the Army and the Armed Services and the DoD. So that's a hurdle.*

The respondent describes wariness among potential applicants about any type of affiliation with the DoD; in this case, the Army. Different from misunderstandings about what the WEP was recruiting for (i.e., uniformed Services versus working as a civilian scientist for the DoD; see Chapter 3), the potential applicants that this respondent had encountered understood the role but were uncomfortable with the idea of working for the DoD at all. Respondents from two other WEPs, both of which also focused on DEIA, similarly recounted recruitment situations in which potential applicants expressed suspicion about why the government was interested in their communities.

Although few respondents reported this challenge, mistrust of the government among HURCs has been documented by other researchers. For example, several studies have documented wariness towards the government among African Americans. A 2019 report (Jamison, Crouse Quinn and Freimuth 2019) found that African Americans may be less likely to trust government interventions (e.g., vaccines) due to the Tuskegee Syphilis Experiment,[13] as well as a variety of rumors about the government dehumanizing or antagonizing racial and ethnic minorities. African Americans may also be less trusting if they perceive the government as contributing to ongoing discrimination or failing to prevent political and economic inequality in American society (Avery 2006). In sum, there may be complex histories conditioning how people react to government outreach towards their respective communities.

WEPs attempted to address this challenge in a couple of ways. One respondent described how they would try to assuage potential applicants' concerns about the

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[13] For the "USPHS [U.S. Public Health Service] Untreated Syphilis Study at Tuskegee," doctors affiliated with USPHS intentionally withheld potentially life-saving treatment from African American males that had contracted syphilis in order to observe the disease's progression without intervention. The experiment lasted 40 years (1932–1972), during which 28 study participants died from syphilis, 100 died from related complications, and 59 relatives were newly infected (Nix 2023).

government's intentions by reframing the conversation as the government trying to engage younger communities because, "you're the future!" Other WEPs intentionally matched the demographic backgrounds of their recruiters to the communities they were trying to attract. One respondent, for example, would invite select program alumni and government scientists to attend a recruitment event if there was a demographic match. Another respondent would leverage his Spanish language skills and South American background to foster "camaraderie" when engaging potential applicants who were Hispanic.

Since wariness about the government is a known challenge, WEPs may also want to consider a proactive approach to addressing people's concerns. For example, WEPs could routinely dedicate some time during recruitment towards dispelling common misunderstandings about the government. By proactively facilitating a dialogue, WEPs would be in a position to stay abreast of emerging concerns, so they may evolve their recruitment messaging in effort to continue building trust.

3. Application Challenges

Once someone has established interest in a WEP, it is time to prepare an application. Respondents identified a few potential barriers that could make it more difficult for HURCs to apply.

Presently, most WEPs require participants to be U.S. citizens. This made it more difficult for respondents to recruit international students and ethnic minorities that possessed the types of skillsets they wanted for the program. For example, one respondent described increasing difficulty in recruiting enough skilled participants for his WEP because most of the students who possessed the necessary capabilities were international students. Similarly, WEPs focused on recruiting racial and ethnic minorities, whether in general or specifically from HBCUs and MSIs, could struggle to meet their recruitment goals because the U.S. citizenship requirement ruled out otherwise qualified candidates.

There was only one WEP in the sample that allowed foreign citizens to participate. The program focused on engaging community college students and was open to permanent residents (green card holders). To help potential applicants understand which types of citizenship statuses were eligible, along with what types of paperwork were required for each status, the WEP intentionally ensured that at least one member of the recruitment team knew the ins and outs of the rules and requirements. The program manager saw the direct benefit of finding ways to recruit non-U.S. citizens, with several former participants returning several years later, after being naturalized, to start federal positions.

Another eligibility requirement that could make it more difficult for otherwise qualified ethnic minorities to get into WEPs was the background check (e.g., security clearance). One respondent said that the background check could deter Hispanic students, even if they were U.S. citizens, because they feared the investigation process would

uncover family members who were undocumented. While this barrier created a frustrating damper on recruitment, the respondent ultimately sympathized with the students' concerns and did not press further.

The other potential barrier that could disproportionately limit the number of applications WEPs received from HURCs was knowledge about the application and hiring processes. Applying for a WEP, like other professional opportunities, requires applicants to know how to prepare a tailored resume, write an effective cover letter, dress for an interview, answer interview questions, and more. This type of knowledge may be less common among first-generation learners and students whose parents or guardians have not held office jobs. To describe this challenge, one respondent said,

> *The majority of the students are -- they may be farmworker families. So, they just don't have the same exposure to experiences as students in a [wealthy neighborhood] high school.*

The respondent had observed that students from farmworker families struggled to complete applications because they had comparatively less knowledge about how to do it than students with more educated parents or guardians. Other respondents similarly noted differences across potential applicants in their familiarity with preparing applications. Moreover, as another respondent pointed out, such differences could be compounded for students at HBCUs or smaller colleges, since their sponsored program offices were often smaller, understaffed, and less available to help students understand the process.

In an effort to address this potential barrier, the WEP that worked with farmworker families spent time during recruitment events to train potential applicants on resume preparation, filling out applications, interviewing, making eye contact, shaking someone's hand, and so forth. Other WEPs likewise helped potential applicants acquire the knowledge that they needed to get into the WEP by conducting mock interviews, providing tips on research proposals, and ensuring applicants understood the agency's mission in detail, so application materials could be tailored accordingly. One of the WEPs that explicitly focused on DEIA went as far as to demonstrate the application process in its entirety:

> *Sometimes the government application process is not the most intuitive. So, during the "Information Session," we showed them how to apply. "Here, here is how you do it." We walk them through the process, so that won't be a barrier – or, they don't get considered because they did something wrong or clicked the wrong button.*

The respondent said that these "Information Sessions were invaluable to us. That's how we got most of the folks through." By taking students through the application process, step-by-step, the WEP used their recruitment presentation to ensure that anyone interested would know how to apply.

4. Selection Challenges

Even if desired candidates are aware of the WEP, interested in participating, meet eligibility requirements, and apply, HURCs may encounter barriers during the application review and selection process. Respondents identified different issues related to the selection process that may limit applicants who belong to HURCs from WEP opportunities. Ultimately, respondents drew challenges regarding selection back to overly narrow understandings of what it means to evaluate an applicant. In particular, a few respondents recognized that traditional measures of evaluating applicants (e.g., GPA, test scores, school quality) are correlated with socioeconomic factors and could therefore inadvertently make it harder for certain fully capable applicants to receive offers.

While GPA and test scores seem to offer unambiguous ways to capture the ability of an applicant, an over reliance on these numbers can keep out talented individuals or usher in those that are not fit for the program. One respondent acknowledged this variability when thinking about the history of interns' performances in the program:

> *We do have a GPA criteria [sic]. Generally speaking, except under some exceptional circumstance, you need to be above a 3.0 to get an interview. Our average GPA tends to be in the 3.6 - 3.7 range. But we've had great interns with much lower GPAs that just absolutely destroy the program. So, we try not to discriminate based off that.*

Here the respondent highlights how participants who may have looked less qualified on paper, if relying upon traditional measures like GPA, can ultimately outperform interns with better quantitative scores.

School quality is another point at which narrow conceptions of applicant evaluation can serve as a challenge for HURC participation. Studies have revealed how particular groups, such as African Americans, those that are economically constrained, or those with less educated parents, are less likely to attend selective colleges, even when possessing the necessary qualifications (Ovink, et al. 2018). For that reason, using school quality as a proxy for evaluating applicants can perpetuate problems of access and inclusion. This can be particularly challenging when mentors from more privileged backgrounds play large roles in the selection process, as they tend to evaluate applicants based on the schools and experiences that are familiar to them without realizing or valuing the larger array of pathways that exist.

One respondent highlighted how entrenched notions of school quality posed an obstacle to getting a program that focuses on community college students off the ground:

I just send out a blanket email to everybody across campus and say, "Who wants an intern?" Then we talk about the internship and the nuances, particularly of working with community college students if all they're used to is [highly selective private university] and [other highly selective private university]. Some of the faculty will not work with community colleges. It took me several years to earn trust that these students have the capability [and] can often be a better intern.

In this quote we hear about the misconceptions surrounding school quality and applicant evaluations. Due to this respondent's efforts, those misconceptions were sufficiently overcome to get faculty members to take on community college students for the WEP.

Respondents offered several approaches to mitigating selection challenges. These approaches entailed changing who is involved in the selection process, changing the evaluation criteria that factor into the selection process, and adding checks and balances to ensure the integrity of the selections.

Changing the "who" that is involved in evaluating candidates means that a wider swath of life experiences can be brought into the conversation. To avoid the pitfalls that come with a single, limited perspective on applicant quality, IDA heard about one program instituting a selection panel made up of multiple evaluators coming from different backgrounds and demographics. Having a panel go through the exercise of rating and ranking all applicants helps ensure that the ultimate selection decisions are fair and equitable. Additionally, IDA heard about the use of an informal check of selected candidates after evaluators make their decisions. If evaluators have made curious selections, respondents would reach out to the evaluators to ask about the thinking behind their choices in effort to catch and address unfair biases.

Respondents also described approaches to dealing with selection issues which grant a more holistic evaluation of candidate quality. The goal in these cases was to gain an understanding of the candidate that goes beyond specific elements of their application package and instead permits evaluators to read between the lines for someone's life story and what they may bring to the table. One program representative explained the different factors that go into a holistic understanding of applicant quality:

A lot of our students kind of had a rocky background. You know like some of them have had to retake coursework. They don't necessarily all have the best GPA. But through their story -- they answer some questions and write some short statements -- and through this story, their transcript, and a letter of recommendation from somebody who knows them in a science or engineering capacity, we're able to select students who we feel would be good for these projects.

For this WEP, checking transcripts is a step to ensure that applicants have taken the proper coursework. But rather than relying on transcripts and GPA alone, evaluators consider the candidate's broader history, along with accounts of that person's abilities from someone who knows them well, which collectively facilitates a more holistic understanding of the candidate and their fit for various projects.

Respondents from other WEPs talked about expanding evaluation criteria by focusing on traits that were more broadly distributed across the student population, rather than traits that were more correlated with social background. For example, respondents identified traits such as personal character, persistence, and problem solving as predictive of successful participation in their respective WEPs, based on their experiences. While selecting for these types of traits may be more challenging than relying on quantitative measures, several respondents still emphasized the value of candidates that did not have a "paved path" and instead had to "figure it out along the way." In the eyes of these respondents, individuals who have had to overcome challenges demonstrate a capacity for persevering even when things get difficult. As an example, upon finding out that an applicant who had a lower GPA was a single parent that kept up with her studies while also working, one respondent saw proof of the types of qualities that fit well with the WEP:

> *And I told [the manager], "You hire her. You pull every string you can to get her." I said, "She knows how to work. She has strong ethics. She's a hard worker and she'll be very loyal." And, sure enough, we hired her and she is an awesome individual.*

In this case, the prioritization of more broadly distributed and relevant qualities—like work ethic, time management, and commitment—allowed the respondent to identify and hire a high-quality candidate who ultimately thrived in the WEP.

5. Relocation Constraints

Another potential barrier to getting into WEPs was relocation requirements. Most WEPs recruit broadly from across the country and expect some level of in-person, on-site presence; however, moving to a different region could be a significant challenge for potential participants. Not everyone has the same capability to temporarily move to a new part of the country, setting aside pre-existing obligations related to family, part-time jobs, and so forth.

The obstacle posed by relocation could manifest as a barrier at any point in the process between a potential candidate hearing about the program and deciding to accept an offer to participate. One respondent, representing a WEP on the East Coast, spoke about how these concerns could stifle interest in the program:

Some have reservations sometimes of leaving the west coast or, you know, it could be from California or from, who knows, Idaho or wherever, and just have reservations of coming to [East Coast state]. So, after talking with folks or family or whatever, they kind of just say "thank you," but, you know, they want to stay more local.

Here the respondent refers to situations where candidates are indeed interested in the program, but face a major relocation barrier. After consulting with the other people in their life with whom they have existing obligations and responsibilities, potential applicants to in-person WEPs may ultimately have to pass on the opportunity.

Respondents described a few different approaches to addressing relocation challenges. The most direct, albeit potentially limiting, solution was to restrict recruitment to local areas as a way of avoiding the issue:

When students come during the summer to work on these in-person projects, which is the goal, it just works better if they're already in the area and don't have to relocate for that short duration.

It may be difficult to move to the WEP's area, since relocating is costly and short-term housing is often limited in supply. Rather than asking more distal participants to shoulder these burdens, especially for only a few months, the WEP exclusively recruited from local schools. Other WEPs that were well-connected to nearby universities could likewise rely upon local networks to find participants.

A significant drawback of only recruiting from local areas is that the available talent pool is considerably smaller. Another approach consisted of making changes to existing requirements for in-person and on-site presence. By allowing for remote or flex-hybrid participation options, relocation could become a more manageable concern. As a hypothetical example, participants could be involved with the WEP virtually for most of the duration, but then spend the beginning and ending of the program on-site to form connections, work with specific equipment, and receive other benefits from in-person participation. Some respondents cited changes that were made to program participation requirements because of the COVID-19 pandemic:

[Before the pandemic,] this used to be an in-person program... I think one of the benefits of going virtual is now we have a much larger pool of candidates. Because previously [if] they were going to be in this program they would have to live near [WEP site] or near the office. But now they can be from anywhere in the U.S. and still participate.

Being forced to temporarily switch the WEP from in-person to virtual participation, due to social distancing requirements, helped the respondent see that virtual participation can

expand the talent pool by mitigating relocation constraints that were previously preventing qualified and interested students from participating.

Lastly, it is worth noting that allowing remote or hybrid work arrangements could also lower barriers for individuals who live somewhat close to the WEP but would still have a lengthy commute. By reducing the amount of time and money spent commuting, flexible work arrangements can help support participants who may have other standing obligations that they need to maintain while being in the WEP.

6. Hidden Costs of Participation

WEPs can involve a number of hidden costs that can create financial barriers that may prevent someone who is interested and qualified from being able to participate. Respondents brought up several ways that hidden costs pose challenges to candidates interested in WEPs, including costs of housing, transportation, equipment, and time out of the labor market.

Housing costs are related to the relocation constraints described earlier, but with a key difference in their root cause. Rather than pre-existing obligations to family or friends preventing someone from relocating to participate in the program, the barrier in this case is the economic cost that comes with finding a temporary residence and moving to a new location. Moving costs money, and while some people can stay with family or friends in the area of the WEP site, it is important to remember that not everyone has this option. For some participants, taking part in a WEP may require paying for housing costs both in their normal locale as well as near the WEP location.

In interviews, respondents offered some thoughts on dealing with housing costs. One idea was to assist participants with the process of finding affordable housing. For example, WEPs could take advantage of connections within their community and pass on information about housing opportunities. One WEP was able to form an arrangement with a local university to place their participants in the dormitories while the normal student population was away for the summer. Another idea was to provide relocation stipends or subsidies to help offset costs for individuals coming from afar:

> *I have some support staff to do the hiring, to get parking passes for the interns, secure housing for the interns, making sure travel is paid for…Our philosophy is that no intern will suffer financial loss to be part of the program. So, if they need to travel or need housing, we try to supply it within the intersection of federal contracting guidelines and the laws of the state.*

In this excerpt, we hear an acknowledgement of the hidden costs of participation and a commitment to cover expenses to the extent possible.

The travel costs referenced above could also be relevant for candidates that do not need to relocate but would still have long or complicated commutes. For some WEPs, public transportation is either unavailable or impractical, which means participants would need a car to get to work. Long commutes are also costly, both literally (gas, car maintenance) and in terms of the time and energy required of the participant. Several respondents acknowledged transportation and travel as barriers for individuals who would otherwise be a good fit for their WEPs. Offering some type of reimbursement for travel costs, on top of the basic program stipend, was one approach discussed in interviews.

The final hidden expense of WEPs comes in the form of opportunity cost. From a practical standpoint, the time required for WEPs can take participants away from the time they have to generate an income through other jobs. As such, it is important to ensure that participants are provided enough economic renumeration to offset time outside of the labor market.

Respondents implemented an approach to this challenge that relied on offering compensation for participation that is commensurate with labor market opportunities. This meant focusing on compensation that accounts for academic level and years of experience, and would be comparable to the pay offered from working another job. When speaking with his leaders about how to increase recruitment, one respondent underscored the primacy of pay for bringing in desired candidates:

> *They [leaders] said, "What do you think we ought to do?" I said, "Start them at higher wages." I said, "You want more people? Pay more." My grandfather told me a long time ago, "People can give you movie tickets, pats on the back, awards – they can give you all that stuff. But when they really, really love you, they're gonna show it with money."*

In other words, while awards and recognition may help participants feel appreciated, they also have a financial reality that requires them to be compensated in a way that allows for covering their bills.

Respondents offered other ways in which participant compensation can be bolstered as an incentive to apply. Specifically, respondents talked about other forms of support such as tuition remission, student loan payments, medical/insurance benefits, retirement benefits, or guaranteed job placement after completion of the program. While these forms of support do not replace the need for a competitive stipend, they can help ease some of the other financial burdens that can make it harder for economically disadvantaged people to participate. Importantly, IDA recommends communicating these benefits during the recruitment process so interested candidates do not rule themselves out from applying because of hidden costs.

C. Equalizing Experiences

Another way of striving towards equality is to address socially based imbalances that impact how someone experiences an opportunity. In other words, are there any barriers that may make it more difficult for certain participants to fully engage in the WEPs' activities? If so, what are WEPs doing that may help address these barriers?

1. Different Starting Points

Respondents talked about how participants may enter WEPs from different starting points that can make it harder to assume their roles and responsibilities. For example, some participants may start the WEP with less developed technical abilities compared to others. As a respondent who primarily works with community college students said,

> *Sometimes they [the community college students] have never been in a lab environment at all and it's a learning curve for them… [And then] sometimes you get the [highly selective 4-year university] student who has been working with other professors doing research already… [and has] participated in studies where she had been an author. So, that's definitely a big gap.*

Here, the respondent calls attention to differences across participants in their knowledge of how to operate in a laboratory environment and contribute to research projects. In particular, the respondent has noticed that community college students may start the program with less technical experience, which adds an extra learning curve in order to catch up to participants from four-year universities.

Respondents were also concerned about different starting points in office decorum; i.e., how to dress and act appropriately in a work environment. In describing the importance of learning office decorum, one respondent shared,

> *I think it takes some getting used to, being in a work environment like ours… You know, getting to work on time, getting to your meetings, finding a building where you're supposed to have the meeting, making sure you look at your calendar because sometimes things change and you might need to know that something has changed… Just learning that you're not in school, that there's not going to be someone there to wake you up in the morning to get you to work on time. You have a work schedule, you have tasking that needs to get done.*

It is easy for more seasoned professionals to unconsciously assume that everyone possesses the types of skills that respondent described since these types of things have long been integrated into their professional behavior. However, for many participants, the WEP is their first time in an office environment, so many of these skills may be new. While it may

also be their first time, participants whose parents or guardians held office jobs have had the advantage of learning, whether directly or indirectly, how to dress and act in an office. Differently, participants whose parents or guardians worked in trades or other occupations outside of an office setting may find themselves learning about office decorum in the WEP. As an example, one of the respondents talked about how participants who came from agricultural families may need a little extra help.

The last difference in starting points that respondents described was how participants engaged authority figures. Research shows that socio-economic class background can shape how students engage professors and other figures of authority. For example, a study (Lareau 2003) found that parenting styles vary between lower- and middle-class families, with the former being more unidirectional (i.e., parent tells child what to do, child does not say anything) and the latter being more bidirectional (i.e., parent and child negotiate what to do). These differences create variation in how students engage figures of authority outside of the home (e.g., teachers), with middle-class students being more likely to challenge or otherwise engage authorities. Similarly, one respondent noticed differences in how Hispanic and White participants interacted with their respective mentors:

> *In the Hispanic culture, there may be issues with authority. In my experience with these students, they are far more humble than their White equivalents; they're not groomed to talk about themselves like their colleagues.*

The advantage of entering the WEP with a bidirectional approach to interacting with mentors is that participants are able to voice concerns and seek help when needed. Conversely, participants who are more used to a unidirectional approach—in this case, Hispanic students from an MSI—are at risk of struggling longer than necessary with WEP activities. As a respondent from another WEP said of a participant who was uncomfortable speaking up, "You don't know if he knows everything and just has nothing to say. Or, if he doesn't know anything and he's just intimidated to ask."

Respondents described several strategies for addressing different starting points among participants. One of the DEIA-focused WEPs went so far as to design their program with the assumption that participants would have none of the required knowledge that they needed. The respondent partnered with their organization's technical experts to gain a better understanding of what skill sets participants needed and which were likely being taught in school. For any requirements that were not being taught in school, the respondent then developed a learning activity to build participants' capabilities. By embedding a short training program within the WEP, the respondent was able to ensure that all participants, regardless of their educational backgrounds, had the skills they needed to do their assigned projects.

Many WEPs similarly incorporated some type of remedial training to help participants gain whatever skills they needed to complete their assigned work. One respondent scoured their Service's existing training opportunities for government employees to find courses that served participants' needs. For the most part, however, remedial training was provided through some type of weekly learning program that occurred in parallel to research projects. To give an example, one program manager hosted a weekly training class for all of her participants on office decorum and other aspects of professional development:

> *I work hard to make sure that they come across as professionally as possible, in ways they may not even think [about]. I try to anticipate any roadblocks that they may have. My job is the soft skills, you know, to make sure that they have an email signature and that they respond to emails –because that's the environment that they're in.*

She also taught participants how to email a professor to ask for 15 minutes of their time, how to shake someone's hand, and how to give an effective elevator pitch. While the participants sometimes thought these lessons were silly, the respondent was confident that they would benefit from these skills both during the WEP and beyond.

Other respondents likewise capitalized on work-adjacent meetings to address any learning gaps among participants. One respondent focused on helping participants develop teamwork skills, since most government research is conducted by teams. Another respondent described training sessions on emotional intelligence and effective communication. Several respondents helped participants understand how to dress appropriately in the workplace for various occasions, whether conducting research, giving a briefing, or talking to a potential new employer. Lastly, a couple of respondents described their efforts to reassure participants that it was okay to speak up and get help when needed.

Knowing that some participants may be less inclined to ask for help, several program managers also created some type of unstructured help opportunity for catching any other challenges that may be hindering a participant's time during the WEP. One respondent, for example, systematically checked in with each participant every week to ask how things were going, see if they needed anything, and so forth. The key, in their view, was to be proactive in an ongoing way, since it was hard to anticipate when and in what areas participants would need help. Since the respondent was a program manager, and not a mentor, this type of approach also provides participants a safe and reliable channel outside of their primary chain of command.

While some respondents advocated for proactively reaching out to participants to see if they needed help, other respondents advocated for encouraging participants to reach out to program managers and mentors if and when needed. These respondents described some version of an "open door policy" that participants could leverage at any time. IDA observed

that all the respondents who put the onus on participants to seek help when needed were from WEPs that did not have DEIA as a specific aspect of their core mission. In contrast, most of the respondents who advocated for a proactive approach came from WEPs that explicitly focused on DEIA. Both approaches have merits, of course, and are not mutually exclusive.

2. Inclusion Challenges

By definition, participants coming from HURCs are more likely to encounter teammates or mentors who are less familiar with the kinds of experiences they may have had and the challenges they may face. This disconnect could make it harder for participants to develop a sense of inclusion within the WEP. Respondents touched on times where there were conflicts or misunderstandings across groups, which made it harder to foster inclusion. One respondent summarized this issue and how it can particularly impact the mentor/mentee relationship, saying,

> *A DoD lab is, you know, predominantly a White environment. So, some of the … challenges that some of the interns did say was … they had mentors and they had to get them to understand it. We don't look like you and we don't have the same culture, but these are the adjustments that we have to make, right?*

This respondent is pointing out that DoD lab environments can be challenging for interns who are not from the majority group (in this case, White people). In particular, the cultural disconnect between mentors and mentees can be difficult on incoming students. Other respondents commented on similar challenges between different groups of participants.

Respondents identified several possible solutions for addressing barriers to inclusion. Some respondents tried to use team composition as a way of promoting inclusion, though they differed in the approach they took. One approach was to put people from different backgrounds together on teams, the idea being that prolonged engagement would facilitate mutual learning. The quote above gives an example of this, where the WEP participants helped their mentors understand where they were coming from and what they needed. The respondent went on to say that this would be "educational" for both sides. The trade-off of this approach, however, is that the mantle of responsibility is primarily placed on a participant from a HURC, which may add more pressure to an already uncomfortable situation.

The other approach to team composition that respondents identified was allowing participants and mentors to sort themselves into teams based on comfort. In practice, this approach usually led to people segregating themselves based on a combination of shared interests and social backgrounds. While this approach may have reduced interpersonal

conflicts based on differences in social backgrounds, it may also limit the potential for cross-cultural learning over time.

Another way of addressing barriers to inclusion was to implement a cultural intervention at the organizational level. A few respondents, for example, described the ways in which their organizations tried to communicate its commitment to inclusion to government employees, participants, and other members of the community. One respondent talked about informing participants about their organization's values, to include how they were expected to "respect all individuals, no matter their background." This respondent also communicated the importance of respecting each other's differences. The participants were reportedly very receptive to both messages, which the respondent attributed to younger generations having greater awareness of inclusion-related issues.

The last idea that respondents offered for fostering greater inclusion was to provide some sort of structured training on diversity-related issues. Some WEPs were more proactive about providing training. For example, one WEP hosted a planned event series that was focused on diversity. One of their events highlighted "Women in STEM" and featured highly placed female guest speakers who talked to participants about the difficulties that they encountered and overcame. In addition to informing participants about important issues in the broader STEM world, these types of events may have the benefit of helping participants plan ahead for potential issues before they occur.

Other WEPs employed a more reactive training approach that focused on dealing with problems as they arose. One respondent recounted a conflict between four participants who were working together on a project. Describing the situation, the respondent said,

> *They had different upbringings, different racial groups... And one student told the other student [that] because she was of a certain racial group versus him, "You're going to be successful regardless. I got to represent my whole culture. So, I need to be able to do these things."*

This exchange caused a lot of issues in the group and eventually escalated to the respondent's attention. The respondent dealt with it by organizing a group training session on how to treat each other fairly and then holding individual mentoring sessions with each participant. Ultimately, the respondent saw this as a success story because the individuals who clashed became friends and would "voluntarily go lunch together." In this case, the strength of using a reactive approach was that it allowed the respondent to tailor interventions to the specific participants' needs. The trade-off to relying upon reactive approaches is that they are less effective for preventing clashes from occurring. As such, WEPs could consider a potential combination of proactive and reactive diversity training.

D. Equalizing Post-Program Outcomes

The third aspect of equality that emerged from the interviews was ensuring that all participants receive comparable gains from the overall WEP experience opportunity. In other words, what kinds of barriers may make it more difficult for participants to apply the skills, credentials, and other benefits that they gained from WEPs towards whatever educational program, learning opportunity, or job they pursue next.

1. Different Aspirations

One of the potential barriers to post-WEP success was knowing what was possible. Specifically, respondents were concerned that people from HURCs could have less ambitious aspirations due to a lack of awareness about opportunities in the federal government and the defense industrial base. Respondents primarily communicated this issue indirectly, by telling IDA about all the things they did to help participants learn about the types of jobs and programs that were possible after the WEP.

To address this challenge, many WEPs used some of the time allotted for professional development activities to introduce participants to possibilities. One respondent approached aspiration shaping by showing participants how there were multiple ways of working in a given research area while also contributing to the government:

> *It's not just, hey, come work for the Army." It's, hey, here are all of the ways that you can participate in this research field, regardless of where you "sit." You can sit in the Army, you can sit in industry, you can sit in academia – you know, you can sit somewhere else and still contribute to the research and the work that we're doing as the defense base.*

Another WEP that focused on students from HBCUs and MSIs assembled all the interns from throughout the installation for a weekly walking tour of the various technical departments. By seeing each area of work in person, interns were able to see what types of jobs were possible, ask questions, and connect with people in the field. The program manager thought that the walking tour was particularly effective for goal shaping because it enabled interns to see, first-hand, what various occupations actually do on a day-to-day basis.

Another strategy that respondents employed to shape participants' aspirations was to connect them with potential role models. One WEP, for example, invited professors from Ivy League Schools and other highly selective universities to introduce their research to participants and describe the paths they took along the way. The intent was to help participants see the kinds of research that they could pursue during graduate school and beyond. Other programs likewise introduced participants to astronauts, people who worked

at the White House, and so forth—all as a way of teaching (a) what types of goals were possible and (b) what types of steps one would have to take to achieve these goals.

The next idea was to use mentoring sessions as a space for suggesting and helping participants refine possible goals. Unlike more singular events (e.g., a guest speaker), the mentoring relationship had the added value of including an iterative feedback element. Since the mentor and participant meet repeatedly over time and get to know each other, the mentor is in a position to hear how aspirations are evolving, redirect as needed, and then help participants understand what steps they would need to take to realize their goals. Respondents emphasized the importance of being honest in these types of conversations. That meant sometimes having to tell a participant something in the spirit of, "Maybe that career is not the best fit for you. Have you considered this other possibility instead?"

The last thing to add with respect to aspirational challenges only came up once, but serves as a valuable consideration for any solution strategy. A program manager from a WEP that focused on HBCUs and MSIs stressed the importance of helping participants understand not only what goals were possible, but also that someone like them could achieve these goals. As the respondent put it, "I want them to be able to… see themselves being able to participate in that type of work." Developing confidence in what one can attain applies to all participants, since people are unlikely to pursue goals deemed impossible. Nevertheless, the development of confidence is especially important to cultivate among participants from HURCs, since—by definition—there are not a lot of people from similar backgrounds in the types of positions that the USG may hope they will consider.

2. Familiar Barriers in New Contexts

Last, but not least, it is important to acknowledge that WEPs are but one step in participants' intellectual and professional development. The impact WEPs have on this development is predicated upon participants' ability to apply what they learned towards the next step in their growth—whether a job, additional schooling, or another learning program. Unfortunately, many of the barriers that HURCs may have encountered for WEPs are not unique and could continue to pose challenges in subsequent pursuits. The reappearance of familiar barriers creates a potential inequity in which participants are successful at leveraging the WEP experience towards post-WEP gains. Consequently, people from HURCs may continue to be at higher risk of leaving a STEM development pathway, regardless of their aspirations. Respondents' accounts revealed three broad strategies for addressing familiar challenges in new contexts.

The first broad strategy was to retain participants in the organization for as long as possible, since fewer transitions meant fewer opportunities for diverting from a STEM development pathway. For participants who were approaching the job market, a good retention technique was converting participants into full-time government employees after

finishing the WEP. Unfortunately, only a couple of WEPs in the sample had an easy way of hiring former participants. Most of the times that conversion was raised, it was in the context of respondents expressing frustration about their lack of continuity mechanisms.

Participants who were not yet ready for the job market could be retained in the STEM ecosystem by designing one's WEP to cover multiple developmental stages. In other words, instead of just supporting undergraduates, the WEP could also support graduate students and postdocs, since this essentially retained students until they can be hired. One of the WEPs that focused on HURCs employed this strategy by mentoring students throughout their two- and four-year degrees, as well as their graduate studies. By allowing participants to stay in the WEP until they were ready for the job market, it reduced the number of times that participants would have to look for other opportunities—potentially outside of the government. As an added benefit, the program manager thought that starting a prolonged mentoring relationship as early as possible allowed the WEP to guide participants towards the classes and credentials they would need to be competitive for government jobs.

The second broad strategy that respondents described was connecting participants to other opportunities in the government. Some WEPs accomplished this by developing strong channels into other programs. In some cases, WEPs were able to establish a formal link between programs, allowing participants to finish one WEP and then go directly into another. As one respondent described,

> *Some of our underserved groups, especially, need more training years before they get to that federal job. And I don't want them lost to, you know, being unemployed after the end of a fellowship – not finding that next step and then going into something else. So, you want to use all your programs to the best of your ability. So, if we can use [one kind of] fellowship for one or two years, and then… I can actually roll them into a [different] fellowship… for the next couple of years. You know, guide them just a little bit more to that next career step.*

To prevent HURCs from being unemployed after the WEP and potentially leaving the STEM development pathway, this respondent was able to transition participants from one funding vehicle to another. By leveraging all the fellowships that were available to her organization, the respondent was able to connect participants with additional development experiences while retaining them in the DoD STEM ecosystem.

WEPs who did not have formal connections to other programs could still connect participants with additional development opportunities informally. Specifically, respondents would recommend other WEPs to participants that would match their evolving needs. A mentor from a program that focused on HURCs recounted an exceptional participant that he really wanted to keep moving along a STEM development pathway until

she was eligible for government jobs. Since his Service did not have a WEP that served her next educational level, he helped her get into a federal-wide WEP that did. Then, after she graduated and moved on to her next educational degree, he helped her find another WEP—now back in his Service—that could support her until she was ready for a government position. In reflecting upon the "hurdles" he jumped to keep her on a STEM path, the mentor said,

> *If somebody is successful, how do we make sure that they get transitioned onto a student billet where they can stay for a while? And, if they're successful with the student billet, how do we make sure that they get transferred over to a government employee? Because, I don't want the pipeline to get leaks in it. Because we have(?) good students, people that really belong in the government, but if you have a leaky pipeline, those people will make it all the way through [their education] and you won't get the end product.*

The last way that respondents connected participants with other opportunities was by helping them cultivate professional networks. For example, respondents could leverage their professional networks and reputation to introduce mentees to key figures at another government organizations that were hiring. One of the program managers recounted an exceptional participant whom he was able to connect to another WEP. Describing how he reacted after the participant expressed interest in gaining more experience in propulsion,

> *"Okay, I'll make some phone calls and get you that experience." I made a phone call to propulsion folks, a person that I knew. "Hey, I got this opportunity. You can have this person [the participant] free of charge. We'll foot the bill, so no cost to you. Just test them out." Within a few months, I got a phone call saying, "We're going to hire this kid." So, they hired him and paid for him to get his master's.*

The program manager used his professional network to connect the participant to another government learning opportunity. The participant did so well in the new program that they hired him and paid for additional schooling.

WEPs also helped participants network with near-peer role models. For example, a WEP that worked with students from HBCUs and MSIs hosted an annual event for both current and former participants as "one big family." The value of these reunions for current participants, according to the program manager, was,

To find out what students are doing, what career paths they're doing, what excites [them], what's happening in their lives… And that's good because there's always a student or a past student that has walked the path, that you may actually want to communicate and connect with. And that networking is key.

By connecting with alumni, current participants were able to hear how those who came before them applied their WEP experiences towards various subsequent pursuits. These connections also allowed current participants to learn about the steps that others took to realize their goals, which could help inform participants' post-WEP plans. While the respondent did not mention it, there may be added value in helping racial and ethnic minorities expand their networks. A recent study (Pedulla and Pager 2019) showed that both African American and White job seekers were more likely to be hired if they were referred by someone in their networks than if they applied without a referral. However, the referral advantage was almost twice as strong for White job seekers compared to African American job seekers. In other words, African American job seekers would need twice as many referrals to secure a single job, compared to White job seekers. This finding underscores the importance of helping African American participants cultivate large professional networks, since—while unfair—they may require support from more professional contacts to secure a future job.

The last broad strategy that respondents employed to help HURCs overcome familiar challenges in new contexts was leaning into the development opportunity afforded by having WEPs at all. One of the respondents described how they communicated the WEP's value to their community college participants:

If you show them [recruiters] two CVs, they're probably going to gravitate towards the one from [a highly selective public university]. But if you can at least equalize your skills and fundamentals, you [might be able to get] that second look where people say, "Well this guy is just as good as someone from [the highly selective public university]."

As discussed throughout this report, WEPs strive to help participants develop STEM skills, professionalism, contacts, and credentials—all of which may help them become more competitive for post-WEP pursuits. WEPs may also help participants by shaping aspirations, lifelong mentoring, and by connecting participants with the kinds of people and training that can help with next steps. While all participants can benefit from what WEPs provide, it may be especially important for HURCs to maximize these developmental experiences as a way of fortifying themselves for potential barriers ahead. To help his participants from HBCUs and MSIs see the strategic importance of not just learning, but mastering, the various skills he taught, one respondent would say to them,

Hey, you need to ensure that you are working your butt off, that you're taking full advantage of all that's provided to you. You need to ensure that you are studying harder, that you're going the extra mile, and that you are keeping your G. P. A. above a 3.0…I know it's sad but that's just the real world.

The respondent, who identified as African American, gave what he called "real world professional communication" to help participants from HURCs understand that they may be held to a higher standard when seeking future opportunities. As such, the respondent encouraged them to take full advantage of the learning opportunities and resources that were provided by the WEP. Reflecting upon overall value of having a WEP that focused on HURCs, the respondent also added, "We need programs like this to give minorities the opportunity to excel. Or, just get that opportunity to kind of show their value, their worth, [and] what they can provide." In other words, WEPs focused on HURCs may help level the playing field by providing the kinds of skills, experiences, and credentials that can help HURCs overcome potential barriers in how they are evaluated when applying for post-WEP opportunities.

E. Summary

When asked about DEIA in their respective DoD STEM WEPs, program managers and mentors identified potential barriers that could impact one or more aspects of social equality. When it came to equalizing accessibility, the types of barriers that could make it harder for HURCs to get in the door were a lack of awareness about the WEP, historically rooted government mistrust, relocation constraints, the hidden costs of participation, application requirements, and potential bias among evaluators. When it came to equalizing experiences, the types of barriers that could make it harder for HURCs to fully participate in their WEPs' activities were technical lags, unfamiliarity with office decorum, misaligned approaches to interacting with authority figures, and competing obligations. With respect to equalizing post-program outcomes, people from HURCs could struggle to reap long-term benefits from WEPs due to differences in the aspirations that were deemed possible and the knowledge needed to pursue various goals. Last, but certainly not the least, program representatives were acutely aware that many of the same barriers that they were trying to address in WEPs could reappear in whatever programs, jobs, or other opportunities that participants pursued afterwards. The more development that participants needed before going on the job market, the more opportunities there were for diverting from a STEM developmental pathway.

Overall, IDA observed that program representatives were primarily concerned with addressing barriers related to recruitment, most likely because this is a key focal point in broader contemporary society. That said, IDA's analytic approach also helped to reveal several emergent challenges related to both participants' experiences during the WEP, as

well as what they take with them into subsequent pursuits. To help level the playing field, IDA recommends that DoD STEM WEPs reframe their approach to DEIA by systematically striving *towards* all three aspects of social equality, rather than limiting themselves to equalizing accessibility. The practices shared throughout this chapter offer a variety of possible solutions to the barriers described above. IDA recommends that DoD STEM WEPs review these practices to explore which, if any, may be adapted to fit their respective challenges and communities.

6. Participant Survey Results

In order to understand the participant's perspective on DoD STEM WEPs, IDA designed and administered a survey that was sent to recent DoD STEM WEP participants. The full survey instrument can be found in Appendix B. The survey covered a range of topics, including

- Basic educational information (e.g., current academic level, current major)
- Information about the WEP that they participated in
- Interest in future STEM careers
- Basic demographic information

The questions on the survey were designed to help understand the perspective of DoD WEP participants as well as what impact the DoD WEP had on them and their future career plans. The remainder of this chapter will explore the responses to the survey. The sampling constraints of the survey meant that it was difficult to systematically sample all DoD WEP programs. The findings will typically be presented for the whole sample. A follow-on study with a more systematic sample would be needed for further analyses between subcategories of respondents (e.g., across different demographic groups or across different programs).

Some of the key findings explored in more detail in this chapter are as follows:

- The survey reached a broad sample of different WEP participants in terms of demographic and academic characteristics. Participants from little less than half of known DoD WEPs were present in the sample, therefore it is not clear whether the responses are statistically representative of DoD WEPs as a whole.
- Participants learned about programs through multiple methods, with the most common method mentioned being from a person they already knew.
- When deciding to apply, the top concern was knowing if the program would benefit their long-term goals.
- Mentorship was an important aspect of WEP participation and most participants indicated they had frequent interactions with their mentors, but some participants felt that they did not have adequate mentorship.
- Some WEP participants indicated that introductory communication from the WEP was lacking, particularly related to bureaucratic issues.

- Survey respondents reported learning to work in a professional environment and growth in their STEM skills.
- When comparing the commercial sector to the government sector, survey respondents see commercial sector jobs as stronger in terms of salary, but government sector jobs as stronger in terms of benefits and job security.

A. Survey Coverage

1. Participant Response Rate

One of the goals of this survey was to reach a broad sample of WEP participant across DoD programs. This section enumerates basic information about who voluntarily responded to the survey. A total of 319 people opened the link and looked at the survey. However, 44 of those people did not answer any questions, which means that 275 people provided at least one answer. Additionally, every question on the survey was optional, so the response rate varies from question to question. The remaining analysis will focus on only those respondents that answered questions. For each question discussed in this analysis, the number of people who responded to it will be reported with results.

2. Programs Represented

The DoD has a wide variety of WEPs, and each program has different goals and characteristics. In order to understand the different types of programs represented within the survey sample, IDA asked respondents to identify the most recent program that they completed. Of the respondents, 217 (79%) identified the programs they participated in. The programs listed included those run by the Army, Navy, and Air Force, as well as several that are DoD-wide programs. Because some of the programs listed may be relatively small and the responses from a participant might disclose their identity, a full listing of programs will not be included. However, the following six programs had at least 10 respondents to the survey: SMART, National Defense Science and Engineering Graduate (NDSEG) Fellowship, PALACE Acquire (PAQ), Premier College Intern Program (PCIP), Naval Research Enterprise Internship Program (NREIP), and National Research Council (NRC) Research Associateship Program (RAP). There were an additional 13 programs that each had fewer than 10 participants respond, making for a total of at least 19 programs identified in the survey data. Overall, this represents many of the programs identified in Belanich et al. (2022), so it could be considered a broad sample across programs but not a statistically representative sample.

There are certain types of programs that may be overrepresented in the number of respondents. Specifically, scholarship-for-service and graduate-level fellowships both had more responses than would be expected based on the distribution of program types in Belanich et al. (2022). This imbalance, along with the large number of respondents who

did not identify their program, impacts the generalizability of the survey results, and wherever possible the results will make clear when the program distribution may have played an important role.

The survey also asked respondents to identify the length of the most recent program that they participated in. The largest category is programs that last a year or more (50.9% or 114 respondents). Scholarship-for-service programs were highly represented in the sample, and those programs tend to span over multiple years. So, this result is likely due to which programs were reached by the survey and may not reflect the overall distribution within DoD WEPs. The other large category are programs that are between 1 month and 4 months (41.1% or 92 respondents). Typical summer internships would fall in this category, and are likely driving the large number of those responses. Programs that are shorter than 1 month and programs between 4 months and a year are rare within the survey sample (a total of 8.1% or 18 people). Thus, the data show that both long and relatively short programs are represented. This is important because program length can influence both experience and impact.

B. Characteristics of the Respondents

There were several questions on the survey that addressed the personal characteristics of the respondents. Looking at the responses to these questions gives insight into who is represented. Importantly, while the characteristics of the respondents may be broad and cover the potential distribution across DoD WEP populations, it should not be taken as statistically representative of the DoD WEP population as a whole due to limited response rates. However, the responses provide a description of who responded to the survey across demographic and academic characteristics. In general, the respondents reflect different demographic groups, a range of academic levels and background, and a variety of locations around the United States.

1. Demographic Characteristics

The survey included questions asking about the respondent's gender, race/ethnicity, and birth year (age). For context, the demographic results will be compared to the Integrated Postsecondary Education Data System (IPEDS) Completions Survey (U.S. Department of Education 2022a). The IPEDS data include recipients of postsecondary degrees or certificates in a STEM field in the United States in 2021.[14]

[14] Note that these results are for degree completions, which may be different than people currently pursuing degrees. The survey sample can include both degree recipients and people who are pursuing degrees. Additionally, IPEDS specifies that "STEM fields include biological and biomedical sciences, computer and information sciences, engineering and engineering technologies, mathematics and statistics, and physical sciences and science technologies." Data from the NREIP participants may

A total of 220 respondents answered the gender question. More than half (57.3%) of the respondents to the survey identified as male, 40.0% of respondents identified as female, and the final 2.7% preferred not to answer.[15] The U.S. population of postsecondary STEM degree or certificate recipients consists of 65.0% males (U.S. Department of Education 2022a). So, male respondents are slightly underrepresented in the survey sample compared to the overall population of STEM degree recipients. It is unknown whether this is because the population of participants in DoD WEPs or the population that decided to respond to the survey follow a different distribution.

The survey also asked respondents to identify their ethnicity and race in two separate questions.[16] In order to make the results comparable to demographics reported in IPEDS, these questions were combined to make a single race/ethnicity value for each respondent, which is reported in Table 4. The standard process that IPEDS and the Census uses for this combining of questions first takes a person's response to the ethnicity (Hispanic or not) and that determines if the race response is used. For example, if a person indicates they are Hispanic then they are recorded as Hispanic and their response to the race question is not used. The race questions are based only on those that indicated that they are not Hispanic. This process leads to a sum of 100% of people that are Hispanic or if not Hispanic then people characterized by their race. The table also includes data from the IPEDS completion survey (U.S. Department of Education 2022a) as a comparison.

Table 4. Race and ethnicity distribution in survey respondents and U.S. STEM degree/certificate recipients.

Race/Ethnicity	Percent of Respondents (*N* = 218)	U.S. STEM Degree Recipients (2021)
American Indian or Alaska Native	0.5%	0.5%
Asian	7.8%	13.6%
Black or African American	1.4%	8.9%
Hispanic	7.3%	15.2%
Native Hawaiian	0.0%	0.2%
White	75.2%	57.4%
Multiracial	2.8%	4.2%
Prefer Not to Answer	5.0%	—

include participants who have a different major. Additionally, IPEDS data include only U.S. citizens and permanent residents.

15 Other gender options (e.g., nonbinary) were not allowed on the survey.

16 For the race question, 15 respondents saw the question and chose not to answer it. For ethnicity, 14 respondents saw the question and chose not to answer it. Respondents who indicated that they were Hispanic or identified at least one Race are included in the table. Finally, 42 respondents did not see either the race or ethnicity question.

Note: The U.S. STEM degree recipients column is based on data from the IPEDS completion survey and includes recipients of any postsecondary degrees or certificates in a STEM field in the United States in 2021 (includes only U.S. citizens and permanent residents).

From these data, it is clear that White respondents are overrepresented in the survey compared to the overall population of STEM degree recipients. Additionally, those respondents that identified as Asian, Black or African American, and Hispanic were present at a lower percentage than in the IPEDS Completion Survey. It is unclear whether this is because these groups are underrepresented in the DoD WEP participant population or whether individuals from these groups were less likely to respond to the survey.

The final question on the survey allowed respondents to input their birth year. Only 187 respondents entered a year for this question, and those years were used to calculate the approximate age of each participant.[17] The distribution of ages has two peaks. The first is around 21–23 years old, and the second is around 26–28 years old. Intuitively, these two peaks correspond to students near the end of their time as an undergraduate or students in the middle of or toward the end of graduate school. No respondents indicated that they were younger than 18 years old.

One of the final questions in the survey asked respondents if any of the following characteristics applied to them: English not their native language, have a disability, first person in their family to go to college, qualified for free/reduced lunch in high school, qualified for federal aid in college, served in the U.S. military, have a close relative who served in the U.S. military, or have a close relative who worked for the DoD. The goal of this question was to understand if respondents identify with typically underrepresented or underserved groups in STEM and understand their connections to the military. In total, 45.5% of respondents (125 people) selected at least one of the categories. There was not a "None of the above" option for this question, so the remaining 54.5% of respondents correspond to people who did not want to answer the question and people who felt that none of the categories applied to them. Table 5 summarizes the responses to this question.

Table 5. Summary of selections for question asking about various underrepresented and military-connected categories.

Category	Percentage of Respondents (*N* = 125)
English is Not Your Native Language	7.2%
Have a Disability	11.2%
First Person in Family to Go to College	16.0%
Qualified for Free or Reduced Lunch in High School	20.8%
Qualified for Federal Aid in College	48.0%

[17] As the survey was taken in 2023, the approximate age was calculated as 2023 minus the birth year.

Category	Percentage of Respondents (*N* = 125)
Served in the U.S. Military	6.4%
Have Immediate Family Who Served in U.S. Military	36.8%
Have Immediate Family Who Worked for the DoD	31.2%

Note: The percentage of respondents reflects the percentage of people who selected at least one characteristic in response to this question. In other words, the N does not include people who felt that none of these categories applied to them. The percentages add up to more than 100% because respondents could select multiple categories.

The data show that each category was represented in the sample, though at varying levels. On the high end, almost half of people who responded to this question qualified for federal aid in college. Additionally, 20.8% of respondents to this question qualified for free and reduced lunch in high school. There was overlap between these two categories as some people qualified for both, and a total of 63 people (50.4% of respondents to this question) qualified for at least one of the two. This indicates that there were a significant number of people who came from a lower income background, which are typically underrepresented in STEM.

The categories that asked about connections to the military also had a fairly large number of responses. Specifically, 74 respondents (corresponding to 59.2% of people who answered the question) indicated that they either had served in the military, have immediate family who served in the military, or have immediate family who worked for the DoD. The family connections were most prominent, with 36.8% of respondents indicating they have family who served in the military and 31.2% indicating they have family who worked for the DoD. A much smaller number (6.4%) indicated that they had served in the U.S. military. The survey did reach military-connected WEP participants, though veterans were a fairly small number of the respondents.

The other categories were identified by respondents at lower rates. Only nine respondents indicated that English was not their native language. Fourteen respondents selected that they have a disability. Finally, 20 people selected that they were the first in their family to go to college. All of these groups are typically underrepresented in STEM, and while there were only a small number of people in the survey who identified with each, it is an indication that the responses to the survey include some people from each of these groups.

The data about underrepresented groups are backed up by another question on the survey which asked about the highest completed education by any primary guardians. All but one respondent answered this question, and 254 people (92.7% of those who answered this question) indicated that their parent or guardian had attended at least some college. A full 232 (84.7% of people who answered the question) had at least one parent or guardian who completed at least a bachelor's degree. There was just a small percentage of

respondents (20 people or 16.0% of the people who answered the question) who indicated that they were first in their family to attend college in the question about underrepresented groups, which lines up with the question about parent/guardian's education levels.[18] Together, these questions support the conclusion that there were some respondents who were first-generation college students, but not very many. Once again, the small number of respondents in this category could reflect who was willing to respond to the survey rather than the underlying characteristics of the DoD STEM participant population.

From the Phase I evaluation (Belanich, et al. 2022), it is known that DoD WEPs aim to reach participants from across the country. To measure the geographic reach of DoD WEPs, two questions on the survey asked about the geographic characteristics of the respondents. In particular, they were asked what state they were living in when they applied for the program, and how they would characterize where they lived (e.g., rural, suburban, urban). A map summarizing the responses to the state question is shown in Figure 1. Each state is colored according to the number of respondents who listed that state.

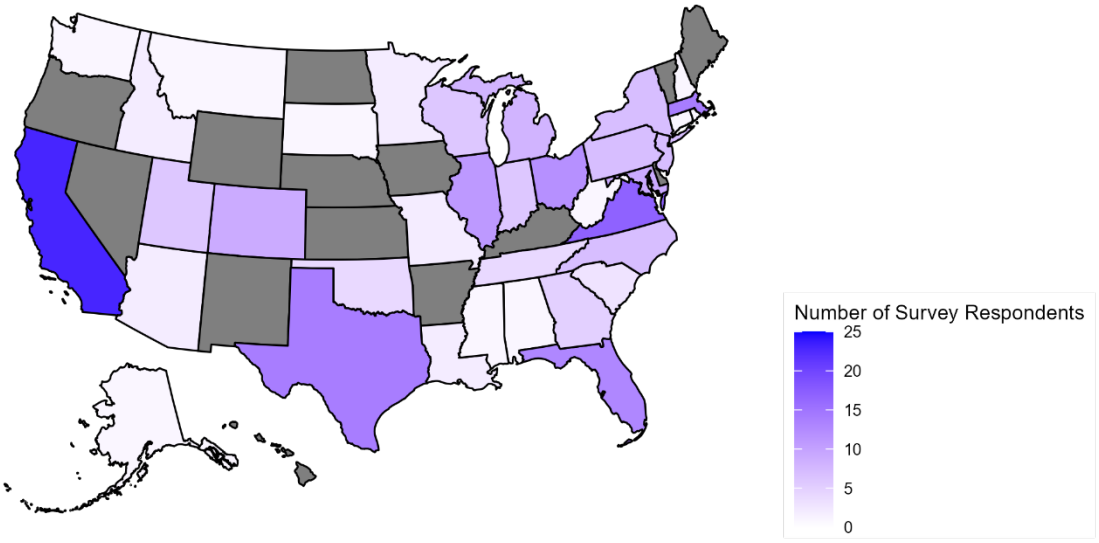

Figure 1. Map of origin states of respondents. The total number of respondents to this question was 215. Note that gray states correspond to states with no respondents.

This map shows that there was at least one respondent from 36 states. Additionally, there was a respondent from D.C. and two respondents who did not reside in the United States at the time of their application. Overall, this shows good coverage of the entire

[18] There were seven respondents who indicated that their parent or guardian had attended some college or received a degree and indicated that they were the first in their family to attend college. However, the overall conclusion that there were a small number of people who were the first in their family to attend college still holds.

country. Additionally, looking at the states with the most responses, they appear to correspond to the states with the largest populations (California, Texas, Florida), states with large DoD lab presence (Virginia, Ohio), or states with a lot of high-quality academic institutions (Massachusetts).

A follow-up question asked respondents to characterize the place they were living as rural, suburban, or urban. A total of 219 respondents answered this question. Overall, 25 (11.4%) of respondents identified as rural, 109 (49.8%) identified as suburban, and 85 (38.8%) identified as urban. The fact that a smaller number identified as rural is not surprising, as it agrees with academic findings that students from rural areas are less likely to pursue STEM postsecondary opportunities (Agger 2021). So, the survey has representation from across the spectrum of locales, and lines up with expectations for STEM postsecondary student locales.

Overall, the demographic variables show that a range of people responded to the survey. There were both male and female respondents, though female respondents were overrepresented compared to the overall population of people who get STEM degrees or certificates. Additionally, there were responses from a variety of racial and ethnic groups, though White respondents were overrepresented compared to STEM degree recipients more broadly. There were a variety of age groups represented as well as people who identify with underrepresented groups and were connected to the military before participating in the WEP. Between the two geographically based questions, the survey respondents seem to indicate a variety of geographic locales across the entire country. Therefore, the survey responses will reflect a variety of different perspectives, though those perspective may not be statistically representative of the broad DoD STEM participant population.

2. Academic Characteristics

DoD WEPs seek out participants from a variety of different academic backgrounds and levels (Belanich, et al. 2022). There were several questions on the survey that were targeted at understanding the academic status of the respondents. First, a question asked respondents to identify the degree that they are currently pursuing. The results are summarized in Table 6.

Table 6. Summary of academic levels that respondents indicated they were pursuing. (*N* = 267)

Degree Level	Currently Pursuing Degree
High School/GED	1.9%
Associate's	0.7%
Bachelor's	22.8%

Degree Level	Currently Pursuing Degree
Master's	14.2%
Doctorate	40.8%
Answered N/A	19.5%

Just five respondents (1.9%) indicated that they were still in high school. A large majority of respondents to the question (210 people or 78.7%) reported pursuing postsecondary degrees. The largest categories were respondents who are currently pursuing doctoral degrees (40.8% or 109 people) or bachelor's degrees (22.8% or 61 people). Additionally, about a fifth of respondents answered N/A. Most of the respondents who answered N/A had already received their doctorate and were currently in postdoctoral WEPs thus are technically not pursuing any degree during the program. This variety makes sense as DoD WEPs can include high school students all the way through postdocs, but programs for undergraduates and graduate students are the most common.

The survey also included information about the current or most recently attended school for each respondent. One question asked students what types of degrees their school awarded, which 272 respondents answered. A vast majority, 215 respondents (79%) responded that their school offered at least bachelor's, master's, and doctoral degrees. Only five respondents (1.8%) went to schools that offer only two-year or shorter than two-year programs. So, the respondents overwhelmingly came from schools that offer traditional undergraduate and graduate degrees, as opposed to two-year associate's degrees.

Two additional questions asked about school characteristics. The first of these questions asked whether the respondent attended a public or private school. Overall, 273 respondents answered this question with 66.3% indicating they attend a public school and 33.0% indicating they attend a private school.[19] In the broad U.S. population, 72.6% of postsecondary students were enrolled in public schools and 27.4% were enrolled in private schools. These data reflect fall enrollment in all U.S. degree-granting postsecondary institutions in 2021 from the IPEDS fall enrollment survey (U.S. Department of Education 2022b). So, about twice as many survey respondents attend a public school as attend a private school, which is fairly similar to the overall enrollment at postsecondary schools.

The second school characteristic question asked whether the school was "a Historically Black College and University (HBCU), a Minority-Serving Institution (MSI), or any other special-mission institution that serves historically-underrepresented communities in higher education." Of the 272 respondents who answered this question, only 7.7% indicated that they attend an HBCU/MSI. The overall population has

[19] An additional two respondents indicated that they did not know whether their school was public or private.

approximately 28% of students enrolled in HBCUs/MSIs, based on American Council on Education (ACE) data reflecting 2015 enrollment (Espinosa, Turk and Taylor 2017). This stark difference could be for a few different reasons It is possible that some students attending MSIs did not know that their school qualified as an MSI, since these designations change from year to year and are based on current enrollment rates. Additionally, the DoD does have WEPs that accept participants exclusively from HBCUs/MSIs, but none of the survey respondents listed one of those programs as the program they had most recently participated in. So, it is possible that the survey request did not reach those programs or, students attending HBCU/MSIs are underrepresented in the DoD STEM participant population.

The final academic category that was covered by the survey was the current or most recent major of the respondent. Respondents were given a large list of possible majors and could pick as many as applied. All but three respondents answered this question, and the results are summarized in Figure 2. The percentages in this figure add up to more than 100% because 68 respondents (25% of those who answered the question) picked multiple majors and are counted in multiple categories.

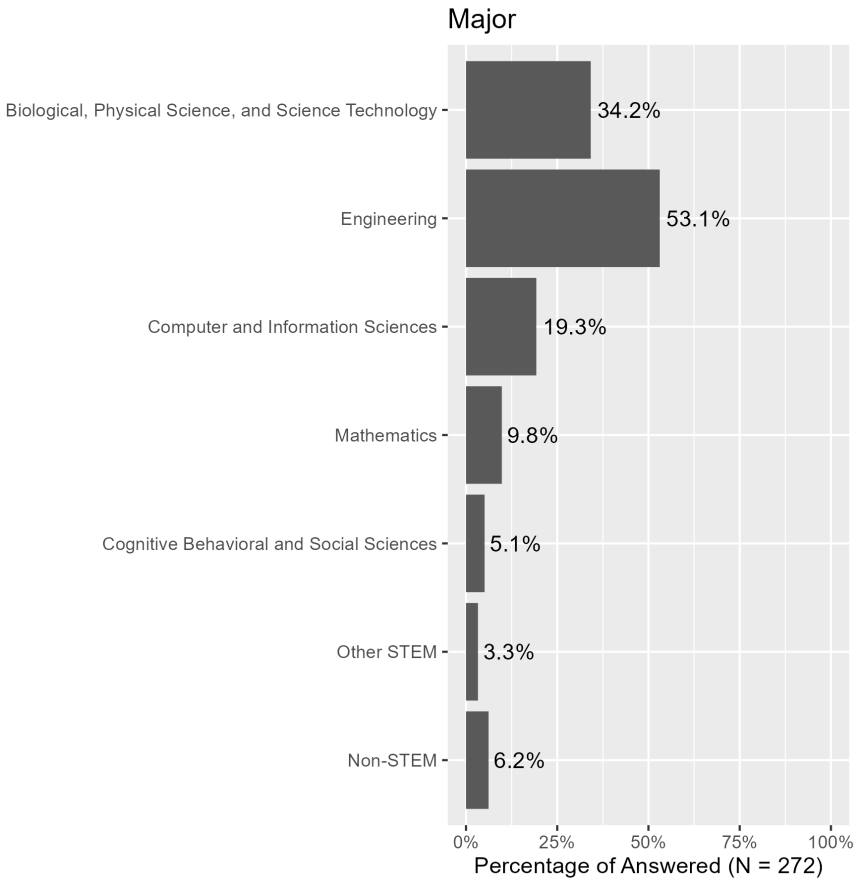

Figure 2. Summary of academic majors of respondents.

From this figure, it is clear that DoD WEPs and the survey are reaching a variety of different STEM majors. However, engineering is by far the largest group, with more than half of respondents selecting that they are engineering majors. The second largest group study biological, physical science, or science technology. This category would include Physics, Biology, and Chemistry, which are all important majors in the DoD STEM ecosystem. The third largest group includes Computer and Information Sciences majors. Other STEM majors are represented in smaller, but still significant numbers.[20] Finally, there were 17 respondents (6.2%) who selected a major that was not specifically STEM related, such as Humanities or Business. Overall, this distribution of majors does not bring any surprises. Engineering, physical science, and computational science are all crucial for the DoD's research mission. Additionally, DoD WEPs reach other majors in smaller numbers, in order to bring in people with a variety of different expertise that are useful in particular situations.

C. Experiences with WEPs

A main goal of the survey was to understand the respondents' experience in DoD WEPs, and a significant number of questions on the survey focused on that. In particular, this portion of the analysis will look at how respondents were recruited to become WEP participants, how they decided to apply for the program, and the logistical and mentorship experiences that respondents had within the WEP. Students often touched on their WEP experiences in the open-ended questions on the survey, and insights from those responses will be included throughout this section.

1. Program Awareness

Several questions on the survey asked about issues related to how the respondents became aware of the program. The first step of this process was simply gaining awareness of the program, and one question asked respondents how they heard or learned about the program. The responses for this question are summarized in Table 7.

Table 7. Summary of how respondents heard about their most recently attended WEP. (*N* = 216)

Type of Communication	Specific Method	Percentage of Respondents
Two-way	Someone I Know	66.2%
	An Event	15.3%

[20] Other STEM majors that were represented in the sample include Agriculture and Natural Resources, Health Care Fields, and Architecture.

Type of Communication	Specific Method	Percentage of Respondents
One-way	E-mail Announcement	24.1%
	Job Post	8.8%
	Social Media	5.6%
	Thought Piece	3.2%
	Traditional Ad	1.4%
	Pay-Per-Click Ad	0.5%

Note: Percentages add up to more than 100% because respondents could select multiple categories.

A majority of respondents (66.2%) heard about the program from someone they knew. This category was by far the most common response, and indicates the importance of word-of-mouth in recruiting people for WEPs. Looking at the responses as a whole, it can be broken down into one-way communication (where the participant just receives information about the program to read) and two-way communication (where the participant can interact with someone and find out more about the program). A total of 165 respondents (76.4% of those who answered the question) identified a method that relied on two-way communication (either someone they know or an event) as a way they heard about the program. This highlights how crucial these types of two-way communication methods are, as they provide more direct access to potential participants.

On the other hand, a total of 84 respondents (38.8% of those who answered the question) identified at least a single one-way communication method (email announcement, job post, social media, thought piece, traditional ad, and pay-per-click ad). This number indicates that a significant number of participants are being reached by these communication methods, and one-way communication can also serve to bring in applicants. Finally, 33 respondents (15.3% of those who answered the question) identified at least a one- and a two-way communication method. People do not hear about programs from just a single mechanism, and it can take several different methods to convince someone to apply to a program. Overall, this information demonstrates that both one- and two-way communication can be important for bringing in participants. In fact, the two different methods can work together as some participants will be reached by one-way, some by two-way, and some by both.[21]

2. Deciding to Apply for the Program

Once students were aware of the program, the next thing they had to do was apply. In order to understand why respondents applied for the program, the survey included a question that asked: "When deciding whether to apply for the program, how much did any

[21] For more on the program manager perspective on one- and two-way communication, see Section 3.B.

of the following concern you?" Respondents had the option to move a slider from 0 (Not at all a concern) to 10 (Very big concern) for each of the options. The results are summarized in Table 8.

Table 8. Summary statistics for different categories of concerns.

Concern	Number of Respondents	Mean (Standard Deviation)
Knowing if Program Would Benefit Long-Term Goals	194	6.8 (3.4)
Being Accepted Into Program	200	5.7 (3.3)
Having Appropriate STEM Skills	176	5.5 (3.1)
Being Able to Afford Costs	163	4.6 (3.9)
Distance to Program	155	4.3 (3.6)
Getting Along with Others in Program	148	3.7 (3.1)
Other Concerns	25	3.6 (4.2)

Note: The scale on the question about concerns went from 0 (Not at all a concern) to 10 (Very big concern)

The first takeaway from these data is that there were a wide range of responses for all of the categories. Each category has a fairly large standard deviation. However, there is still a split between the categories. Three of the concerns had an average response above 5, indicating that respondents generally moved the slider toward "Very big concern." Four of the options had an average response below 5, indicating that respondents generally moved the slider toward "Not at all a concern." An important note is that this survey was sent to WEP participants, so it is possible that there were potential applicants who had different concerns that kept them from applying at all. These people would not be reflected in the survey results.

Looking at the three categories that tended to be bigger concerns, the top concern was knowing if the program would benefit long-term goals. As WEPs are a step toward the workforce, students are coming in with the understanding that these programs should lead to benefits for their career down the line, and based on the survey responses, this is something they are considering when looking at programs. The other two concerns that had averages above 5 were being accepted into the program and having appropriate STEM skills. Both of these reflect concerns from the respondents with being prepared for the program in question. Either they feel they might get rejected, or they worry that once they are in the program they may not have the abilities they need to succeed.

The other options all tended more toward lower levels of concern, but for some respondents they were still very much a concern. Specifically, being able to afford costs associated with the WEP (such as travel and rent) had an average response of 4.6, which indicates that it is a moderate concern. For participants from lower socioeconomic

backgrounds, this will be a bigger concern than for participants from higher socioeconomic backgrounds. In particular, respondents who identified with an underrepresented group[22] had a significantly higher average response to this question (average response of 5.9)[23] compared with people who did not identify with an underrepresented group (average response of 3.8). This indicates that if a program wants to be able to bring in more people who belong to those underrepresented groups, they should focus on minimizing unexpected or uncovered costs or addressing the concerns of applicants regarding these costs.

These results should be compared with responses from the open-ended question asking about the most helpful aspect of the program. A large group of responses had to do with the funding. For most of these respondents, this financial support was referenced as being helpful for them while they were completing their academic studies. Funding from the program allowed them to pursue research that was personally interesting, rather than being forced to focus on whatever their advisor had funding for at the time. External funding also meant that participants did not have to dilute their time with teaching or research commitments in order to receive financial support from the university. Overall, the program benefit of funding meant that respondents had a level of independence in pursuing their research. While being able to afford costs is a moderate concern for participants, they also see the benefit of how the stipend allows them to afford independence from other financial support.

Distance between the program and the home location was also a moderately sized concern with an average response of 4.3. Once again, this is an issue that may impact certain applicants more than others, particularly those that have obligations in their home location. Additionally, it is important to remember that the survey only reflects participants' perspectives, and potential applicants who did not end up participating were not able to take the survey. Not being able to afford moving costs or not being able to move to participate in a WEP would mean that people for whom this is such a big concern that they would not participate would not be in the survey pool.

Finally, two options had fairly low average scores. Getting along with others in the program and an “other” option both had an average below 4.0, indicating that they were typically small concerns. The fact that getting along with others in the program ranks fairly low indicates that the other topics are likely more pressing for people as they are applying to WEPs. Their long-term goals, whether the WEP is a good academic fit, and whether

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[22] The specific underrepresented groups included here are people who say English is not their native language, have a disability, are the first person in their family to go to college, qualified for free or reduced lunch in high school, or qualified for federal aid in college.

[23] To test statistical significance, the average value for participants who identified with a socioeconomically underrepresented group was compared with the average value for participants who did not identify with a socioeconomically underrepresented group using a two-tailed t-test. The resulting *p*-value was 0.001.

they can handle the financial and geographic logistics of participation were simply more pressing to these respondents than social considerations.

Respondents were able to list other concerns they had, and most of these write-ins reinforced rankings of the other categories. For example, people listed concern with the stipend, concern with whether the program would lead to a desired full-time career, and worry about having enough prior experience. One person mentioned concern over their ability to get a security clearance. Overall, the responses about other concerns primarily served to support the other listed concerns.

Applicants concerns can be addressed by programs through various benefits or accommodations. Survey participants were asked a question about what benefits or accommodations were important for them to be able to take part in the programs. People had the chance to write in up to five different benefits/accommodations for this question. A total of 161 respondents took the opportunity to write in at least one accommodation. Another 21 people specifically wrote that they needed no accommodations.

An important category of accommodations was financial compensation and benefits. Specifically, the number one benefit/accommodation topic by far was stipend/salary (listed by 135 people, or 74.2% of respondents). While in Table 8 “Being Able to Afford Costs” was not the top concern when considering whether to apply for a program, it is clear from the data on accommodations that receiving some form of financial support is imperative for participating in a program. The paradigm of an “unpaid internship” does not seem reconcilable with the needs of respondents, especially considering the heavy demands of time spent on project work and relocation costs that may be required of participants.

The primacy of financial concerns is made even clearer by the other top categories mentioned by respondents: tuition coverage or student loan repayments were brought up by 34.1% of respondents (62 people), housing stipends or relocation payments were mentioned by 29.1% of respondents (53 people), and healthcare was mentioned by 17.0% of respondents (31 people). When considered with the other 11.0% of responses for this question (20 people) that talk about miscellaneous financial-related aspects of the program (such as book allowance, built-in wage increases, hiring or sign-on bonuses, retirement funding, or child-care subsidization), it can be seen that a staggering 95% of respondents that answered this question included some financial-related topic in their response. Money is an important factor for DoD WEPs bringing in the best participants.

Another group of accommodations focused on WEP activities and arrangement. Nineteen respondents (10.4%) saw flexible work arrangements as something that allowed them to participate in the program. About one quarter of respondents (46 people) mentioned that having a budget to be able to travel for work or conferences was a useful benefit. So, the activities and arrangements occurring during the WEP can have an impact on whether or not some applicants will even consider attending the WEP.

Finally, some respondents were focused on the anticipated impacts of the WEP when thinking about accommodations and benefits that allowed them to participate. Quite a few people (35.7% of respondents or 65 people) mentioned the future opportunities which are granted to participants as a result of their time in the program. Most of these responses talked about either the guarantee or the high likelihood of job placement after the program is finished, while a few others talked about the strong possibility of being brought back for multiple periods of participation (summers). Clearly, having some security in their knowledge of "next steps" is important for participants as they consider taking part in a program. This aligns with the results in Table 8, which indicated that applicants are concerned with whether or not programs are aligned with their long-term goals. Just under a fifth of people mentioned that professional development considerations (such as being able to network or learn about professional opportunities) was a benefit they were looking for. Applicants are thinking about what the WEP can do for them, and how they can come out of the program more prepared for whatever comes next.

The survey revealed several insights into WEP recruiting. First, both one- and two-way communication were important for bringing in applicants. Next, when considering different programs, respondents were particularly concerned with how well the program would align with their long-term goals, how well they would be a match academically, and whether they could manage the financial and geographic logistics. To help with these concerns, programs can provide accommodations. Financial accommodations were by far the most valued by respondents, but other benefits also helped, particularly professional development that could lead participants to concrete next career steps.

3. Work Setting

Survey respondents had a variety of logistical experiences with their most recent WEPs. One question asked where the program was located compared to where the respondent was living when they applied. Of the 218 people who answered this question, 37.6% (81 respondents) replied that the WEP location was in the same city or a nearby city that they could easily commute to. The other 62.4% (136 respondents) attended a WEP that was farther away from their home address. A separate question asking about work arrangements had 220 respondents answer. Of those, 63.6% (140 respondents) worked on-site only, 18.2% (40 respondents) worked fully remotely, and 18.2% (40 respondents) worked in a hybrid arrangement. It is interesting to compare the responses to these two questions, which are summarized in Table 9.

Table 9. Summary of responses about distance from lab site to home address and work arrangement. (*N* = 216)

Distance from Site to Home Address	Only On-site Work	Hybrid Work	Only Remote Work	Total
Same or Nearby City	65.4% (53)	23.5% (19)	11.1% (9)	*81*
Further away	64.4% (87)	14.8% (20)	20.7% (28)	*135*

From this table, it is clear that most respondents worked on-site, whether or not their home address was close to the site where their WEP was based. However, for respondents who had at least some remote work, there is a difference. Respondents who were part of a WEP that was based in the same city or a nearby city were more likely to have a hybrid work arrangement, while respondents who participated in a WEP based farther away from their home were more likely to have a fully remote work arrangement. Of course, it is much easier for someone who already lives in the correct city to come in some days for a WEP, so this result makes sense.

Remote work also came up in the open-ended questions on the survey, where respondents were given the opportunity to comment on the program. As reported in Section 6.C.2, 20 respondents listed that flexible work was an important accommodation to allow them to participate in the WEP. Several respondents also mentioned that they had requirements to be on-site that were unnecessarily burdensome. They saw this work arrangement as the "least helpful" aspect of the program. However, a couple of respondents commented that virtual or hybrid work arrangements were the "least helpful" aspects of the program. For these respondents, they indicated having fewer networking opportunities given the absence of face-to-face interactions. One respondent commented that this was especially problematic for new employees and interns. Overall, the variety of responses relating to remote work arrangements mean that there is no "one-size-fits-all" work arrangement. Each WEP participant must be matched to the correct work arrangement based on the work they are doing, their professional goals, and their personal situation.

4. Mentorship

A key aspect of many WEP experiences is developing a relationship with one or more mentors. The survey addressed this aspect directly with two questions asking about the number of mentors each respondent had and how often they interacted with their main mentor. In the first question about mentorship, respondents were asked how many formal and/or informal mentors they worked with during the program. The responses of the 221 people who answered the question are found in Figure 3.

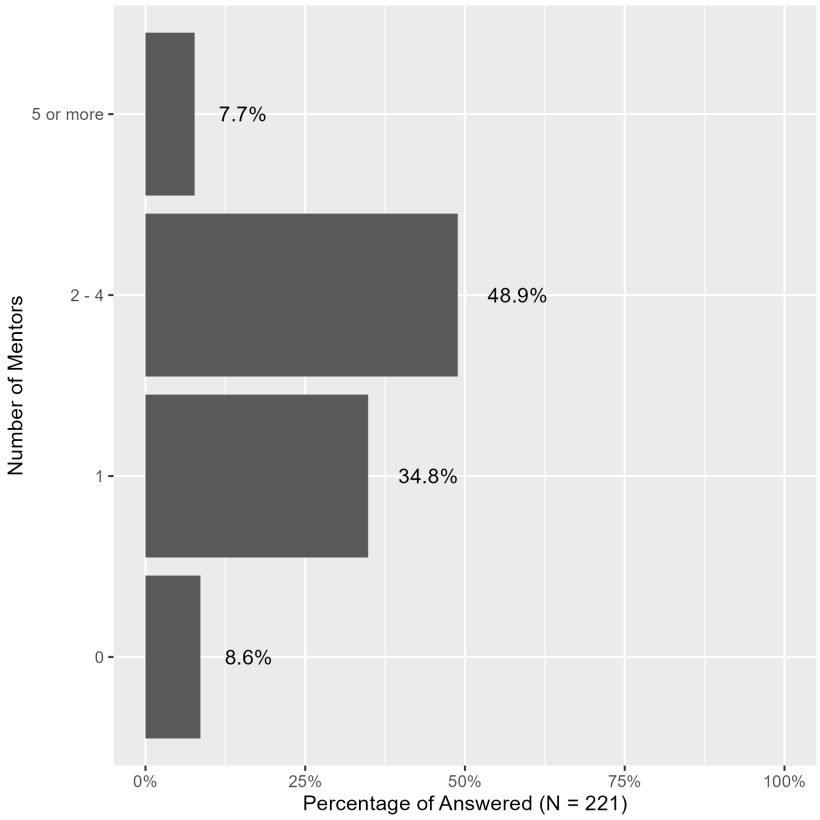


Figure 3. Number of formal and/or informal mentors for the survey respondents.

A small number of respondents (19, or 8.6% of those who answered the question) reported having no mentors. Not all programs involve a guaranteed mentorship component, and these respondents reflect only a small percentage of the programs they represent. About one-third of the respondents who answered this question (34.8%, 77 respondents) had exactly one mentor. Another 48.9% (108 respondents) reported having between 2 and 4 mentors. As expected, these categories reflect what is often considered the typical WEP experience: working in a lab with a particular mentor or a handful of mentors that are there to help guide progress on the work. A few respondents (17, or 7.7% of those who answered the question) reported having 5 or more mentors. Overall, the data reflects while most respondents did have at least one mentor, with a few respondents feeling that they had quite a few people who could fill the mentorship role during the program, there were some students who felt they had no mentors.

The other aspect of mentorship that can impact the WEP experience is the frequency of meeting between a mentor and their mentee. Figure 4 summarizes the responses to a question asking how frequently they met with their closest mentor, either virtually or in person. The responses have been filtered to exclude respondents who said they had zero mentors.

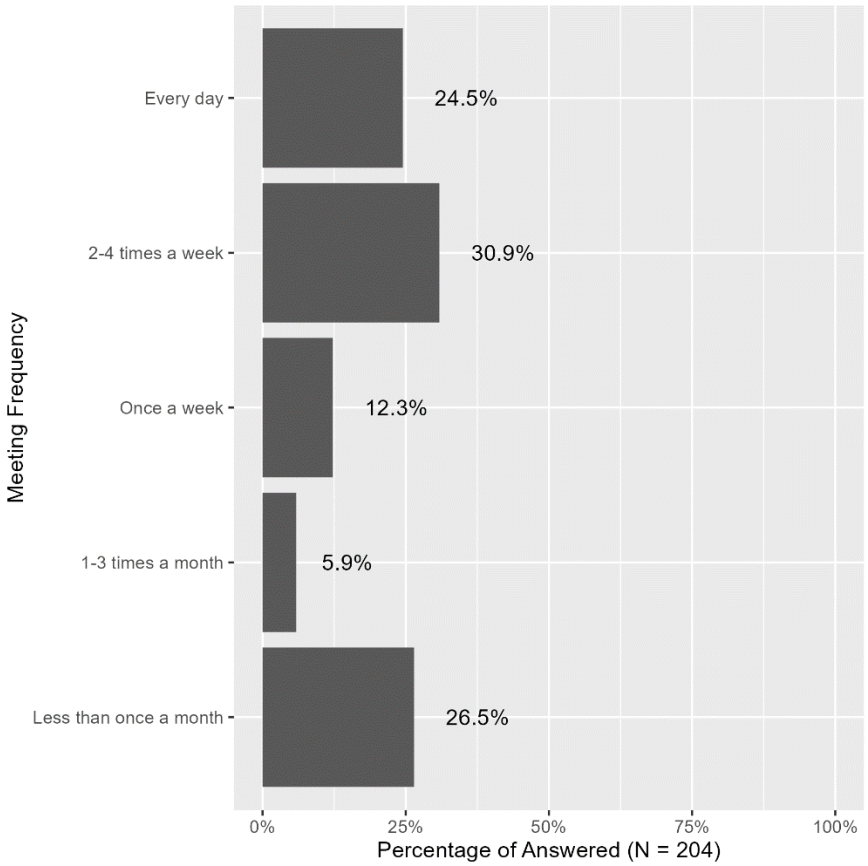


Figure 4. Summary of responses about frequency of meeting with mentor.

A majority of respondents (113 people, or 55.4% of people who answered the question) met with their mentor more than once per week. This finding is reassuring, as frequent meetings can be helpful for the mentor to guide the work and help the participant grow. On the other hand, just over a quarter of respondents (26.5%, corresponding to 54 people) said they met with their mentor less than once a month. These participants may get less out of their programs as they have less direct contact with a STEM mentor.

The responses to the open-ended questions gave more insights on mentorship. Based on these responses, mentorship (or lack thereof) drastically impacted respondents' experiences in their program. A total of 25 respondents (18.2%) mentioned mentorship in their descriptions of the "least helpful" aspects of the program. Their responses tended to focus on the dearth of mentor presence/engagement (with some respondents saying they've never gotten to interact with their assigned mentor at all), or the general poor fit between mentor and mentee. For those describing a poor fit, additional commentary usually went on to talk about the lack of overlap between the mentor's own research or background and the mentee's interests. While these responses do not provide significant detail, they do indicate that some DoD WEPs could focus more on making sure that their mentors are correctly prepared and equipped to provide the best experience for participants.

Taken together, the survey questions relating to WEP experience give a few areas of focus. In terms of logistics, it is important that WEPs match the work arrangement to the needs of the work and the participants. For mentorship, the open-ended responses and the number of respondents who indicate they met only rarely with their mentors show room for improvement with mentorship across the WEPs represented in the survey.

D. Reported WEP Impacts

DoD WEPs represent a variety of different goals, but they universally are attempting to have a lasting impact on their participants. There are several different areas in which WEPs can have an impact. This section will analyze how the WEPs impacted the participants abilities and interest. In general, survey respondents saw growth in their professional and STEM skills. Additionally, the WEP impacted participants' professional networks, though the amount varied widely.

1. Change in Ability or Interest

One question in the survey asked respondents to use numerical sliders to indicate how the most recent program they attended impacted them on a variety of STEM-relevant categories. The numerical results are summarized in Table 10. Participants were able to rank each category on a scale from -10 (Big Decrease) to +10 (Big Increase). An answer of 0 meant that the WEP in question caused no change in that category.

Table 10. Summary statistics for WEPs impact.

Category	Number of Respondents	Mean (Standard Deviation)
Ability to Work in Professional Environment	218	4.4 (3.8)
Ability to Use STEM Skills	217	3.6 (4.2)
Ability to Collaborate with Other Majors	216	3.5 (3.9)
Understanding How to Get STEM Job	217	2.9 (3.8)
Interest in STEM Job	217	1.8 (3.6)
Understanding How to Succeed in STEM Classes	217	1.6 (3.5)
Interest in Taking STEM Classes	217	1.6 (3.3)

Note: The scale for the question about WEP impact went from -10 (Big Decrease) to +10 (Big Increase).

The categories are sorted from highest mean to lowest, so respondents felt like the WEP they attended caused the biggest increase in their skills or abilities for the categories at the top of the table. All of the categories had means that were above 0, meaning that, on average, respondents thought that WEPs caused increases in their skills or abilities in all of the categories. However, three categories had medians of 0, indicating that fewer than half of students thought those categories caused increases in their skills or abilities. These

categories were increasing interest in STEM jobs, understanding how to succeed in STEM classes, and interest in taking STEM classes. As the WEPs typically are not class based, it makes sense that participants may not feel that they gain a lot with regards to coursework. However, it is interesting that gaining interest in STEM jobs is also toward the bottom of the rankings. Based on the responses about ideal future jobs, it is possible that the respondents to the survey were already interested in STEM jobs, and so the WEPs did not have a large impact to increase this interest.

On the other side, WEPs are having a positive influence in preparing students to join the WEP workforce in the future. The category where WEPs produced the largest increase was ability to work in a professional environment. For a lot of WEP participants, the program is their first exposure to a true work environment, so it makes sense that they would gain comfort in that space. This result is supported by responses to the question asking about the most helpful aspects of the program. Professional development was the largest category of responses, and for respondents that described growth in their professional development and capabilities, a significant number mentioned improvements in the non-technical skills needed to perform successfully in a workplace environment. Responses of this nature included working with stakeholders, time management, communication, and collaboration, especially if it related to working with professionals from a different field. It is clear that these WEPs are providing relevant experience to many participants that helps prepare them for professional workplaces.

The responses in Table 10 also show that WEPs were having a positive impact on participants' abilities to use STEM skills. This finding was supported by the open-ended questions, where gains in STEM skills and knowledge was cited by many respondents as the area where they gained the most from the program. Comments here described field-specific knowledge, such as signal processing, coding skills such as with Linux and Python, or more general references to an improved ability to perform research. A subset of responses brought up the real-world or hands-on nature of their work, meaning that their experience in the WEP offered a more tangible opportunity to see the applications of their field of study, an opportunity not often afforded in the classroom. So, the WEPs are having an impact by providing real-world experience to the participants, which improves their ability to use STEM skills. Finally, Table 10 indicates some respondents reported that they gained an understanding of how to get a STEM job. While the responses were more mixed for this category, it is an encouraging sign that some WEPs are helping participants understand what it actually takes to move into the STEM workforce.

2. Building Professional Network

An important aspect of moving into the STEM workforce is networking. To understand how WEPs impacted the professional networks of the respondents, the survey asked them to think about STEM professionals that they would "feel comfortable

contacting for help learning about STEM-oriented degrees or jobs, including how to get them." In other words, the survey asked respondents to focus on STEM professionals who could have an impact on their future career path in STEM. The question asked both how many STEM professionals they currently know, and how many of those are new contacts made through their most recent WEP. The results from this question are summarized in Table 11.

Table 11. Number of STEM professional contacts reported by respondents.

Number range	STEM Professionals they currently know (*N* = 170)	New contacts made through the program (*N* = 172)
0	1.8%	10.5%
1–4	20.6%	48.3%
5–10	31.8%	32.0%
11–25	22.9%	6.4%
More than 25	22.9%	2.9%

These data show that people report STEM networks of very different sizes. While only three people (1.8% of those who responded) reported having no STEM professionals that they could turn to, the remaining 98.2% of respondents had at least one person they considered a contact. Among those, there was a wide range, with some respondents saying that they had only 1 or a small handful of STEM professionals that they know, while other reported knowing more than 25 STEM professionals. Interestingly, while there was a lot of variation in the total size of respondents' STEM networks, there was less variation in the number of new contacts they made through the program. A total of 138 people (80.2% of people who responded to the question) reported making between 1 and 10 contacts. The remaining respondents were about evenly split between people who made no new contacts (18 people or 10.5%) and people who made more than 10 contacts (16 people or 9.3%). For people who responded to both parts of this question, on average they reported that 34% of their total number of contacts were new contacts from their WEP.[24] The data did not show any drastic differences in the changes of network sizes between demographic or gender groups, but more systematic sampling and additional analysis would be helpful to test whether different groups of participants get different network gains out of DoD WEPs. The key takeaway here is that a large majority of respondents gained a modest number of contacts in DoD WEPs, and only a few either drastically expanded their network or did not

[24] This number is based on people who knew at least one STEM professional contact and did not report that they made more new contacts than they had total contacts. For example, if someone said they made 20 new contacts, but had only 5 total contacts, then their data were removed from the calculation because it did not make sense.

make any new contacts. So, DoD WEPs are contributing to most participants' networks, but to varying degrees.

Corroboration for the frequency of networking gains can also be found in responses to the question asking about the most helpful aspect of the program. Networking was the third most frequently mentioned topic. Respondents in these cases talked about making connections with leading researchers or potential future employers, meeting like-minded individuals, forming lasting relationships with mentors, and building professional networks within the DoD and government. Some of these networking connections were considered a "foot in the door" for jobs, while others were referenced as collaboration partners. Despite the variety of ways that networking manifested, and the variety of outcomes that networking could result in, identifying and strengthening personal connections was a benefit from program participation that resonated with respondents.

E. Post-WEP Plans

WEPs are often an important step on the career path of a young researcher. By exposing participants to the realities of research, these programs can play an important role in determining the future plans of their participants. As seen in Section 6.C.2., whether or not the WEP aligned with future plans was the most important concern when thinking about whether or not to apply to a program. Also, several questions on the survey attempted to understand the career paths of participants and how the WEPs impacted those paths.

The value of the WEP experience for informing future plans is, in part, revealed by a look at responses for the question asking about the "most helpful aspect of the program." The second most frequent category of responses was Career Insight, or in other words, benefits related to better understanding of what working in a particular job, field, or environment is like, and whether it fits with participants' needs and desires. Respondents talked about this career insight in a few different ways.

When they provided contextual details, this insight was most commonly oriented towards learning about careers in government. Respondents mentioned learning about the structure and logistics of the government and its research agencies, what opportunities are provided by a career in civil service, and how it might help them in their career goals. Responses described learning about the DoD slightly less often than the government more broadly, and here respondents realized what goes on in the DoD, how the DoD facilities fit into the larger organization, and what career paths look like for DoD scientists/researchers. Finally, career insight could be related to STEM or research broadly, in which respondents described learning what the expectations are like for a job in STEM, what the real-world applications are for their STEM fields, and whether STEM is right for them.

Of course, not every program participant was going straight from the program into a long-term job. One survey question asked respondents what they did after their most recent

WEP, and the results from the 199 people who responded are shown in Figure 5. Respondents could select more than one response (for example, if they were returning to school but also working), so the percentages add up to more than 100%.

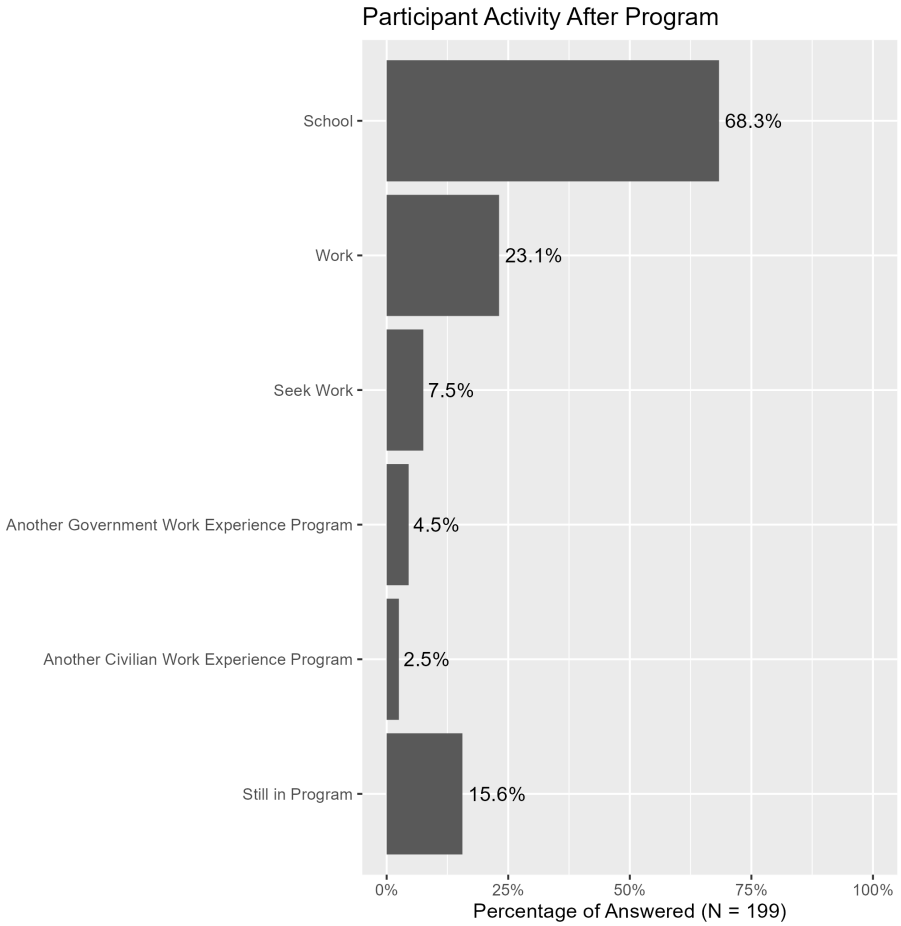


Figure 5. Summary of responses about what participants did after their most recent WEP.

A large majority of the respondents (68.3% or 136 people) were returning to school. Only 30.6% (61 people) were either going directly into a job or were seeking work. Additionally, 7.0% (14 people) were going into another work experience program. Finally, 15.6% (31 people) reported that they were still in the program in question, so could not answer what their next stop would be. The main takeaway from these data is that WEPs do not always feed directly into the workforce. This is aligned with the data from Table 6 that show that many of the WEP participants are planning to continue their education and attain a higher-level degree. A large portion of their participants may be returning to school and not immediately finding jobs. So, the entire career pathway of participants needs to be considered as opposed to just the next step.

A large majority of survey respondents expressed interest in continuing in STEM. When asked whether their future education plans focus on STEM, 273 people responded to the question. Of those, only two people (0.7%) answered that their future education plans do not involve STEM. The other 99.3% either did plan to have STEM involved in their future education plans (77.3%, or 211 people) or did not have future education plans (of people who responded to the question (22.0%, or 60 people). All of the respondents who did not have future education plans were either currently in a master's or doctoral program or were currently not in an educational program. The responses show that very few respondents are specifically planning to pursue further education in something that is not STEM.

The respondents also provided information about the highest degree that they planned to get. These results are summarized in Table 12. More than half of respondents indicated that they planned on eventually pursuing a doctoral degree. Additionally, 30 respondents indicated that they already had their doctorate and either answered N/A or did not select a response for their highest planned degree. Putting these together, more than 60% of the respondents either already have a doctoral degree or are planning to get one. This makes sense given that WEPs try to target individuals who will continue to participate in research, which often requires a PhD. The second largest category in highest planned degrees is master's, which is also useful in order to become part of the STEM research workforce. Overall, the planned degree responses indicate that the respondents are reflective of DoD STEM WEPs' target audience: students who eventually want to pursue degrees to help them participate in STEM research.

Table 12. Summary of highest planned degree. (*N* = 262)

Degree Level	Highest Planned Degree
Bachelor's	4.2%
Master's	28.6%
Doctorate	53.1%
Answered N/A	14.1%

It is interesting to look at how the respondents' highest planned degrees compare with what their parent or guardian's highest earned degrees are. The results comparing the two are summarized in Figure 6.

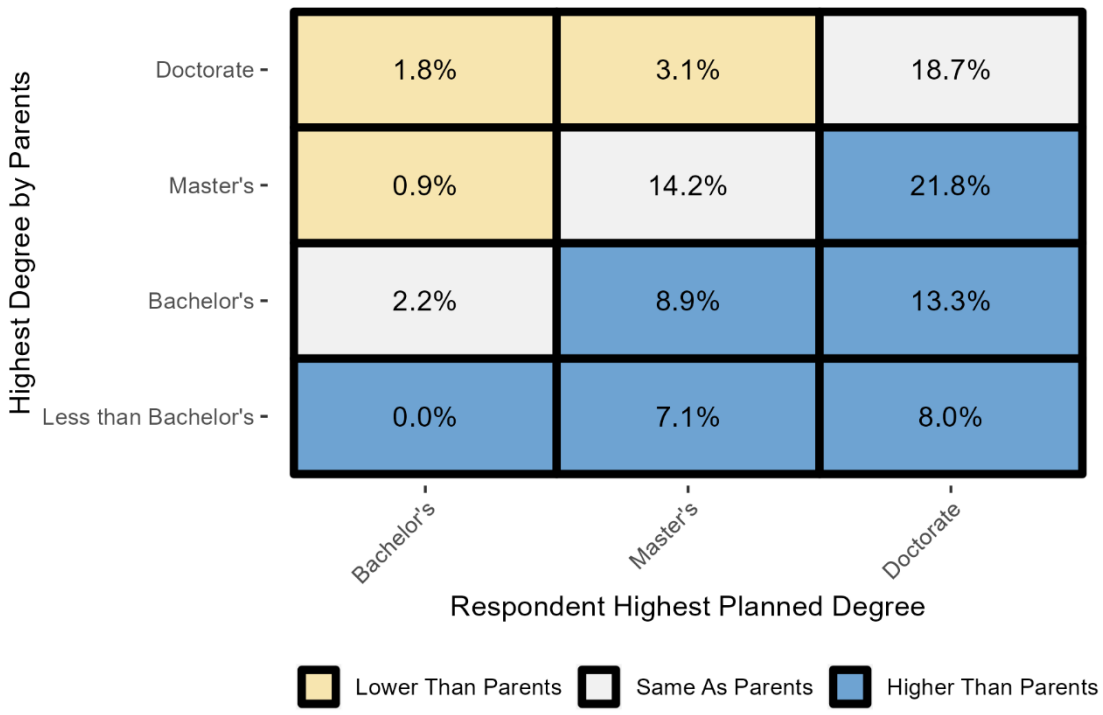


Figure 6. Summary of highest degree obtained by parents/guardians and the highest degree planned by respondents (*N* = 225)

There were 225 respondents who answered both questions. Of these, only 5.8% (13 respondents) were planning on pursuing a degree lower than what their parents/guardians accomplished. Another 35.1% (79 respondents) were planning on pursuing the same degree as the highest degree their parents/guardians received. This means more than half, 59.1% (133 respondents), were planning to achieve a higher degree than their parents/guardians. This result is expected, as each generation tends to pursue at least the same level of degree as the generation before them (Choy 2001).

1. Personal Fit with STEM

The survey also worked to understand whether the respondents identify with and feel included in STEM communities. Respondents were asked how strongly they agree with each of three statements regarding their link to STEM: (1) connect with people in STEM on a personal level, (2) connect with people in STEM on a professional level, and (3) future perspective of STEM being the right fit. Respondents could slide a numerical slider from -10 (Strongly Disagree) to +10 (Strongly Agree), with 0 reflecting Neutral. The results from this question are summarized in Table 13.

Table 13. Summary statistics for connections to STEM.

Statement	Number of Respondents	Mean (Standard Deviation)
STEM is Right Fit for Me	204	7.1 (3.7)
I Connect with People in STEM on Professional Level	205	6.8 (3.6)
I Connect with People in STEM on Personal Level	203	4.8 (4.2)

Note: The scale on the question about connections to STEM went from -10 (Strongly disagree) to +10 (Strongly agree)

The results in the table are sorted by the mean response, so the statement that respondents agreed with the strongest on average is on top and the statement they agreed with the least is on the bottom. Overall, all the statements had positive averages in that 0 would be a neutral response, meaning that for the most part respondents agreed with these statements. However, at least a few respondents disagreed with each statement. The statement that had the strongest agreement was that STEM is the right fit. Additionally, most people indicated that they agreed fairly strongly with the statement that they connect on a professional level with people in STEM. This is an indication that respondents in general can see themselves in professional STEM roles. The statement with the weakest agreement is that they connect with people in STEM on a personal level, though there is no particular indication from the open-ended responses why this might be the case. Ultimately, the survey respondents mostly connect with STEM and STEM professionals, but a few of them do not feel that connection, which could impact their interest or ability to continue into a STEM career.

2. Desired Job Characteristics

The interest in STEM careers is also driven home by respondents' answers to a question asking them to list their desired job title. While the answers included a lot of variety, two themes that emerged are that most of the respondents were interested in doing some type of research or becoming an engineer. While there were some other jobs listed (such as involvement in business or agriculture), almost all the responses were related to STEM. The results relating to future plans are encouraging, as DoD WEPs almost universally strive to keep participants in the STEM ecosystem.

Two questions asked respondents about their goal job. To understand better what respondents were looking for in a goal job, a numerical slider question asked them to rate how important each of several characteristics would be in deciding what company to join for their goal job. Then, a follow-up question asked them to rate whether they thought the commercial sector or the government sector was stronger on each of the goal job

characteristics. The responses to these questions are summarized in Figure 7. The Importance column gives the mean and standard deviation of responses to how important each of the characteristics would be in deciding what company to join for their goal job with 0 corresponding to "Not at All Important" and 10 corresponding to "Very Important." The characteristics are sorted by the Importance column, with the most important characteristics at the top. The More Competitive Sector column captures responses to the question of which sector was stronger. A response of -10 meant the commercial sector was stronger, 0 meant the two sectors were equally competitive, and +10 meant the government sector was stronger. The position of the dot indicates the mean response while the error bars give the 95% confidence interval. The color of the dots is also shaded to reflect the mean, with more blue indicating a strength of the commercial sector and more yellow a strength of the government sector.

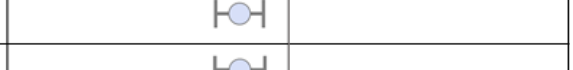
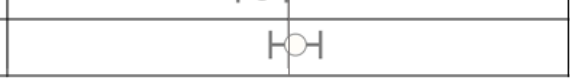
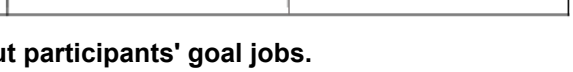
Characteristic	Importance	More Competitive Sector
	Mean (Standard Deviation)	-10 Commercial Sector Stronger / 0 Two Sectors Equally Competitive / +10 Government Sector Stronger
Benefits	7.8 (1.9)	
Salary	7.8 (2.1)	
Job Security	7.5 (2.1)	
Job Location	7.5 (2.1)	
Opportunities for Advancement	7.3 (2.1)	
Intellectual Challenge	7.3 (2.3)	
Contribution to Society	7.0 (2.6)	
Ability to Use STEM Skills	6.9 (2.7)	
Flexible Work Arrangements	6.4 (2.8)	
Degree of Independence	6.4 (2.4)	
Level of Responsibility	5.8 (2.3)	

Figure 7. Responses about participants' goal jobs.

This figure allows for an analysis of which factors are important to students when thinking about their goal job and which sector they think is more competitive for that factor. The Importance column captures the mean response to the question about how important each characteristic was when considering which job to take, with larger numbers corresponding to more important. The characteristics toward the top of the table were, on average, seen as more important than those toward the bottom of the table. The More

Competitive Sector column visually captures the average responses to the question about which sector was stronger. Points farther to the left indicate the commercial sector was seen as stronger while points farther to the right indicate that the governmental sector was seen as stronger. Points near the middle line indicate that the sectors were seen as fairly comparable.

One takeaway is that benefits and salary were seen as the two most important factors. Respondents also had strong opinions about which sector was stronger for each of these. In particular, the government was seen to provide better benefits while the commercial sector was perceived to provide better salaries. Job security and location were seen as almost as important as the top two characteristics. For job security, respondents saw the government sector as much stronger. For job location, the commercial sector was seen as somewhat stronger. So, for the top four most important characteristics, the government was seen as stronger in two of them, and the commercial sector was seen as stronger for the other two. Overall, these results indicate that emphasizing the strong points of government jobs (benefits and job security) could help overcome hesitation in moving into the government sector caused by characteristics where the commercial sector is seen as stronger (salary and job location).

Other characteristics were seen as less important by respondents, though still fairly important as no characteristic averaged less than a 5.8 on the 10-point scale. These results make sense for early-career WEP participants. They are thinking about their long-term stability (salary, benefits, job security) and personal requirement (job location). The amount that they are worried about their control over the work (degree of independence and level of responsibility) is not front of mind. Additionally, they see the government and commercial sectors as more evenly matched for the characteristics that are ranked as less important.[25] This result may be because these characteristics are simply not something that these respondents are thinking about. With their top concerns, they have preconceived notions about which sector is stronger, but for other concerns they may not have looked into the details at the same level. Highlighting the most important job considerations and understanding where the government is seen as competitive may be beneficial to recruiting for jobs within the government.

F. Participants' Suggestions for Improvement

In addition to asking about their experiences, the survey gave respondents the opportunity to provide any ideas they had that would improve the program. A total of 123 respondents took the opportunity to give feedback. The most frequently provided answer (15% of respondents who entered a response, or 19 people) was that the respondent had no suggestions for improving the program. This can be taken as evidence of a positive program

[25] One notable exception is that the government is seen as stronger for contribution to society.

experience. Yet many other respondents did have suggestions to help the program. Certain suggestions may apply more to certain programs, but WEPs across the DoD can benefit from seeing the different types of concerns these participants raised.

A total of 17 people (13.8% of people who responded to the question) suggested improvements to how information is communicated from program representatives to participants. While this is a broad category, there is an important and consistent theme of respondents not feeling like they received sufficient or timely information about topics such as stipends, benefits, task work, program paperwork and reporting requirements, setting up network and facility access, completing tax forms relevant to program funding, expectations for and evaluations of participants during their tenure, and job opportunities after participation. The significance of this category is bolstered when taking into account responses from the question about "least helpful" aspects of the program, where quite a few respondents mentioned bureaucracy (amount of paperwork, reporting requirements, and waiting for requests to be processed) and communication. Oftentimes, the types of communication being focused on here are not related to the actual work, and shortcomings in communication are seen as barriers to accomplishing the actual research goals. As with any job, it is important for DoD WEPs to clearly communicate bureaucratic requirements and help participants prepare for their work.

Respondents also stated that mentoring was an area for improvement when asked how the program could be improved. Most of the 14 people who mentioned mentoring focused on better matching of mentors with mentees, empowering mentors to be better in their role, and bringing in more structure to the mentor relationship. In general, these suggestions align with the findings in the previous section that mentorship experiences are not positive for all WEP participants and have room for improvement.

Fourteen respondents gave suggestions regarding project work. The top suggestion for project work focused on granting respondents more choice/agency in picking their project work, or if this was not possible, at least ensuring that program work was related to their field of research. Other suggestions included being more transparent about the type of work that participants would be doing, offering some sort of rotational assignment paradigm to expand the breadth of work that respondents are exposed to, building in more collaboration for project work, or simply making certain there is work available for participants to complete when they show up to participate. These suggestions line up with comments from respondents who felt that the least helpful aspect of the program was that they were not given work related to their field of study, or were given work that is not technical in nature. Overall, these comments indicate that WEPs could examine how they match people to work and make sure that they are doing what is best for the research and the participant.

A group of nine respondents suggested increasing the stipend or salary of program participants. A few of these comments mentioned making pay more comparable or

competitive with private industry. In general, stipend/salary was an important benefit (see section 6.C.2), and offering stipends and salaries is vital for people to be able to participate in the program at all. Some participants are having a harder time than others living on these budgets, considering the very real differences in cost of living across areas, the variety in distances that respondents need to commute, and participant socio-economic status.

Other categories of suggestions were mentioned by fewer respondents. A handful of respondents wanted more organized events or stronger focus on networking. Some respondents suggested increasing professional development opportunities more generally. A small number of respondents specifically mentioned how the program handles taxes as an important place for improvement. Finally, smaller numbers of respondents were interested in different work arrangements, additional benefits, or more travel as part of the program. All of these reflect important considerations that could be looked into on a program-by-program basis.

The suggestions provided by the respondents could prove helpful to a variety of DoD WEPs. In particular, making sure that communication is clear and relevant would be an important improvement. Additionally, it would be good to work to ensure that both mentors and project work are appropriately matched with participants. Finally, monetary concerns continue to be an important consideration, and making sure that stipends are competitive is crucial in bringing in the best participants.

G. Summary

The participants survey responses provided key insights into how WEP participants felt about their most recent program. The survey reached a broad sample of different participants in terms of demographic and academic characteristics, though sampling constraints meant that the sample may not be fully representative of DoD WEPs. Survey respondents reported impacts from WEPs, including growth in their ability to work in a professional environment and in their STEM skills. However, some participants pointed out some challenges with adequate mentorship and a lack of clear communication about bureaucratic issues. When thinking about their future jobs, respondents felt that government jobs are stronger than commercial sector jobs for benefits and job security, but that commercial sector jobs bring better salaries than government sector jobs.

7. Comparison of Program Representative and Participant Perspectives

IDA conducted a mixed-methods analysis on WEPs that included the perspective from the program representatives gathered through interviews (which provided in-depth information from 35 interviewees) and the participants through a survey (which provided information from hundreds of respondents). Even though the methods were not the same, both groups touched on some of the same topics, therefore their perspectives can be compared.

This section will focus on the insights that can be gained by comparing both perspectives on recruiting, the experience and benefits of the WEP, and opportunities after the WEP. Because the methods differed, the questions asked and the options for responding for each group did not exactly mirror each other, so the insights gained from each will be by topic. Additionally, due to sampling limitations with the survey imposed by OMB we were unable to control who responded to the survey and which programs may be over or underrepresented in the sample as compared to the purposive interview sample of programs. Therefore, some differences in perspectives may simply reflect the fact that there were different levels of representation of programs in each dataset. Some of the key comparisons between the two perspectives explored in detail in this chapter are listed below:

- To bring in applicants, one- and two-way communication methods were seen as important for both groups, though more survey respondents found WEPs through two-way communication methods.
- Both survey respondents and WEP representatives touched on a range of concerns that might bring participants into WEPs, including financial considerations and long-term goals.
- The growth of participants' STEM skills and abilities to work in a professional environment were a goal of WEP representatives and were realized by WEP participants.
- WEP representatives and participants agreed that mentorship was an important aspect of WEPs, but participants were more likely to reflect on negative mentorship experiences.
- Both groups had similar understandings of the strengths and weaknesses of government sector jobs compared to commercial sector jobs.

A. Recruiting

The interview and survey both had sections focused on recruiting participants into the program. The program representatives were focused on who they wanted in the program and the methods they could use to recruit them. On the other hand, participant survey respondents reported how they were recruited for the program. Both groups provided feedback about potential challenges that might keep people from participating in the program and the types of accommodations or mitigations available to overcome those challenges.

In the interviews, program representatives indicated that they were looking for a wide range of candidates. Across programs, the participants recruited varied across academic, demographic, and geographic characteristics; though any particular program might be looking for a specific subset of characteristics. The survey data did include participants from a wide range of academic and geographic backgrounds. Demographically, white participants were overrepresented in the survey sample. Though not necessarily representative of all DoD WEPs, this demographic breakdown is aligned with some program representatives who talked about struggling to bring in diverse cohorts.

Both program representatives and survey respondents answered questions about program outreach. In the case of program representatives, they talked about the different methods they used to try to reach people to apply for the program. Survey respondents answered a question related to how they heard about the program they participated in. The responses for each can be broken down into one-way communication (e.g., e-mail blasts or flyers) and two-way communication (e.g., hearing about it from someone they know or an on-campus event). The results for each group are summarized in Table 14.

Table 14. Summary of outreach activities reported by program representatives and how survey respondents heard about the last program they participated in.

Type of Communication	Programs That Used Method (*N* = 33)	Survey Respondents Who Heard About Program Through Method (*N* = 216)
One-way	81%	39%
Two-way	68%	76%

Note: Percentages add up to more than 100% because programs could use multiple types of outreach.

These data show that both types of communication are important, but two-way communication is primarily what drove the survey respondents to be aware of the WEPs. In particular, the majority heard about the program from someone they knew. Program representatives discussed more balanced outreach, including more one-way communication that could reach larger numbers of possible applicants. Though program representatives acknowledged how powerful two-way communication can be, they also

recognized that it was easier to reach more people with one-way communication. Reaching people through targeted word of mouth can be very hard and expensive, while sending out e-mail blasts to a broad range of people is economical even if it has a lower success rate. Despite many survey respondents being brought in through two-way communication, program representatives should continue to use both one-way and two-way methods.

The challenges in bringing people into the program were also touched on from both perspectives. For the survey participants, they were asked about what they considered when accepting the program and what accommodations the program provided that allowed them to participate. The most important consideration to the survey participants was whether or not the program would benefit long-term goals. Program representatives used their programs' strengths in this area to bring in candidates. Some WEPs focused on how they provided a path to a permanent job, sometimes though a guaranteed service agreement. Program representatives also mentioned publication and professional development opportunities that would help program participants even after the program is done. Participants are thinking long-term, and even short WEPs should be positioning themselves to help participants' goals in order to attract the best candidates.

Financial concerns were also an important factor for deciding to apply for a program. Many survey respondents listed stipend as a necessary benefit. Program representatives understood this, and commented on how offering a stipend can help bring in people, though they acknowledged that it is hard to match stipends from the private sector. Other financial benefits such as healthcare coverage and tuition support were also mentioned as incentives to participation by both groups.

Many of the WEP representatives were concerned that misconceptions or wariness of the WEP work were keeping people from applying. This worry is backed up by the survey participants, who indicated they were concerned about having the appropriate STEM skills when considering which programs to apply for. Additionally, the survey participants were concerned with actually being accepted into the program. WEPs should continue to try to clearly communicate the structure of the WEP, the types of work participants will be doing, and the specific criteria that are used to select participants.

The WEP locations were also a concern for both the WEP representatives and the survey participants. WEP representatives thought that some of the lab locations were not particularly attractive to candidates, and survey respondents backed this up. WEP location was a moderately sized concern, and quite a few survey respondents mentioned that housing stipends or relocation payments were a useful accommodation. Additionally, the survey respondents brought up hybrid work as a key accommodation. Allowing remote work when possible is one way to bring in candidates who may otherwise not be able to participate due to the work location.

Overall, the interview and survey data supported each other when it came to recruiting. Participants are hearing about programs through both one- and two-way communication, and the WEP representatives acknowledge that the two-way communication can be more powerful but that one-way is an affordable way to get the message to a high number of people. Additionally, WEP representatives know that they face challenges in structuring the program and putting together incentives to bring in the best participants. The two most important factors identified by participants were if the program would benefit their long-term goals and the financial incentives. The WEPs also need to be sure to be very clear about the work being done during the WEP to make sure they do not drive away any qualified candidates who might worry that they do not have the correct skills. Overall, WEPs should continue to point out the ways that their program can benefit the long-term goals of its participants.

B. Impact of WEP

A key aspect of both the interviews and the survey was understanding what impact the WEP had on participants. From the program perspective, this category meant discussing the types of gains that program representatives were hoping participants received from the WEP. From the participant perspective, this category meant enumerating the different benefits that they did receive, as well as discussing any challenges standing between them and those benefits.

One topic of agreement was in gaining the ability to use STEM skills. Program managers and mentors overwhelmingly talked about how they wanted participants to develop "hands-on" and "real-world" STEM skills. In the survey, participants ranked gains in their ability to use STEM skills highly. Additionally, they commented about what they specifically gained through the applied nature of the work. The goal of WEPs to help students become stronger scientists and engineers through real experience is matching the participants' experience.

An area where participants and program representatives had mixed agreement was how the WEP prepares participants to join the STEM workforce. The survey results showed that participants indicated a large gain in their ability to work in a professional environment, and a significant number of survey respondents talked about learning the non-technical skills needed to be successful in a workplace. The program representatives also talked about helping the participants learn soft skills such as communication, teamwork, and professional etiquette. Program representatives also wanted to give participants career insight and prepare them to apply for STEM jobs. Participant responses were more mixed in these areas, as only some survey participants felt that the WEP helped them gain an understanding of how to get a STEM job. Additionally, fewer than half of survey participants indicated that the WEP increased their interest in getting a STEM job. Of course, that could be because their interest level was already high. Additionally, most

of the survey respondents agreed with the statement that STEM is the right fit for them. Overall, the results indicate that WEPs are often fostering the soft skills that participants need to succeed in a professional setting, but participants are more mixed on whether they are gaining information about how to successfully apply for STEM jobs.

WEP representatives also discussed helping participants grow their networks, and most survey respondents reported at least modest network gains through the WEP. Specifically, program representatives talked about having network connections at different levels, including fellow participants, other people within the organization, and then people outside of the network. Survey respondents brought up each of these groups when talking about networking, though most typically they mentioned the network within the organization. A handful of participants did suggest having additional networking opportunities, but in general WEPs seem to be providing the desired types of networking.

A few program representatives discussed wanting to build participants' sense of self-esteem or self-confidence. This category was also present in the survey responses. A small number of respondents put that building their confidence was one of the most helpful aspects of the program. This issue was not the most pressing for either group, but building the confidence of participants was an impact of value from participating in WEPs.

Mentorship is a key aspect of many WEPs that can either help or hinder these gains. Both groups of respondents talked about how important mentorship is for the WEP experience. Program representatives typically talked about mentors as people who could help facilitate these gains by introducing participants to particular STEM skills and how to operate in a workplace. While they did acknowledge that there were occasionally mismatches between mentors and participants, they overall saw mentors as a helpful resource. Opinions on mentorship in WEPs were more mixed from the survey respondents. Most respondents to the survey had at least one mentor with almost half reporting two to four mentors. But the amount that they met with their mentors varied widely, with about a quarter of them indicating that they met with their mentors less than once a month. Additionally, some respondents saw the mentorship as the least helpful aspect of the program, particularly when the mentor was not present, engaged, or interested in the same things as the participant. Both groups agreed that mentorship was important to the overall WEP experience, but participants identified some issues with the mentorship experience that would be helpful for the programs to address.

The participant survey also provided the opportunity for respondents to discuss other challenges to their gains that did not come up in the interviews with program representatives. Participants touched on several bureaucratic issues that could be addressed. The main one of these was timely communication. While a few program representatives did bring up challenges in getting participants started in a timely fashion, the survey respondents went deeper into specific communication issues that they thought could be solved. Of course, these may not impact all WEPs, but it would be beneficial for

each WEP to have a clear communication plan in place to minimize the bureaucratic issues that participants face.

Overall, both WEP representatives and participants saw some key benefits to the participants from the programs. In particular, participants grew their real-world STEM skills and their ability to work in a professional environment, though only some participants learned how to apply for STEM jobs. Network growth was fairly good for participants, though some of them requested more networking opportunities. WEP representatives saw mentorship as usually a positive factor that helped facilitate benefits, but the program participants had more mixed opinions, pointing out several ways that a disengaged or mismatched mentor could drastically impact the WEP experience. Finally, participants pointed out some bureaucratic areas where the WEP representatives could take a closer look for opportunities for improvement.

C. Post-WEP Opportunities

What participants do after the WEP was a key aspect of the findings for both the survey respondents and the program representatives. Survey respondents were asked specifically about their post-WEP plans and what characteristics they look for in permanent jobs. Program representatives talked about their goals for participants after the program and how they hoped to bring participants into positions at their agency or within the DoD. Overall, there was also a shared understanding between the program representatives and the program participants about the challenges of different post-WEP pathways.

When discussing post-WEP opportunities, one common option was going directly into a permanent job. However, not every program was focused on this goal, and some program representatives talked about how their program tries to keep students in the educational ecosystem. This goal was particularly common for programs that reached younger students or community college students that might benefit from additional degrees. From the participant side, a majority of the respondents reported that they were going back to school after the program. Only about a quarter were transitioning directly into the workforce. A large majority of survey respondents indicated that they are currently pursuing or planning to pursue higher degrees in STEM, which will make them stronger candidates for the DoD STEM workforce in the future. So, program representatives should keep in mind that not all of their students are looking to work right after the program. In order to help with long-term hiring goals, it is important for the program to have mechanisms in place to continue outreach to the former participants until they are ready to enter the workforce, which may be a few years after their participation in the program.

Both program representatives and participants agreed that the WEP provided participants with insight into possible future careers. The WEP representatives saw their programs as previews for the participants, helping them understand what it is like to work in a particular site day-to-day, and also what it is like to work within the government more

broadly. Participants agreed, with many of them providing details about how they learned about careers in the government and what opportunities are out there. Ultimately, this career insight led to some WEP participants deciding that working within the DoD was not the right fit for them. While this could be disheartening for the agency representatives, it is ultimately a positive outcome, as it gives the agency space to bring in someone who is potentially a better fit.

Several questions on the survey asked participants about what characteristics they might look for in their goal jobs. It is interesting to compare these responses to what WEP representatives said when discussing how they attract participants to apply for permanent jobs. A summary of which sector (commercial or government) the survey participants thought was stronger for the four most important characteristics is shown in Table 15.

Table 15. Stronger sector for four most important characteristics in goal job according to survey respondents.

Characteristic	Stronger Sector
Benefits	Government
Salary	Commercial
Job Security	Government
Job Location	Commercial

The main takeaway from this table is that one sector is not seen as universally stronger across the most important characteristics to future job applicants. Program representatives commented that competition with the private sector was tough, particularly when it comes to salary. Government jobs simply cannot match some of the salaries in the private sector. However, based on the survey responses, WEP representatives looking to increase interest in permanent government jobs could highlight other important characteristics, such as benefits and job security, and emphasize how the government sector is stronger on those aspects.

D. Summary

Overall, there was a lot of agreement between the program representatives and the survey participants in terms of post-WEP opportunities. The WEP representatives recognized that many of the younger participants would not be going straight into the workforce, and most of the participants indicated an interest in continuing their STEM education. Additionally, both groups discussed the benefit of the career insight that the WEPs provide. Finally, both groups have similar understandings of the strengths and weaknesses of a government sector job versus a commercial sector position. WEP representatives should use this shared understanding to emphasize the strengths of the DoD

and their agency to help with long-term hiring goals once the WEP participants are finished with their education.

8. Conclusion

A. Key Findings and Recommendations

In general, the information gathered from the program representative interviews and the participant survey indicate that WEPs provide benefit to both the participants as well as the organizations that conduct them. Taken together with the Phase I finding that across the 50-or-so programs with more than 5,000 participants per year, the DoD provides a large positive impact on the development of the future STEM workforce for the nation. However, there were a few challenges identified, with some programs already working to overcome them to potentially improve program impact.

Below is a summary of key findings from the Phase II study, along with recommendations. The recommendations were derived from the study findings that were generated from both the interview of program representatives as well as the survey of participants. Both groups were asked how the programs could be improved or how particular challenges could be overcome, and their responses helped generate the recommendations. The most common answer from survey participants was that they had no suggestion for improving the program, which reflects that they seemed to have relatively positive experiences in WEPs. Overall, the recommendations in this section should be seen not as criticisms, but as suggestions for ways to maintain the strong work that WEPs are already doing.

1. Recruiting

Program representatives talked about a wide range of characteristics that they look for in candidates for their WEPs. In terms of individual traits, they described explicit criteria such as academic levels, majors, and performance. However, they also looked for implicit criteria such as determination, enthusiasm, and professionalism that they did not always make clear to applicants. Some program representatives also talked about searching for diversity across the cohort, including demographic, academic, socioeconomic, and geographic diversity. Many of these types of diversity were tied back to looking for diversity of thought in their different candidates.

Recommendation: *Programs should clearly lay out the selection criteria in recruiting material to describe what program representatives are seeking, and create methods to assess candidates based on them.*

Programs used a broad set of communication methods to get the word out to potential applicants and encourage people to apply. In particular, programs used a combination of one-way communication methods (e.g., email blasts, job postings) and two-way communication methods (e.g., career fairs, school STEM nights, and conference interactions). These methods have different strengths, as one-way communication methods can typically reach a wider audience while two-way methods provide the opportunity to answer questions and provide more relevant detail. By using multiple methods, the programs increased the reach and their ability to provide detailed information. In the survey, participants indicated that they typically heard about the program through a discussion with someone they know (a two-way method), though some survey respondents also indicated that they heard about the program through one-way communication methods. This suggests that a combination of methods may be useful for reaching potential applicants.

Regardless of whether one- or two-way communication was being used, program representatives recognized the importance of leveraging strategic intermediaries to enhance recruitment. There was some variation in using intermediaries. For example, when the relationship was between a specific person from the program (e.g., mentor) and an individual intermediary (i.e., person-to-person) the relationship may be fragile if one of those people leaves. Thus, established and maintained relationships between the program and organizations more broadly may provide more robust recruiting capabilities. Additionally, a WEP's alumni network could be a powerful recruiting tool to give the WEP access to more potential candidates and spread the word of positive WEP experiences.

Recommendation: *Programs should continue to balance one- and two-way communication methods to reach a wide audience with relevant information.*

Recommendation: *Programs should leverage strategic intermediary ties to enhance recruiting. This includes strengthening their alumni network to provide further recruiting.*

The WEP representatives discussed several different types of challenges in getting enough applications. In particular, some programs struggled with making sure candidates were aware of the program, particularly candidates from HURCs. Some of the programs encountered potential applicants with misconceptions or wariness of the work done by their agency. Many programs faced challenges in providing attractive offers, particularly when compared with the stipends available in the commercial sector. A cumbersome application process and major historical factors such as COVID were also reasons mentioned as to why programs did not get enough applications.

Survey participants also gave information about what they considered when thinking about whether or not to apply for a WEP. The top three considerations were (1) knowing if the program would benefit longer-term goals, (2) being accepted into the program, and (3) having appropriate STEM skills that the program may require. One important other concern was the affordability of costs associated with participating in the WEP, which was a stronger concern for individuals who identified as coming from a lower socioeconomic background. The survey participants also identified the types of accommodations they needed in order to apply for and attend a WEP. In particular, financial considerations dominated these responses, as many participants required a stipend or other financial aspects (e.g., housing assistance or temporary relocation costs). Ultimately, there was a shared understanding between the program representatives and the survey participants that the stipend is important, but other aspects (such as long-term participant goals) also play a role in deciding whether or not to apply.

Recommendation: *Programs should leverage knowledge of students' long-term goals and explain benefits of program participation, potentially with examples of how the program can lead to long-term success.*

Recommendation: *Programs should proactively and clearly advertise their accommodations while recruiting.*

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2. Experience During WEPs

Both the interviews and the survey touched on the participants' experiences during the WEP. Specifically, there were findings related to the mentorship participants receive through WEPs and the logistical choices and challenges that WEPs face.

There was mutual agreement by program participants and program representatives that mentorship had a large impact on participants' WEP experience. In general, there seems to be strong positive mentorship experiences for most participants, but there were

some troubling findings. When asked about the number of mentors they had, the most common survey response (49%) indicated that participants had two to four mentors, with another 35% indicating they had one mentor, and another 8% indicated they had five or more. However, about 9% indicated they had no mentors. So, as was expected, it was most common to have one or even a few mentors, but concerning that some respondents indicated they had no mentor. Likewise, with the frequency that participants met with their mentors, a majority (67%) of respondents who had mentors indicated that they met with their mentor at least once per week. However, a troubling finding was that 27% of respondents who had mentors indicated that they met with their mentor less than once a month.

There were some comments by participants in their open-ended responses that indicated poor mentorship or a lack of mentorship negatively impacted their experience. Also, there were some participants who indicated there was a poor match between the mentor and themselves (i.e., mentee), in that the research backgrounds didn't align. While it was a minority of respondents who indicated they had negative mentorship experiences, the importance of mentorship in a WEP means that it is crucial to address any negative experiences

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Recommendation: *Programs should ensure that all participants have at least one clearly identified mentor, and there is regular interaction between mentor and mentee.*

Recommendation: *Programs should train mentors on best practices, including routine meetings with participants and ensuring that participant goals are considered.*

Both interview and survey respondents also discussed logistical considerations. When thinking about potential remote work, program representatives acknowledged that having to come to a lab site (many of which are remotely located) can be a hindrance to bringing in participants. In the participant survey, about two-thirds of the participants worked only on-site, while the rest were a combination of hybrid or all remote options. In open-ended responses, about 10% of respondents indicated that flexible work accommodations were an important factor for enabling them to participate in the WEP. However, other respondents indicated that care needs to be taken if the position is hybrid or fully remote in that it decreases the opportunity for networking.

Recommendation: *To expand their pool of applicants, programs should consider thoughtful hybrid or remote options if the work does not require the participants to always be on-site.*

Another logistical challenge that the survey respondents discussed was communication with their WEP point of contact or program representatives. This issue particularly applied to introductory communication before and at the beginning of the program. Some of the specific topics where respondents felt they didn't receive clear communication included stipends, benefits, task work, program paperwork and reporting requirements, setting up network and facility access, completing tax forms relevant to program funding, expectations for and evaluations of participants during their tenure, and job opportunities after participation. In particular, issues with legal implications such as taxes were often not fully understood by the point of contact for the participants. When these participants asked questions, they were told that their point of contact could not provide specific legal advice.

Recommendation: *Programs should work to provide timely information to participants about all relevant onboarding procedures.*

Recommendation: *For information with legal implications (e.g., taxes, future commitments to work for the DoD), standardized information vetted by a lawyer should be provided to participants.*

3. WEP Impacts on Participants

The findings indicate that the WEPs had a variety of impacts on the participants. The WEP representatives talked about the impacts they hoped their WEP had, and the survey respondents typically agreed with those benefits as indicated by their responses. Generally, the WEP participants grew in their ability to work in a professional environment, their ability to use STEM skills, and other aspects of career awareness and professional development (e.g., how to get a job).

In the survey responses, WEP participants indicated that the top impact from the WEP was their ability to work in a professional environment. As many participants are entering the workforce for the first time through this WEP, they reported growth in their non-technical skills (e.g., working in a professional environment and collaboration with people in other disciplines) that will help them succeed in the workforce. This aligns well with the

program representatives, who touched on how their programs helped participants learn soft skills such as communication, teamwork, and professional etiquette.

An additional piece of professional development was seen in growing the participants' networks. WEP representatives wanted students to gain networks with their fellow participants, other STEM professionals within the organization, and STEM professionals outside of the organization. The results from the survey were more mixed on this front, with many respondents reporting increases in the size of their STEM networks due to the WEPs, but a few (approximately 10%) saying that they had no growth in their network from WEP participation. There was a perceived value in building professional networks, with some survey respondents expressing interest in having more networking events to help with this.

Recommendation: *Programs should continue to facilitate building professional networks by conducting specific activities that bring participants together with STEM professionals.*

Survey respondents also reported seeing a lot of growth in their ability to use STEM skills. They saw the hands-on learning of the WEP as a way to learn new skills and grow in how they can apply their skills. This type of growth was also a key goal for many of the program representatives, who intended for the hands-on and real-world work in the WEP to help grow STEM literacy within the participants through working alongside DoD STEM professionals. One potential area of growth deals with matching participants to the projects they work on. Some participants felt that the projects they were put on did not match their skills or interest, which meant they could not grow the skills they were hoping to. This could be enhanced through improving the communication of potential projects applicants may work on during the recruiting/outreach, or after award by aligning participants' skills with project needs. Several participants suggested that having the option to change project teams or rotate between different projects might make the experience more positive.

Recommendation: *Programs should ensure that participants' projects match the participants' interests and skills.*

An important aspect of most WEPs is increasing the participants' career awareness. While survey respondents did not rank the impact of the WEP on their understanding of how to get a STEM job as highly as some other categories, they did indicate in open-ended responses that they learned a lot about careers in government and its research agencies. The nature of government R&D is not taught in schools, therefore having experience at a DoD

facility may expose participants to the full life-cycle of R&D. Program representatives indicated that they saw this as a key benefit of their WEPs, as participants would gain insights into working within the DoD and STEM. WEP participants also gained additional experiences and credentials to add to their resume. In general, their participation in the WEP was perceived by program representatives to make them more hirable in the future.

4. WEP Impacts on Organizations

The WEPs had a variety of positive impacts for their organizations in addition to the benefits to participants. These organizational benefits included supplementing their current work output, helping with hiring after the program, and building communities more broadly.

The current work at organizations can be supplemented by bringing in more labor through WEPs. The participants are additional hands in the lab, and are often an affordable option. Some WEPs also discussed how they emphasize documentation to ensure that the impact of the work lasts beyond the WEP activity. WEP participants also provide exposure for the current workforce to new people and new ideas. This allows research to move in new directions and often reinvigorates enthusiasm for the mentors. Finally, several WEP representatives discussed specific trainings that improved their mentors' work more generally or were applicable across the entire agency.

Recommendation: *Programs should have systematic documentation of participants' work to ensure it lasts beyond the period of the WEP.*

Many WEP representatives discussed how the WEP helps with long-term hiring, either into the organization or the DoD more broadly. First, the programs helped increase interest in government jobs. As the program participants gain familiarity with the DoD, they become aware of more of the options that are out there. Next, the programs helped agencies filter through and identify high-quality candidates for full-time permanent positions, as the WEP could act as an extended interview. This experience allowed the agency representatives to advocate for the WEP participants who would make good long-term employees. Finally, the WEP helped prepare the participants to become long-term employees, which, after they are hired, decreases some of the onboarding burden on the agencies. Essentially, the WEP helped pre-train potential employees in the cultural, logistical, and procedural aspects of the agency.

The program representatives did discuss challenges with long-term hiring. One challenge that often came up was a lack of open positions for the WEP participants to come into the workforce on a full-time basis. In order to address this, some program managers

and mentors would try to tell participants about positions and opportunities outside of their agency. However, there is currently no systematic way for WEP participants to be alerted of and guided towards applying to these positions.

Recommendation: *DoD should create a centralized pool (i.e., marketplace) of WEP alumni so that successful participants can be recruited and hired by programs that need talent.*

Additional challenges were relevant to differences between working for the government versus in the private sector. One challenge identified was that some participants may end up learning that they are not interested in government jobs, though ultimately this may benefit both the participant and the agency as they find a sector that is a better fit for them. Finally, program representatives talked about how competition with the private sector, particularly monetarily, can keep people from being interested in the government sector. This aligns with survey results, where participants indicated that the commercial sector outperforms the government sector in terms of salary. However, survey participants and program representatives both recognized that the government sector can be stronger in factors such as job security and benefits.

Recommendation: *DoD agencies should emphasize positive characteristics of their jobs such as benefits and job security to be competitive with the commercial sector.*

Another challenge to immediate hiring that came up in the survey results is that the majority of WEP participants were returning to school after the WEP. Given that, there may be a period of time, several months if not years, between the end of the WEP and when the participant may be ready to look for a full-time position after they graduate. Nearly all survey respondents indicated that STEM was in their future plans, either with additional education or jobs. However, the timing might be such that the participants may have lost touch with their mentor or WEP supervisor.

Recommendation: *Programs should stay in contact with participants they may wish to hire in the future, and reach out closer to graduation with available job openings.*

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5. Social Equality

Social equality was an important consideration for many programs. In particular, participants from HURCs may face barriers in their efforts to get into WEPs, experience and engage in program activities, and apply what they gained towards subsequent pursuits. In particular, when addressing DEIA, most program representatives gravitated towards discussing efforts focused on equalizing access to the program. That said, some program representatives also touched upon potential barriers related to what participants experienced during the WEP and what happened post-program.

Program representatives identified several different barriers that could keep HURCs from entering their programs at the desired rates. For example, programs indicated that awareness of WEPs was typically lower amongst HURCs and those communities were more likely to mistrust anything affiliated with the government. Additionally, HURCs could have other obligations and constraints that had to be navigated in order to participate. Likewise, the survey results also indicated that respondents from lower socioeconomic statuses could struggle with the hidden costs of participation (e.g., temporary relocation costs, added costs for commuting). Additionally, application and eligibility requirements could serve to block some members of HURCs from being able to apply to WEPs. Finally, program representatives alluded to potential bias in the application evaluation process that could disproportionately impact HURCs.

Though they were less likely to think about it explicitly, program representatives also mentioned several barriers that could limit a participant's ability to fully engage in WEP activities. For example, other standing obligations (e.g., caring for family, medical needs, other jobs) could conflict with the amount of time available for WEP activities, creating a time management challenge that had to be overcome. Participants also entered WEPs with different levels of technical ability and familiarity with professional environments, especially if they were first-generation learners or enrolled in less selective schools. Participants from HURCs may also start WEPs with a more deferential approach towards figures of authority, which meant they could be less likely to advocate for themselves or seek help when needed. Joining an environment as any type of relative minority (e.g., gender, race, ethnicity, religion, region, socioeconomic background, citizenship status) could also make it more difficult to connect with others and develop an overall sense of belonging. Program representatives shared examples of participants from HURCs clashing with either other participants or mentors, due to misunderstandings about their abilities and needs.

Program representative also identified a number of barriers that could make it more difficult for HURCs to translate their WEP experiences into post-program gains. First, participants from HURCs may have a different level of awareness of the types of goals that are both possible and, perhaps more importantly, achievable for someone like them. Without closing the gap in aspirations, HURC participants may be less likely to pursue the

types of long-term goals that are possible within or in partnership with the federal government (e.g., working on a government grant as a professor at a university). Program representatives were also cognizant of the fact that WEPs were but one step along a STEM development pathway. As participants completed WEPs and moved on to further schooling, learning opportunities, or jobs, they may encounter many of the same types of barriers that they had to overcome with WEPs. For all participants, each additional opportunity that was needed before being job ready increased the odds of leaving the government STEM ecosystem, since each transition came with the risk of being diverted into a new field or the private sector. But participants from HURCs may be at greater risk of being diverted, should they encounter additional barriers during their post-WEP pursuits.

In discussing the variety of barriers that could hinder efforts to facilitate social equality, program representatives also described a number of potential solutions worthy of consideration by other WEPs. Overall, IDA observed that WEPs may be dedicating more attention to equalizing access to WEPs, compared to ensuring equity either during or after the WEP. While the examples included in this report demonstrate that program representatives collectively touched upon all three aspects of social equality—before, during, and after the WEP—they still dedicated much more time during interviews to discussing challenges related to getting people in the door. Looking forward, IDA recommends that WEPs draw upon the insights shared by their peers, to gain a broader understanding of the kinds of barriers that HURCs may face and, more importantly, the types of solutions that could be considered and adapted to their respective communities.

Recommendation: *Programs should consider expanding efforts to support social equality by including greater consideration on how participants fare both during and after the WEPs.*

B. Study Strengths and Limitations

This study aimed to understand nuance and detail across a broad range of programs that can be considered WEPs. Additionally, periods of time before, during, and after these programs were all included in the study scope. The main strength of this study was a design that allowed for discovery and identification across all of these aspects. This included the use of interviews of the program representatives which allowed the study team to identify key issues and considerations facing WEPs, and delve deeper into understanding those issues. Complementarily, the survey balanced close-ended questions with open-ended responses to gather comparable information on WEP experiences and outcomes from a wide sample of participants.

Another strength of the study is that the interviews and survey were designed to triangulate program representative and program participant perspectives. It would not have made sense to ask both groups exactly the same questions since the analysis used two different methods and were focused on different perspectives, so the instruments were designed to get the appropriate information from each group in similar topics. This approach allowed the study team to identify places where the perspectives of the people running WEPs and the people participating in WEPs either agreed or differed.

While the study included broad representation across programs and participants and provided a general understanding of DoD STEM WEPs, the study also had limitations. For the interviews, sampling was done purposively to cover the categories laid out in the methods section. Ultimately, approximately half of the programs identified in the Phase I study (Kolodrubetz et al., 2022) were interviewed. Due to the sampling plan to cover programs with specific characteristics, these programs may not necessarily represent half of all participants in DoD STEM WEPs. Some programs that reach a large number of students and might not be limited to STEM disciplines were not in the sample. The study also intentionally excluded programs that exclusively reach high school students and programs exclusively for active military members. These types of programs may have markedly different characteristics, so the findings may not apply to them. Additionally, it was not possible to get both a mentor and program manager for each program sampled, which could lead to unevenness in the understanding of the programs.

For the survey, sampling participants was a potential issue that might limit how well the findings might generalize. Based on the survey process requirements for OMB approval, the study had to rely on a volunteer sample that was recruited by parties external to the study team (i.e., program representatives) rather than the study team. These restrictions may have led to a fairly low response rate that came from only some of the identified programs. Also, an unexpectedly large number of participants chose not to identify their program or did not clearly identify the program they had participated in. So, the sample may not be an overall representation of DoD WEP participants, and it is unknown how the results in this study might scale to the full population. The sampling process used was due to the importance of ensuring the anonymity of respondents, but makes the understanding of variation within and across programs difficult.

C. Next Steps

Building from the findings presented in this study, there are a few possible next steps that the DoD STEM community could consider to benefit the use of WEPs across the DoD portfolio. Some suggested efforts include the following:

- **Pilot a WEP employment marketplace.** One key recommendation of the current study was to create a marketplace that would help match WEP alumni with potential jobs or future opportunities. This marketplace may be a large

undertaking, so a pilot effort could initially test implementation options and create a small marketplace across a few programs or agencies. Based on the initial implementation and an assessment of options, the marketplace could later be expanded across the DoD.

- **Identification of WEP participants' paths.** The DoD STEM community could share registration information of participants for long-term (multiple years) tracking of a sample of WEP participants across programs. By tracking a select set of WEP participants across a representative selection of programs, the DoD would learn about the paths participants take through successive programs towards employment in STEM, ideally in DoD positions. These participants would be tracked as they moved beyond the WEP into other programs or into employment. This undertaking would allow for a more detailed and representative view of the varied pathways that WEP participants may follow to start STEM careers.
- **Deepen understanding of connections between WEPs.** The current study found that there are informal and formal connections between different WEPs and other agency programs. The DoD could gain additional understanding by reaching out to WEP representatives to provide lessons learned on how WEPs and other programs may collaborate or could potentially collaborate to help keep students progressing along a STEM development pathway as they participate in a series of programs. The results could be used to further develop WEP communities and strengthen existing and build new connections.

Ultimately, any of these next steps would provide useful new insights and allow for a deeper understanding of the important work being done by DoD WEPs. WEPs are important mechanisms for recruiting and developing quality STEM talent for the DoD's science and technology agencies. Continued evolution of WEPs will enable the DoD to better compete for valuable STEM talent that will allow it to maintain its technical superiority into the future.

Appendix A.
Interview Protocol

Below is the interview protocol followed by study staff.

Interview Protocol

Opening Remarks

Thank you for taking time to meet. As I shared in my email, we are conducting a study for DoD STEM on DoD-affiliated programs that provide work-based experiences for students and recent graduates (e.g., internships, apprenticeships, fellowships). We call these type of programs Work Experience Programs (or "WEPs") for short.

As part of the project, we are interviewing people who work on these types of programs to gain a better sense of the mechanics of how the programs work and how programs may impact both the participants as well as the agencies these programs are tied to.

Before we begin, I want to go through a few basic things about the interview. First, it is important to me that you understand that there are no right or wrong answers to any of my questions. Also, we cover a lot of topics, so it's ok if you don't know about something or prefer not to answer; please just tell me and we will move on. You can pass on any question you do not wish to answer, and you can end our interview at any time. Anything you share will remain confidential. Our report is focused on trends and grouped answers, so nothing you say will be attributed to you by name.

- Do you have any questions?
- If it's alright with you, I'd like to record the audio of our conversation. This just helps me focus on what you are sharing and helps ensure we are capturing what you say accurately and completely. It will not be shared outside of our team. If you do not feel comfortable with this, we will rely upon [name's] notes and do the best we can. Would you be ok if we recorded the audio?
- Are you ready to begin?
- Do you have any time constraints I should know about?

Warm Up

1. To start, can you please help me understand your role or roles with respect to the [program name]?
    - Probe: About how long have you had this role?
2. Can you please share a high-level summary of what the program does?
    - Probe: How long is the program for participants?

Program Access

3. How does the program recruit new participants?
    - Probe: How might potential participants hear about the program?
    - Probe: Can you explain the recruiting, application, selection schedule, or timeframe?
4. From your experience, what types of people seem to be a good fit for the program? What do you look for?
    - Probe: Are there certain knowledge areas, skillsets, or other characteristics that make someone a particularly attractive candidate?
5. How do you attract the participants that you want to apply?
6. What types of challenges has the program encountered with respect to bringing the right people aboard?
    - Probe: Do you have any insight into why a good candidate might not apply to the program?
    - Probe: Do you have any insight into why someone who was accepted to your program may ultimately decide not to participate?
7. Do you have any ideas on how to potentially enhance recruiting going forward?

Participation – Performance – Development

The next set of questions focuses on what happens during the program.

8. What do you want participants to gain from being in the program?
    - Probe: What types of knowledge and/or skills do you want participants to gain?
9. How does the program help participants achieve their goals?
    - Probe: How structured is the goal or expectation setting process? For example, is there some type of planning worksheet?
10. Does the program include some type of mentorship? If so, can you tell me about it?
    - Probe: How are mentors selected?
    - Probe: How are mentors paired with participants?
    - Probe: What type of training or guidance do mentors receive?

11. Apart from mentors, are there any other people who play a major role in helping participants achieve their program goals?
    - Probe: Is there any type of peer-to-peer support?
12. What are some potential reasons why a participant may struggle during the program?
13. What types of things may help them overcome these challenges?

Understandings of Success

14. Let's say it's now the end of the program. How do you know if a participant has been successful?
    - Probe: Is there some type of performance review or feedback?
15. How do you know if a mentor has been successful?
16. How do you know if the program has been successful overall?
    - Probe: Are there any particular program metrics to assess the program?
17. After participants finish up and leave the program, what would be your idea of successful next steps for the participants?
    - Follow-up: About how often does this happen; for example, among the most recent cohort of participants?
18. Do you have any insight into why some participants may struggle more than others to take these types of next steps?
19. Does your program have a hiring mechanism for current or former participants? If so, can you please describe it?
    - Follow-up: How are participants identified for this type of opportunity?
    - Follow-up: About how frequently -- rarely, sometimes, almost always -- does hiring by your facility happen; for example, among the most recent cohort of participants?
20. Are there any other post-program opportunities available to participants?

Reflection Questions

The next few questions I have are about helping me get a sense of the bigger picture.

21. A topic receiving attention in STEM education and development is supporting diversity, equity, inclusion, and access (DEIA). What are your thoughts with respect to these types of issues and your program?
22. What does your organization gain from supporting work-based experiences for students and recent graduates?
23. How, if at all, does your program help address or enhance STEM needs in the DoD?

Demographics

That's it for the main interview topics. Before we wrap, I have a few demographic questions. We like to collect this type of information because it helps us describe the variety of folks we managed to connect with for the project. As always, none of the answers you give will be connected to your name in the final report. And you may skip any question you do not wish to answer.

24. How would you categorize your employment with respect to [program name]?
    - Employee
    - Contractor
    - Volunteer
    - Other
        - Follow-up [if selected]: Is there a term or category you would like me to use?
25. How would you like to identify your gender?
26. How would you like to identify your race or ethnicity?
27. Lastly, is there anything else you feel would be helpful for me to know about how the programs is run? Alternatively, is there anything additional that you think I should be asking other program representatives?

Appendix B.
Survey Instrument

Below is the full survey instrument administered to WEP participants via Qualtrics.

WEP Participant Questionnaire

Start of Block: Default Question Block

We are seeking feedback from people who participated in one or more STEM-oriented work experience programs (e.g., internships, apprenticeships, fellowships) that are affiliated with the Department of Defense (DoD) within the past 12 months. By STEM, we mean any field that involves some type of science, technology, engineering, or mathematics. Examples: biology, chemistry, computer science, electrical engineering, social science, physics, and more.

The goal is to gain a better understanding of the wide range of backgrounds and experiences that participants brought to these programs, what participants gained, and how programs may be improved for future cohorts.

If you are open to helping us meet this goal, please complete the following questionnaire. It is best viewed in a browser, though may also be taken on a mobile device. We anticipate the questionnaire will take approximately 10-20 minutes. Please note that all questions are optional, so you may skip any question you do not wish to answer. Lastly, per recommendation from the Office of Management and Budget and so that we may keep this survey anonymous, please do not include personally identifiable information such as people's name, birthdate, address, or any information that could identify you or others in any of your written answers.

Thank you, in advance, for your time!

End of Block: Default Question Block

Start of Block: Professional and Ed Background

The first set of questions helps us get a better sense of where you are in your educational and professional development.

Where are you in your education? *If you are done with school, please select "N/A" for Currently Pursuing and Highest Planned. If you are not currently in school, but might return in the future, please select "N/A" for Currently Pursuing and then the appropriate degree type for Highest Planned.*

	High School/GED	Associate's	Bachelor's	Master's	Doctorate	N/A
Last completed	○	○	○	○	○	○
Currently pursuing	○	○	○	○	○	○
Highest planned	○	○	○	○	○	○

Is your current (or most recently attended) school public or private?

- ○ Public
- ○ Private
- ○ I don't know

What types of programs does your current (or most recently attended) school offer? *Select all that apply.*

- [ ] Shorter than 2-year programs
- [ ] 2-year programs
- [ ] 4-year programs
- [ ] Master's programs
- [ ] Doctoral programs

Is your current (or most recently attended) school a Historically Black College and University (HBCU), a Minority-Serving Institution (MSI), or any other special-mission institution that serves historically-underrepresented communities in higher education?

- ○ Yes
- ○ No

What is (or was) your academic major or concentration? *Select all that apply.*

- [ ] Computer and information sciences
- [ ] Engineering and engineering technology
- [ ] Biological, physical science, and science technology
- [ ] Mathematics
- [ ] Agriculture and natural resources
- [ ] General studies
- [ ] Social sciences
- [ ] Psychology
- [ ] Humanities
- [ ] History
- [ ] Personal and consumer services
- [ ] Manufacturing, construction, repair, and transportation
- [ ] Military technology and protective services
- [ ] Health care fields
- [ ] Business
- [ ] Education

- [ ] Architecture
- [ ] Communications
- [ ] Public administration and human services
- [ ] Design and applied arts
- [ ] Law and legal studies
- [ ] Library sciences
- [ ] Theology and religious vocations
- [ ] Other (please specify)

_____

Do any of your future education plans focus on STEM (i.e., any field involving science, technology, engineering, or mathematics)?

- ○ Yes
- ○ No
- ○ No future education plans

What is the highest level of completed education among any of your parents or primary guardians?

- ○ Middle school
- ○ High school / GED
- ○ Some college
- ○ Vocational certification or license
- ○ Associate's Degree
- ○ Bachelor's Degree
- ○ Master's Degree
- ○ Doctorate

What is the name or title of the job you would want for your career (e.g., astrophysicist, cryptographer, mechanical engineer)? In other words, what is your "goal job"? *If you do not know, please put, "Unsure." So we may keep this survey anonymous, please do not include personally-identifying information, such as people's names, birthdates, addresses, or any information that could identify you or others.*

_____

If you received multiple job offers from companies where you could work in your "goal job," how important would each of the following factors be in deciding which company to join?

	Not at all important	Very important

Salary	
Benefits	
Job security	
Job location	
Opportunities for advancement	
Intellectual challenge	
Level of responsibility	
Degree of independence	
Contribution to society	
Ability to use STEM skills	
Flexible work arrangements (e.g., telework)	

Many jobs in the U.S. government (including in the Department of Defense) may also be found outside of the government in the commercial sector (e.g., academia, private industry, contracting, non-profits) Thinking about your possible "goal job," which sector is stronger or more competitive in each of the following factors?

	Commercial	They are equal	U.S. Gov	I don't know

Salary	
Benefits	
Job security	
Job location	
Opportunities for advancement	
Intellectual challenge	
Level of responsibility	
Degree of independence	
Contribution to society	
Ability to use STEM skills	
Flexible work arrangements (e.g., telework)	

End of Block: Professional and Ed Background

Start of Block: Program Feedback

The following questions are about your most recent experience in a STEM-oriented work experience program affiliated with the DoD. To keep things simple, we will refer to this as the "program." If you are still in the program, please answer based on your time so far.

What is the name of the most recent program that you attended?

_____

How or where did you hear about the program before applying? *Select all that apply.*

- [ ] Someone I know
- [ ] An event (e.g., job fair, science expo)
- [ ] Traditional ad (e.g., radio announcement, print ad, mailer)
- [ ] Thought piece on the program (e.g., news article, blog post, publication, podcast)
- [ ] Email announcement
- [ ] Pay-per-click ad (in a browser or app)
- [ ] Job post (e.g., school job bulletin, Indeed, Monster, USA Jobs)
- [ ] Social media (e.g., LinkedIn, Twitter, Facebook)

Where was the program's on-site location relative to where you were living when you applied?

- ○ Same city or in a nearby city that you can easily commute from
- ○ Further away

How did you participate?

- ○ On-site
- ○ Remotely
- ○ Hybrid (some on-site, some remote)

How long was the program? Or, if it is ongoing, how long have you been in the program so far?

- ○ One month or less
- ○ More than one month but less than 4 months
- ○ 4 months to a year
- ○ A year or more

How many formal and/or informal mentors did you work with during the program? *If none, please write "0."*

_____

Thinking about the mentor you worked most closely with (formally or informally), about how often did you meet either virtually or in person?

- ○ Every day
- ○ 2-4 times a week
- ○ Once a week
- ○ 1-3 times a month
- ○ Less than once a month
- ○ Did not have a mentor

How, if at all, did your experience in the program impact any of the following? *Please drag the slider to the place on the scale that best describes your answer.*

Big Decrease No change Big Increase

Interest in taking STEM classes or pursuing a STEM major in school.	
Interest in getting a STEM job one day.	
Understanding of how to succeed in STEM classes or as a STEM major in school.	
Understanding of how to get a STEM job one day.	
Ability to use your STEM skills.	
Ability to collaborate with people from academic majors that are different from your own.	
Ability to work in a professional environment (e.g., communication, time management).	

When deciding whether to apply for the program, how much did any of the following concern you? *Please drag the slider to the place on the scale that best describes your answer.*

Not at all a concern Very big concern

Knowing whether the program would benefit your long-term goals	
Being accepted into the program	
Being able to afford associated costs (e.g., travel, rent, professional clothes, equipment)	
Distance between the program and your home	
Having good enough STEM skills in the right topic areas	
Getting along well with others in the program	
Other (please specify)	

Did the program offer any benefits or accommodations (e.g., housing support, stipend, hybrid learning environment, guaranteed job placement) that were important for you to be able to participate? If so, can you please list up to 5? *If there were none, please write "No." So we may keep this survey anonymous, please do not include personally-identifying information, such as people's names, birthdates, addresses, or any information that could identify you or others.*

- ○ 1 _____
- ○ 2 _____
- ○ 3 _____
- ○ 4 _____
- ○ 5 _____

Overall, what was the most helpful or meaningful thing that you gained from being in the program? This could be something specific (e.g., a new job, contact information for a potential future employer), abstract (e.g., knowledge, confidence, perspective) and/or anything in between. *So we may keep this survey anonymous, please do not include personally-identifying information, such as people's names, birthdates, addresses, or any information that could identify you or others.*

_____

_____

_____

_____

_____

Overall, what was the least helpful or meaningful aspect of the program for you? *So we may keep this survey anonymous, please do not include personally-identifying information, such as people's names, birthdates, addresses, or any information that could identify you or others.*

_____

_____

Do you have any ideas on how to improve the program going forward? If so, what? *So we may keep this survey anonymous, please do not include personally-identifying information, such as people's names, birthdates, addresses, or any information that could identify you or others.*

_____

After the program, what did you do? *Select all that apply.*

- ☐ School
- ☐ Work
- ☐ Seek Work
- ☐ Another work experience program (U.S. Government)
- ☐ Another work experience program (civilian)
- ☐ Other (please specify)

_____

Approximately how many STEM professionals do you currently know that you would feel comfortable contacting for help learning about STEM-oriented degrees or jobs, including how to get them? Of these, how many are new contacts that you made through the program?

- ○ # of STEM professionals you know

_____

- ○ # of new contacts made through the program

_____

Currently, how strongly do you agree or disagree with the following statements? *Please drag the slider to the place on the scale that best represents your answer.*

	Strongly Disagree	Neutral	Strongly Agree
I connect with people in STEM on a personal level.			
I connect with people in STEM on a professional level.			
Thinking about my future, STEM is the right fit for me.			

End of Block: Program Feedback

Start of Block: Demographics

Lastly, we have a few demographic questions to help us get a better sense of the wide range of people who have participated in DoD work experience programs.

In which state were you living when you applied for the program?

▼ Alabama ... I do not reside in the United States

How would you characterize the place where you were living when you applied for the program?

- ○ Rural
- ○ Suburban
- ○ Urban

How, if at all, would you like to identify your ethnicity?

- ○ Hispanic
- ○ Non-Hispanic
- ○ Prefer not to answer

How, if at all, would you like to identify your race? *Select all that apply.*

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Prefer not to answer

What is your gender?

- ○ Male
- ○ Female
- ○ Prefer not to answer

Do any of the following apply to you? *Select all that apply.*

- ☐ English is not your native language
- ☐ Have a disability (e.g., hearing, vision, cognitive, mobility)
- ☐ First person in your family to go to college
- ☐ Qualified for free/reduced lunch in high school
- ☐ Qualified for federal aid in college (e.g., Pell Grant)
- ☐ Served in the U.S. military
- ☐ Have a parent/guardian, sibling, or child who served in the U.S. military
- ☐ Have a parent/guardian, sibling, or child who worked for the DoD as a civilian or contractor

*

In what year were you born?

____

End of Block: Demographics

Appendix C.
Software Used

Through multiple parts of this analysis, various software tools were essential.

R

The analysis of concrete survey questions was done using the R programming language (R Core Team 2022). Beyond the basic R installation, the specific packages used in the analysis were:

- **tidyverse** to organize data in useful data structures and organize the analysis (Wickham 2022)
- **janitor** to create summary tables and clean input data (Firke 2021)
- **lubridate** to standardize storage of dates and times (Grolemund and Wickham 2011)
- **broom** to standardize storage of statistical test output (Robinson, Hayes and Couch 2022)
- **naniar** to deal with missing values in the data (Tierney, et al. 2021)
- **usmap** (Lorenzo 2022) and **rgdal** (Bivand, Keitt and Rowlingson 2022) to create maps

NVivo

IDA used NVivo Version 10 for the interview analysis (Lumivero 2014). This software allowed for the tracking and coding of the interview corpus.

Illustrations

Figures

Tables

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Abbreviations

CCWT	Center for Research on College-Workforce Transitions
DoD	Department of Defense
DEIA	diversity, equity, inclusion, and accessibility
GPA	grade point average
HBCU	historically Black colleges and universities
HURC	historically underrepresented communities
IDA	Institute for Defense Analyses
IPEDS	Integrated Postsecondary Education Data System
MSI	minority serving institution
NACE	National Association of Colleges and Employers
NDAA	National Defense Authorization Act
NDSEG	National Defense Science and Engineering Graduate
NRC	National Research Council
NREIP	Naval Research Enterprise Internship Program
OPM	Office of Personnel Management
PAQ	PALACE Acquire
PCIP	Premier College Intern Program
RAP	Research Associateship Program
SMART	Science, Mathematics, and Research for Transformation
STEM	Science, Technology, Engineering, and Mathematics
USG	United States government
WEP	work experience program

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14. ABSTRACT

A critical step in the development of science, technology, engineering, and mathematics (STEM) professionals is the opportunity to gain relevant work skills and capabilities through internships, apprenticeships, or related experiences such as work-based learning, cooperative education, and postdoctoral positions. We call these types of programs Work Experience Programs (WEPs), which include two defining characteristics: (1) an experiential component where participants engage in meaningful work and (2) an educational component where they acquire skills or knowledge. This report is the culmination of the second phase of IDA's portfolio review of DoD WEPs, and it provides an analysis of the perspective of the programs through interviews with program managers and mentors as well as the perspective of participants from a survey. In general, the responses from participants indicate positive experiences, and the interviews with program representatives shows that DoD WEPs are actively managing their programs to optimize outcomes and making adaptions when needed. Some challenges were identified, and a set of recommendations is provided to help programs address challenges.

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