Understanding STEM Education Opportunities to Build the Future Workforce

James Belanich, Franklin Moses,
Allyson Buytendyk, Christian Dobbins, Dan Kolodrubetz, and Alexis Pang
Institute for Defense Analyses
Alexandria, Virginia
jbelanic@ida.org, fmoses@ida.org, abuytend@ida.org, cdobbins@ida.org
dkolodru@ida.org, fmoses@ida.org, apang@ida.org

ABSTRACT

Building and maintaining a science, technology, engineering, and mathematics (STEM) workforce needs better explication to serve the needs of government, industry, and academia. Relevant experiences throughout education are key steps in a STEM professional's developmental lifecycle. This presentation focuses on strategies, methods, and practices used by DoD initiatives to inform others about how to promote STEM education and development of the future workforce. The presentation describes findings from a portfolio assessment of 54 work experience programs (WEPs), e.g., internships, scholarships, postdoctoral positions) that educate an estimated 5000+ participants annually. The portfolio uses various ways to meet program goals: 1) broad range of opportunities with 89% of the programs addressing multiple STEM areas, while 11% specialized in one area (e.g., cyber and artificial intelligence); 2) available at different education levels (e.g., high school, undergraduate, graduate, and post-graduate) with 13 programs for high school students, 29 to support Bachelor's degrees, and 36 for MS/PhD; 3) nationwide recruiting (approximately 75% of the programs recruit from a national pool of applicants) while some programs focused on local communities (e.g., single geographical area, DoD facility, or university lab) to attract talent to the area or foster participation of students in traditionally underrepresented groups; 4) DoD WEPs also offer enrichment activities (e.g., seminars, field trips, and competitions) combined with practical experience – developing knowledge, skills, and practices needed by STEM professionals; and 5) build a workforce through hiring incentives and opportunities. By illustrating such practices, this paper will help others decide about options for engaging and developing STEM professionals for the workforce of the future, and how these programs can benefit both the participants and the organizations that conduct them.

ABOUT THE AUTHORS

Dr. James Belanich has been a research psychologist conducting applied research projects for the Department of Defense for the past 20 years. Since 2012, at the Institute for Defense Analyses (IDA), he has conducted research analyzing human behavior, investigating workforce issues, evaluating STEM (science, technology, engineering, and math) education program, assessing training technology, and modeling intermediate force capabilities. He was also a member of the U.S. Army's Education Advisory Committee (2015-2021). From 2001 to 2012 he was a research psychologist at the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), managing ARI's research program, coordinating institute-wide activities, and conducting research on advanced training methods. He received his Ph.D. in Psychology – Learning Processes from the City University of New York in 2001.

Dr. Franklin Moses has been a research psychologist conducting applied research projects for the Department of Defense for more than 45 years. Since 2004, at the Institute for Defense Analyses (IDA), he conducted research about air and ground systems, command and control, intelligence analysis, and personnel, training, and education topics. Prior to 2004, he was a research psychologist at the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) responsible for projects in command, control, communications, computer and intelligence systems. In addition, he had a 4-year assignment to the Office of the Undersecretary of Defense (Acquisition) to review research and engineering projects performed by the three military departments. Dr. Moses received his Ph.D. in applied Experimental Psychology at Tufts University followed by a National Science Foundation postdoctoral fellowship at New York University.

Dr. Allyson Buytendyk has been a chemist conducting basic and applied research projects in support of the Department of Defense for 14 years. Since 2015, at the Institute for Defense Analyses (IDA), she conducted research involving STEM education, chemical sensing technologies, energetic materials and environmental pollutants. She was also a chemistry laboratory instructor at Marymount University (2016) and the College of Wooster (2016-2018) for the Buckeye Women In Science, Engineering, and Research (B-WISER) science camp. She received her doctorate in Chemistry from Johns Hopkins University.

Mr. Christian Dobbins is a psychologist who has been conducting research in support of the Department of Defense since 2017. His work at the Institute for Defense Analyses has focused on human behavior, workforce issues such as selection, assessment, and training, and evaluation of STEM education programs. Before coming to IDA, he completed a graduate research fellowship at the Army Research Institute for Social and Behavioral Sciences (ARI) where he worked on developing measures for Army officer selection. He received his master's degree in Industrial/Organizational Psychology from George Mason University in 2018.

Dr. Daniel Kolodrubetz has been a researcher on DoD projects for the past 5 years. Since 2018, at the Institute for Defense Analyses (IDA), he has conducted research evaluating STEM (science, technology, engineering, and math) education programs, assessing historical nuclear test data, and performing test and evaluation for underwater UXO (unexploded ordnance) remediation. He received his Ph.D. in physics from the Massachusetts Institute of Technology in 2016.

Dr. Alexis Pang has been a sociologist conducting basic and applied research projects in support of national security for more than 12 years. Since 2019, at the Institute for Defense Analyses (IDA), she conducted research on sexual misconduct, suicide, military personnel and veterans, STEM education, and ethics. Prior to IDA, she was a post-doctorate fellow at the U.S. Army Research Institute for the Behavioral and Social Sciences, where she worked on projects related to military culture and professionalism. Dr. Pang received her Ph.D. in Sociology from New York University.

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INTRODUCTION

For science, technology, engineering, and mathematics (STEM) professionals, their initial experiences in a workplace setting while still students or early in their careers are important milestones along a STEM development pathway. These are times when students leverage the skills they have learned in school while also gaining career awareness to explore options and improve their readiness for a potential STEM career (Ainslie & Huffman, 2019; Boudreau & Marx, 2019). DoD has several programs to provide participants with different opportunities to gain relevant work skills. For the purposes of this paper, we call them "work experience programs" (WEPs), which we define 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. This definition includes programs labeled as internships, apprenticeships, or related experiences, such as work-based learning, cooperative education, and postdoctoral positions.

Gaining relevant work experiences is a key step in a STEM professional's developmental lifecycle (Egarievwe, 2015). The overall STEM developmental lifecycle begins by attracting students in the earlier grades to become interested in STEM, as shown in Figure 1. Examples of early interest experiences provided by DoD may include STEM camps, hands on demonstrations, or possibly going on DoD lab tours. As students progress through high school grades, they receive more specific STEM education and training to build skills, which may then lead a student to pursue a STEM degree in college, gaining additional skills and abilities. Whether in high school or college, students may get their first taste of working in a STEM profession, potentially through real-world STEM work experiences during internships, co-ops, and post-doctoral positions that bridge the gap between education and work. These work experiences can help students explore careers and potentially identify their target jobs. DoD provides many opportunities where burgeoning STEM professionals can gain such experiences.

Figure 1. Steps Along the STEM Development Path That May Help Students Gain Experiences and Capabilities That May Ultimately Facilitate Them Targeting the Career and/or Job for Their Future.

The Department of Defense (DoD) conducts WEPs to facilitate the development of an estimated 5000+ participants annually. These programs are designed to inspire, cultivate, and develop students and early-career professionals to help provide for DoD's STEM needs for the future. The Institute for Defense Analyses (IDA) examined 54 such programs in the DoD portfolio of WEPs through the analysis of publicly available program information, interviews with key stakeholders, and analysis of program-generated data. The portfolio represents a variety of program goals to

include attracting interest in STEM, reaching underserved populations, increasing domain interest, identifying people to hire, facilitating early career growth, and creating a regional community of expertise. DoD's initiatives to replenish a workforce estimated at over 150,000 civilian STEM professionals suggest how others might seek and attract such talent.

IDA's portfolio analysis reveals that DoD programs 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. This portfolio of varied programs enables the numerous DoD agencies that participate to use the programs that best fit their organizational needs. For a large and complex organization like DoD, this portfolio perspective of distributing goals across options/programs maximizes overall outcomes while minimizing potential risk of missing opportunities (Anand, 2008; Mangram, 2013). It can meet a broad set of needs required to form relationships with the potential future workforce. The analysis provides a profile of what the programs do, what appears to be working well, and where there may be some on-going challenges. The current report plus emerging data about what is important for program and student success will inform DoD (and others) about program strengths and explicate where attention may be needed.

BACKGROUND

Most prior studies of the benefits of work experience emphasize private industry and non-DoD employment. There have also been some assessments of single Federal or DoD WEPs, but there have been no portfolio evaluations that have looked across the range of programs that DoD offers to provide a more comprehensive look at the opportunities and benefits of the full portfolio of options.

Industry Data: Hiring after WEPs

Participation in work experience programs can be a gateway to a job (Gault, Leach, Duey, 2010). Surveys published by NACE indicate the important role of work experience in student education and employment. A 2009 report by NACE[1] indicated that over 30% of people in internship programs received a job offer from a company because of their successful participation in an internship. A more recent survey (NACE 2022) of 115 employer organizations showed that about 70% of students who interned with a company were offered full-time, entry-level jobs.

A 2019 survey of students by NACE included an analysis of the impact of students' internships on their transition from college to work (NACE, 2019). 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 with a paid internship received nearly 50% more job offers than those who had either an unpaid internship or no internship.
- Paid interns expect to make $10,000 more than those who were unpaid interns and those who were never interns.
- Most paid and unpaid interns reported that their internships improved their professionalism, teamwork, communication, and critical-thinking/problem solving skills.

The employers who conduct these programs also see a benefit to the organization (Atkinson, Misko, & Stanwick, 2015). These benefits include the opportunity to identify talented students and recruit them for full-time employment post-graduation, getting work done by the student, and the opportunity to further develop the broader STEM pipeline in their industry. This indicates that there are benefits to the organization as well as the participants.

Federal Government Perspective

The Pathways Programs include the primary U.S. Government WEP by number of participants encompassing STEM as well as many other disciplines. Pathways consists of the Internship Program, the Recent Graduates Program, and the Presidential Management Fellows Program. These programs evolved from previous Federal-wide programs and

[1] The National Association of Colleges and Employers (NACE) tracks demand for work experience, recruiting practices, compensation, and their trends (https://www.naceweb.org).

started as Pathways in 2012 with the intent to facilitate potential careers in the Federal Government by training students and recent graduates. In 2016, OPM conducted an evaluation on the use and effectiveness of the Pathways Programs (OPM, 2016). This evaluation covered the first two years of Pathways and compared them with earlier programs. Pathways offers opportunities to many participants. For example, in FY14, a total of 6,800 interns and recent graduates entered Federal service through the Pathways Programs. Of those, some 2,597 were in DoD (471 Air Force, 562 Army, 1,177 Navy, and 387 Fourth Estate, which are agencies like the Missile Defense Agency, Defense Health Agency, or Defense Logistics Agency). These were a mix of STEM and non-STEM positions, but the 2016 evaluation did not distinguish among them. The sheer size of the program indicates the importance that the Federal Government places on WEPs—about 14.4% (15.1% for DoD) of hires come through the Pathways Programs. The 2016 evaluation indicates that the Pathways Programs are an important tool for bringing an enthusiastic, talented, and diverse workforce into the Federal Government.

There have been only a few evaluations with a specific focus on individual DoD STEM WEPs. One example is the Army's annual evaluations of its five apprenticeship programs that align with Army Educational Outreach Programs (AEOP) priorities and document the number of participants and demographics, program costs, and trends across years (Johnson, Sondergeld, & Walton, 2020). Another example is the Army Research Laboratory's (ARL) external review by the National Research Council's Laboratory Assessments Board of how ARL funds were used by Historically Black Colleges and Universities and Minority Institutions (HBCU/MI) to enhance STEM programs over the past decade. This qualitative assessment indicated that internships are a way to facilitate the development of a more diverse workforce (National Research Council, 2014). Another example was the Air Force Research Laboratory's internal evaluation of its Advanced Course in Cyber Security Bootcamp (ACE) to document topics covered in the program's activities, number of participants, as well as longer range outcomes like retention rates (Blair & Devendorf, 2019). The Air Force Institute of Technology surveyed participants in its internship program and found interests in increased mentoring, increased interaction with other students, and assistance for developing STEM skills that may improve future employment opportunities. The Navy's Problem-Based Initiatives for Powerful Engagement and Learning in Naval Engineering and Science (PIPELINES) program was evaluated to document how the program was developed and implemented over its first few years (Napoli et al., 2017). In addition, the DoD-wide Science, Mathematics, and Research for Transformation (SMART) Scholarship for Service program was evaluated by IDA, which conducted both a process and an outcome evaluation (Balakrishnan et al., 2018a; Balakrishnan et al., 2018b). The SMART evaluations indicated that the program attracted high-quality talent into DoD, but had some issues with long-term retention. Beyond these single-program evaluations, there has been no analyses on the portfolio of options across the DoD and its broad expanse of WEPs.

RATIONALE FOR COLLECTING DOD STEM DATA ABOUT WEPS

DoD has a large STEM workforce of Federal civilians and contractors and a need to continually attract and develop talent to maintain it. WEPs are a means for developing potential civilian STEM employees and are also a means for attracting the talent to join the DoD workforce. There are many programs across DoD Components, but no recent assessments across the DoD STEM community to identify the strategies, methods, and practices. The intent of this study is to illustrate how WEPS are done and the benefits provided in the portfolio of DoD STEM initiatives.

WEPs should represent the organizations who want to develop student interests in STEM so IDA initially analyzed where that interest exists in DoD science and engineering (S&E) organizations and facilities. The DoD has many programs that reach across the Services and Fourth Estate agencies (Figure 2). They allow participants to enhance their STEM skills and abilities, gain valuable experience, and learn how to effectively contribute to an organization or team. However, there is no prior description of what constitutes the DoD's WEP portfolio and the many mechanisms it employs to foster STEM interests and grow professionals.

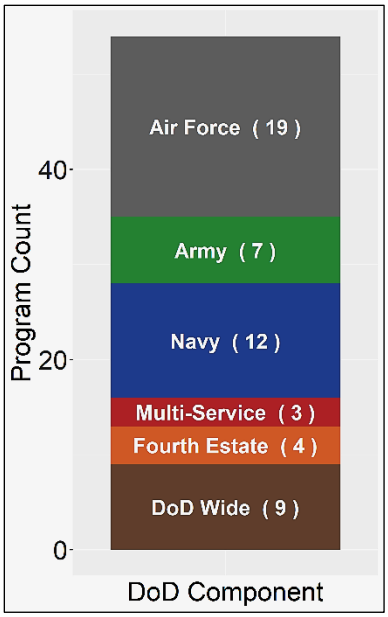

Figure 2. Number of Programs Across the Service Components and Fourth Estate Agencies.

METHOD

The first step was to determine the programs of the DoD organizations we should include in the study. Based on a literature review on internships, apprenticeships, work-based learning, and other work programs that involve a structured developmental component, the following three criteria were identified as necessary for a program to qualify for inclusion in our analysis: a) Meaningful Work: Participants conduct work that contributes to the STEM mission of the organization. Examples include conducting research, developing/testing software, or performing analysis at a research lab, and b) Educational Component: Program activities are geared toward increasing participants' skills in a STEM field. All of the programs that we analyzed were supported by DoD, in that the DoD either directly funded the program, sponsored it, or hosted participants.

With the above criteria we generated a list of DoD STEM WEPs to analyze for determining the principles they use to attract participants and build the future workforce. Three types of information sources were used for the WEP analysis:

1. Open-Source Documentation: Collectors used web searches to locate publicly available documentation on each program in the sample including program websites, information from application portals, news articles, LinkedIn profiles, and university websites.

2. Stakeholder Interviews: Open-source documentation was corroborated and supplemented with information about programs that emerged during short interviews held with representatives from them.

3. Other Documentation: Collectors examined documentation shared by DoD stakeholders.

The IDA team identified 54 programs that met study criteria and initially examined a few of those to learn more about the types of supporting information. This information was cross-walked with insights from a literature review about program features considered analytically important. A standardized profile document was then developed including a set of common metrics, measures, and categorical information. The profile template was organized into four sections:

1. Program Overview: Program goal/mission, high-level description, annual cycle and duration, program inception, anything unique or special about the program that does not fit within the other categories.

2. Participants: General description of participants, number of participants per year (and stability of that number), eligibility criteria, participants' work experience, benefits of the program for participants.

3. Program Management: Application process (including information on recruiting and selection), participant characteristics sought, program locations, mentoring and supervision of participants, centralization, description of how WEP performance is measured.

4. Impact of Program: How programs may benefit the organization, examples of work completed by participants, approximate percentage of past interns hired, and potential STEM development opportunities for participants.

RESULTS

DoD's STEM WEP programs have multifaceted designs that inspire, cultivate, and develop students and early-career professionals. DoD's WEPs use a variety of methods to attract participants, provide mentorship, and prepare students for a career as a STEM professional. Their strategies, methods, and practices attract many different kinds of students and promote their STEM education. DoD's programs encompass a wide range of goals, as shown in Table 1.

Table 1. STEM WEP Program Goals

Goal	Number of Programs
Increase Interest in STEM	31
Reach Underserved Populations	16
Increase Domain Interest	11
Identify People to Hire	11
Early Career Growth	10
Create Geographic/Regional community	5

The results from the analyses of what makes good WEPs are highlighted below in five sections about useful strategies, methods, and practices used by DoD initiatives in high school and above that can inform others about how to promote STEM education: 1) Broad Range of Opportunities; 2) Availability at different education levels; 3) Nationwide recruiting; 4) Enrichment and practical experience; 5) Building a workforce.

Broad Range of Opportunities

A portfolio of programs for an organization as big and multi-dimensional as DoD should provide a broad range of opportunities to participants. There is "no one size fits all". To gain a better understanding of what was considered desirable, IDA documented any academic majors and skillsets that programs advertised as preferred or required in their recruitment and application materials. Figure 3 plots the findings of this analysis into a word cloud, where the size of the skillset's name is driven by the number of times any program listed it at least once in its open-source documentation.

The word cloud illustrates the range of skillsets that DoD WEPs sought in their talent pools. We observe traditional STEM skillsets like "Chemistry" and "Mathematics," as well as skillsets like "Humanities" and "Operations Research." The word cloud also demonstrates that programs varied with respect to the specificity of their preferred skillsets. In the bottom left corner, for example, we see that at least one program sought participants who knew about something very specific, "Spectrum Warfare." On the other hand, several of the larger word cloud items (e.g., "Computer Science," "Electrical Engineering") were communicated on a much more general level. One of the larger word cloud items, near the upper left corner, is "Any STEM," which denotes the 16 programs that were open to participants with any type of STEM-related skillset. The broadness of the larger word cloud items suggests programs opted for more general language to attract participants, potentially because it afforded a larger recruitment pool for selecting key talent. The programs are available across the spectrum of STEM fields and disciplines. Of the WEPs in the sample, 11% specialized in one specific area of STEM, while the remaining 89% supported multiple areas. Some

of the most common disciplines identified include computer science, engineering (e.g., electrical, mechanical, and civil), mathematics, physics, and chemistry.

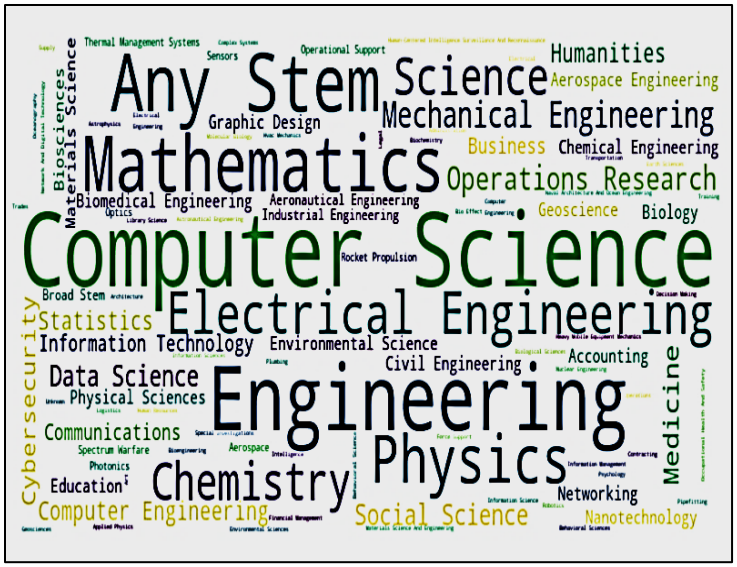

Figure 3. Word Cloud Showing the Many Varied Disciplines Identified in Program Recruitment Literature, with Word Size Indicating Prevalence of Use.

Availability to Different Education Levels of Participants

WEPs should provide participants with developmental opportunities that are suitable for multiple education levels. In DoD, there are WEPs available to students in high school, community colleges, undergraduate and graduate programs, as well as programs for students who have recently graduated (Figure 4). A few WEPs provide support to participants as they prepare for the next level of education, such as helping those working towards an associate's degree apply for bachelor's programs or those in undergraduate programs to pursue graduate degrees. Most programs are open to students at several education levels, which is why the values for bars in Figure 4 sum to greater than the 54 programs analyzed.

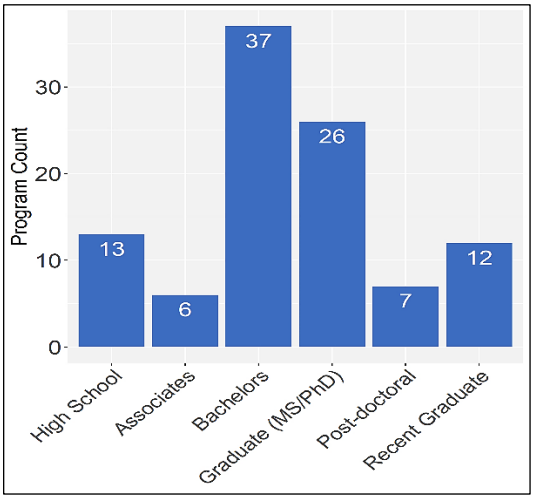

Figure 4. Number of Programs that Offer Opportunities to Students at Particular Education Levels.

The number of options that DoD offers is striking, from programs that focus exclusively on students at 2-year community colleges to programs that cater to everyone from high school students to postdoctoral fellows. In other words, DoD WEPs offer professional development and learning opportunities for people at any stage of their

educational careers. There were 32 WEPs (59% of the sample) that catered to more than one type of educational background, with the most popular combination being undergraduates and graduate students (16 programs). Six additional programs catered to two educational stages, two programs catered to three educational stages, six programs catered to four educational stages, and one program offered activities for five educational stages.

Some programs add value by guiding students across programs along their STEM development path (i.e., STEM pipeline). The variety of education levels and duration of WEPs provide participants with ample opportunities to stay in the STEM developmental pipeline over multiple years. We observed three general methods for keeping students in the STEM pipeline:

- Formal organizational networks where there is an explicit link from one program to another program many times within the same organization.
- Informal program connections where participants in one program may learn about other DoD opportunities.
- Programs that explicitly promote student participation in the next level of education beyond their current educational objective.

One indirect benefit of these many different kinds of WEPs is to allow organizers the latitude to engage different student groups. For example, 16 programs sought to encourage participants from demographic groups that are traditionally underrepresented or underserved in STEM education; 10 programs seek early career growth.

Different durations of WEPs are valuable to make them available for most types of STEM interests from short sessions that familiarize students with what STEM is about all the way to intense research experiences with well-established practitioners for graduate students and postdoctoral fellows. The programs in DoD (Figure 5) primarily are structured for summer sessions of 8–12 weeks to reach the large number of students interested in becoming familiar with STEM and its methods. About a third of the programs are year-round, most of them with the opportunity for multiyear experiences. More specifically, 31 programs seek to increase interest in STEM while 11 programs target students in STEM domains with DoD priorities such as: autonomy/artificial intelligence (AI), engineering, social sciences, test and evaluation, and high-performance computing.

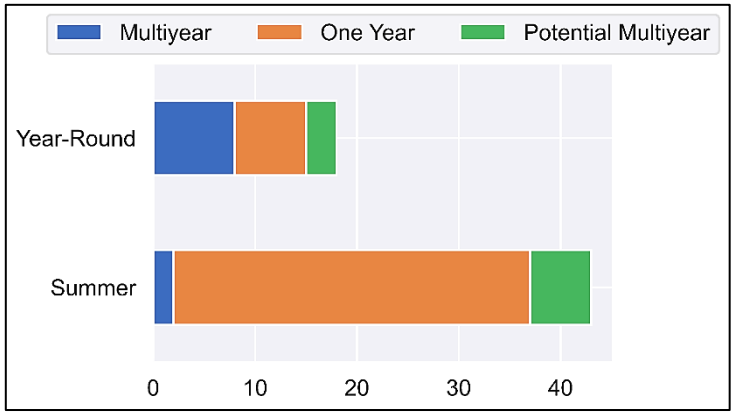

Figure 5. Number of Programs that Offer WEPS of Varying Duration.

Nationwide Recruiting for Broad Access

An important strategy for WEPs is to offer opportunities to attract participants from the appropriate locations based on the needs of the organizations. Since DoD has facilities across the nation, it makes sense that they recruit from many parts of the country. For DoD, Figure 6 shows the distribution of programs based on how many locations they operate. The number of locations for the programs we identified followed a bimodal pattern. Many programs had 1-4 locations, while several programs had 30 or more locations. We made estimates about participation for 41 programs of the 54 we analyzed. Based on these, DoD WEPs reach between 5,000 or more participants per year. The net result

is a geographic community with extensive regional presence. This number reflects a considerable impact on attracting our nation's future STEM workforce.

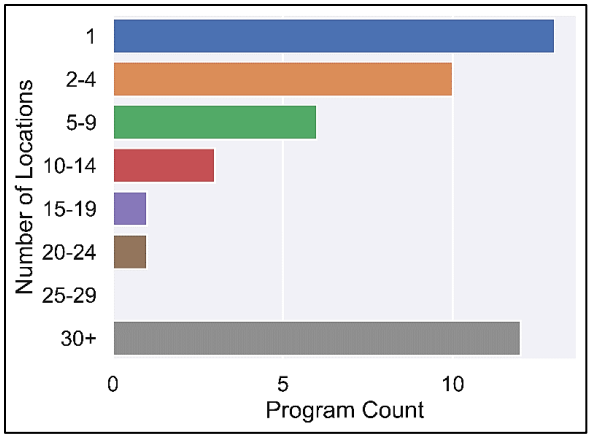

Figure 6. Distribution of Programs Based on Number of Locations Where WEPS Are Conducted.

Most programs in the sample (76%) encouraged applications from anywhere in the country. For example, an Air Force program recruits high school students through postdoctoral fellows, from anywhere in the country, to work with mentors on projects related to sensing and autonomy technologies. Notably, the program offers several benefits that may have made it easier for people from afar to participate, namely: competitive pay, free housing, travel support, and a wide range of enrichment activities. Approximately 9% of the sample sought participants from the same state or region. For example, the Air Force has a program for southwestern Ohio that technically is open to participants from around the country, but focused its recruitment efforts on a few universities in the region. This approach was well aligned with one of their program goals: bolstering the STEM Workforce in southwestern Ohio. Similarly, another internship program in Rome, New York, only draws students from New York universities that are part of a collaborative agreement with local Air Force facilities. Programs like these regularly had a goal to create some sort of geographic or regional community to bolster the workforce in a particular area. About 7% of the sample aimed to recruit participants locally, from the same city or town. The Naval postgraduate school offers a good example of a hyperlocal program. The program recruits high achieving STEM students from a community college close (20-minute drive or 1-hour bus ride) to the work site. Such proximity may make it easier for students to participate, especially if they do not have cars and require public transportation. The short distance between sending and receiving sites may also make it easier for program alumni to maintain ties after the summer ends. While the program primarily takes place during the summer, select participants continue to work with their program mentors during the school year.

How a program is managed—locally or centrally—also influences students' perceptions of them. For programs that were only in one location, they were always managed locally giving them a personal connection with students. However, for the programs that are in many locations, the management of the program was done through different means affecting whether students felt like "just one more of many applicants" or not. One method that is more personable is to have a single entity provide oversight and coordination of how the program is conducted at the distributed locations. For example, AEOP manages several WEP programs (SEAP, URAP, REAP, HSAP, and CQL). Several programs blend components of local and component-level management along with a third-party contractor to handle administration and day-to-day execution functions. The SMART Program Office in USD R&E employs another approach that begins less personable with central oversight and formal management control of the program in addition to contract support for the program's administration (e.g., recruiting, receiving the applications, organizing the selection process, maintaining records, and coordinating payments). However, the individual sponsoring facilities for SMART control the activities that are specific to each WEP location giving program execution a very student-oriented flavor. The best balance of program management style and students' experiences in DoD remains unclear.

Enrichment and Practical Experience

WEPs seem most beneficial when they promote enrichment combined with practical experience —knowledge, skills, and practices needed by STEM professionals. For example, students in high school can benefit by the opportunity to

meet STEM practitioners who introduce and demonstrate real-world STEM topics. At more advanced levels, students who work with these professionals receive mentorship while learning about their mentor's field. Such mentorship opportunities are valuable for developing STEM professionals. In DoD, the combination of enrichment and practical experience is enhanced by using settings such as government labs, government facilities, and also government-funded university research labs. Even in many of the summer programs, participants usually join ongoing government projects, help to advance the work, and gain practical experience. In addition, these programs typically include some meaningful enrichment activities (see Figure 7 for some examples of the types of activities).

Figure 7. Enrichment and Practical Experience.

Participants' experiences generally focus on particular STEM projects described as well-planned, mentor guided, and designed to build technical skills. Professional development activities also frequently are part of DoD's WEPs. For some programs, these activities include the opportunity to present one's work to develop public-speaking and presentation skills. Some participants also develop skills through publishing or being part of a team that publishes its research in a professional journal. Other opportunities include attending seminars about their STEM activities, and going on field trips to experience STEM in action. Combined with their work on projects, such activities help students grow their abilities in STEM, increase their awareness of STEM efforts and opportunities throughout the DoD, and gain the knowledge and experiences they will need to turn their educational and professional aspirations into realities.

Building a Workforce

Ultimately, building the workforce is a guiding force that underlies having WEPs for employers and perhaps also for students. DoD WEPs certainly aim to enhance the future STEM workforce in ways that benefit both participants and DoD host agencies. Participants gain valuable STEM work skills and experiences while the DoD benefits by getting work done and assessing talent that may be hired in the near-future. Programs create opportunities for students to grow their abilities as STEM scientists and junior professionals using several types of activities. An additional benefit for several of DoD's programs is for participants to gain a security clearance, a valuable credential when looking for employment. Participants join or lead STEM projects that support the hosting agency's mission, working closely alongside government employees and staff. Through this experience, they are able to contribute their ideas and perspectives to some of the most pressing challenges in national security.

WEPs provide a benefit to host agencies by creating a strategic opportunity for them to access the upcoming talent pool. These benefits include supplementing the workforce, aiding the hiring process, and increasing the STEM workforce relevant to the organization. Several programs in the sample used WEP activities as a way to assess participants for permanent positions immediately after graduation or at a later time after further education: 11 programs have the goal to identify people to hire. Some programs have formal hiring mechanisms and designated

hiring authorities through which successful participants are placed into permanent, full-time positions within Government. This hiring incentive approach lines up closely with how private industry often uses internships. Thus, WEPs provide a means for transitioning successful participants into jobs and building the workforce.

CONCLUSION

DoD has many needs (i.e., large number of people with many different STEM talents at many locations across the country) for their future workforce, so having a broad portfolio of varied programs enables them to support those needs. The intent of this study was to gain a broad understanding of the landscape of STEM work experience programs in DoD that could benefit others. The DoD has many such programs across the Services and components, and there has not been a prior compendium of them. By compiling the range of programs, it provides lessons learned and examples of program execution that can be used by others if they are looking to develop their own program or refine a pre-existing one. An ongoing study of the portfolio will assess the program and participant perspectives on what is going well and what can benefit from improvement; this additional assessment will continue to provide lessons learned.

Filling the many varied DoD STEM needs of tomorrow requires programs that facilitate the development of STEM students and early-career professionals of today. The DoD's approach offers a broad range of WEP opportunities to develop a diversity of STEM professionals because one size does not fit all. The programs address a varied set of goals that are important to the organizations running them but also to participants, the essential STEM talent for the future. The strategies, methods, and practices that DoD initiatives use to promote STEM education help to bridge the gap between sitting in the classroom and completing meaningful STEM work to make real-world contributions. By connecting students and junior professionals with DoD STEM opportunities, WEPs position themselves to address the perennial need to recruit and develop future generations of a STEM workforce.

DoD has s large need for new STEM talent to continually replenish and build its workforce. An important set of tools for this are the range of WEPs that DoD uses to engage and train their potential workforce of the future. To do this, DoD WEPs provide opportunities to participants who are midway along the path to a potential STEM career and provide them with a broad range of professional enrichment opportunities that are available to students at different education levels across the nation.

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