Army Educational Outreach Program

Science & Engineering Apprenticeship Program
2014 Annual Program Evaluation Report

ARMY EDUCATIONAL OUTREACH PROGRAM

SEAP_03_06032015

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Report SEAP_03_05152015 has been prepared for the AEOP Cooperative Agreement and the U.S. Army by Virginia Tech in collaboration with Horizon Research, Inc. under award W911NF-10-2-0076.

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Executive Summary

The Science & Engineering Apprenticeship Program (SEAP), managed by the American Society for Engineering Education (ASEE), is an Army Educational Outreach Program (AEOP) that matches talented high school students (herein referred to as apprentices) with practicing Army Scientists and Engineers (Army S&Es, herein referred to as mentors), creating a direct apprentice-mentor relationship that provides apprentice training that is unparalleled at most high schools. SEAP apprentices receive firsthand research experience and exposure to Army research laboratories during their summer apprenticeships. The intent of the program is that apprentices will return in future summers and continue their association with their original laboratory and mentor and upon graduation from high school participate in the College Qualified Leaders (CQL) program or other AEOP or Army programs to continue their relationship with the laboratory. Through their SEAP experience, apprentices are exposed to the real world of research, gain valuable mentorship, and learn about education and career opportunities in STEM. SEAP apprentices learn how their research can benefit the Army as well as the civilian community.

In 2014, SEAP provided outreach to 92 apprentices and 86 Army S&Es (all adults who acted as mentors) at nine Army laboratory sites (herein called SEAP sites). The number of apprentices represents a 9% decrease from the 101 participants in 2013; the number of applicants was essentially unchanged (810 in 2014 vs. 814 in 2013).

This report documents the evaluation of the 2014 SEAP program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The assessment strategy for SEAP included post-program questionnaires distributed to all apprentices and mentors, 4 focus groups with apprentices, 4 focus groups with mentors, and an annual program report compiled by ASEE.

2014 SEAP Fast Facts	
Description	STEM Apprenticeship Program – Summer, at Army laboratories with Army S&E mentors
Participant Population	9th-12th grade students
No. of Applicants	810
No. of Students (Apprentices)	92
Placement Rate	11%
No. of Adults (Mentors)	86
No. of Army S&Es	86
No. of Army Research Laboratories	9
No. of K-12 Schools	58
No. of K-12 Schools – Title I	N/A
Total Cost	$259,719
Stipend Cost (paid by participating labs)	$220,966
Administrative Cost to ASEE	$38,753

Cost Per Student Participant	$2,823

The response rates for the post-program apprentice and mentor surveys were 64% and 18%, respectively. The margin of error for both surveys is larger than generally acceptable (7.9% at 95% confidence[1] for the apprentice survey and 21.7% at 95% confidence for the mentor survey), indicating that the samples may not be representative of their respective populations and caution is needed in interpreting the results.

Summary of Findings

The FY14 evaluation of SEAP collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in the following table.

2014 SEAP Evaluation Findings	
Participant Profiles	
SEAP had some success in providing outreach to participants from historically underrepresented and underserved populations.	• SEAP has been somewhat successful in attracting participation of female students; 40% of FY14 participants were female—a population that is historically underrepresented in engineering fields.
	• SEAP has had limited success in providing outreach to students from historically underrepresented and underserved race/ethnic groups. Of enrolled apprentices in FY14, 13% identify as Black or African American, 5% as Native American or Alaskan Native, and 2% as Native Hawaiian or Other Pacific Islander.
SEAP appears to have had limited success in engaging a diverse group of adult participants as STEM mentors.	• Of the 17 respondents to the mentor questionnaire, two-thirds (65%) were males and the large majority identified themselves at White (82%). Because of the nature of the SEAP program, nearly all responding mentors were scientists, engineers, or mathematics professionals (94%). However, because of the low response rate to the questionnaire, the respondents may not be representative of the population of SEAP mentors.
Actionable Program Evaluation	
Some efforts were made by ASEE to market SEAP to underrepresented and underserved populations. The impact of these efforts is	• A number of strategies were used by ASEE to market SEAP and recruit students from schools and school networks identified as serving large populations of traditionally underrepresented and underserved students. These efforts included sending email blasts to teachers, guidance counselors, and principals in areas nearby participating SEAP labs; mailing promotional materials when

[1] "Margin of error @ 95% confidence" means that 95% of the time, the true percentage of the population who would select an answer lies within the stated margin of error. For example, if 47% of the sample selects a response and the margin of error at 95% confidence is calculated to be 5%, if you had asked the question to the entire population, there is a 95% likelihood that between 42% and 52% would have selected that answer. A 2-5% margin of error is generally acceptable at the 95% confidence level.

unclear as most apprentices report learning about the program from alternative sources.	requested by teachers (e.g., AEOP brochures); and sharing information at events such as "Hispanic Association for Colleges and Universities Conference" and "Invent it. Build it. Career Expo at the Society of Women Engineers Conference."
	• Similar to FY13, FY14 apprentices frequently learned about the SEAP program from an immediate family member (43%), a teacher or professor (21%), or a past participant of SEAP (19%).
SEAP apprentices are motivated by opportunities to learn about STEM, typically in ways not possible in school.	• Apprentices were motivated to participate in SEAP because of their interest in STEM (88%), the opportunity to learn in ways that are not possible in school (82%), the desire to learn something new or interesting (79%), and the desire to expand laboratory or research skills (68%).
SEAP engages apprentices in meaningful STEM learning, through team-based and authentic STEM experiences.	• Most apprentices (70-86%) report interacting with STEM professionals, applying STEM to real-life situations, learning about STEM topics, learning about cutting-edge STEM research, and learning about different STEM careers on most days or every day of their SEAP experience.
	• Apprentices had opportunities to engage in a variety of STEM practices during their SEAP experience. For example, 79% reported participating in hands-on activities; 73% communicating with other students about STEM; and 73% practicing using laboratory or field techniques, procedures, and tools on most days or every day.
	• Similar to FY13, apprentices in FY14 reported greater opportunities to learn about STEM and greater engagement in STEM practices in their SEAP experience than they typically have in school.
	• Large proportions of mentors report using strategies to help make learning activities relevant to apprentices, support the needs of diverse learners, develop apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
SEAP promotes DoD STEM research and careers but can improve marketing of other AEOP opportunities.	• The vast majority of responding apprentices have favorable opinions of what DoD researchers do and the value of DoD research more broadly.
	• Most apprentices (83%) reported learning about multiple DoD STEM careers during their participation in SEAP. Mentors were most likely to rate participation in SEAP, administrators or site coordinators, and invited speakers or career events as "very much" useful in their efforts to expose their apprentices to different DoD STEM careers.
	• As in FY13, the vast majority of FY14 apprentices reported never hearing about or never participating in AEOP programs beyond SEAP. Similarly, responding mentors generally had no awareness of or past participation in other AEOP programs.
The SEAP experience is valued by apprentices and mentors.	• In general, responding apprentices indicated being satisfied with their SEAP experience, highlighting the instruction and mentorship they received during program activities.

	• The vast majority of responding mentors indicated having a positive experience. Further, many commented on the benefits the program provides apprentices, including opportunities for apprentices to have hands-on/real-life research experiences and the introduction of STEM at an early age.
Outcomes Evaluation	
SEAP had positive impacts on apprentices' STEM knowledge and competencies.	• A vast majority of apprentices reported large or extreme gains on their knowledge of what everyday research work is like in STEM; how professionals work on real problems in STEM; research conducted in a STEM topic or field; a STEM topic or field in depth; and the research processes, ethics, and rules for conduct in STEM. These impacts were identified across all demographic subgroups examined.
	• Many apprentices reported large or extreme gains in their abilities to do STEM, including such things as communicating information about their design processes and/or solutions in different formats, carrying out procedures for an investigation, supporting a proposed explanation with data from investigations, and displaying numeric data from an investigation in charts or graphs to identify patterns and relationships.
SEAP had positive impacts on apprentices' 21st Century Skills.	• A large majority of apprentices reported large or extreme gains on their ability to build relationships with professionals in the field, make changes when things do not go as planned, stick with a task until it is complete, and communicate effectively with others.
SEAP positively impacted apprentices' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many apprentices reported a large or extreme gain on their preparedness for more challenging STEM activities (77%), confidence to do well in future STEM courses (75%), and ability to think creatively about a STEM project or activity (74%). In addition, 63% reported increased confidence in their ability to contribute to STEM (73%) and increased sense of belonging to a STEM community (65%).
	• A majority of apprentices indicated that as a result of SEAP, they were more likely to work on a STEM project or experiment in a university or professional setting, look up STEM information at a library or on the internet, mentor or teach other students about STEM, and take an elective STEM class.
SEAP did not impact apprentices' education or career aspirations, likely because of the entry requirements of the program.	• Both before and after participating in SEAP, most apprentices indicated wanting to pursue an advanced degree after college.
	• A substantial proportion of apprentices expressed uncertainty about their career aspirations, both before and after participating in SEAP. The remaining apprentices generally indicating a desire to pursue a STEM-related career, both before and after participating in SEAP.
Apprentices show interest in future AEOP opportunities.	• Consistent with FY13, FY14 apprentices indicated being "very much" interested in participating in future AEOP programs, including SEAP (61%), CQL (47%), and SMART (45%).

SEAP raised apprentice awareness and appreciation of DoD STEM research and careers, as well as their interest in pursuing a STEM career with the DoD.	• A majority of apprentices reported that they had a greater awareness (78%) and appreciation (88%) of DoD STEM research and careers. In addition, 68% indicated that SEAP raised their interest in pursuing a STEM career with the DoD.

Recommendations

1. Although it is not an objective of SEAP in particular, the AEOP portfolio has the goal of attracting students from groups historically underrepresented and underserved in STEM. SEAP has had limited success in this area—a finding that is fairly consistent with previous years, indicating that this area is one in which SEAP can continue to improve. Although ASEE made some efforts to reach out to minority-serving schools and networks, the majority of apprentice survey respondents indicated learning about SEAP through other means (most frequently through an immediate family member (48%)). Many responding mentors indicted recruiting their apprentices through personal networks (e.g., workplace colleagues, personal acquaintances, university faculty). The lack of success in recruiting students from groups historically underrepresented and underserved in STEM to SEAP is shaped by multiple factors including the recruitment and selection process that is used by mentors and the marketing of SEAP to target groups by ASEE. Improvements can be made in all areas. The program may want to consider additional/alternate means of recruiting and selecting apprentices and mentors to ensure that SEAP includes diverse groups of highly talented participants. For example, the IPA may need to look at each site and compare its geographical reach to the target population. In addition, each site may want to compare the population of potential apprentices in its area to the applicant pool to identify gaps in its outreach to historically underrepresented and underserved populations.

2. Given the goal of having apprentices progress from SEAP into other AEOP programs, the program may want to work with sites to increase apprentices' exposure to AEOP. Small percentages of mentors explicitly discussed other AEOPs with their apprentices, typically GEMS (35%), SMART (24%), and GEMS Near Peers (24%). Further, although many apprentices expressed interest in participating in other AEOP programs, a substantial proportion indicated having no interest. The program may want to work with each site to ensure that all apprentices have access to structured opportunities that both describe the other AEOPs and provide information to apprentices on how they can apply to them. To this end, SEAP should ensure that mentors: (1) are aware of the intended focus on exposing apprentices to AEOP/DoD programs, (2) have the resources to educate themselves and their apprentices about these programs, and (3) are equipped to help apprentices apply to other AEOP/DoD programs. In addition, given the limited use of the program website, print materials, and social media, the program should consider how these resources could be modified or leveraged to provide mentors and apprentices with more information about AEOP initiatives and facilitate increased enrollment.

3. Efforts should be undertaken to improve participation in evaluation activities, as the low response rates for both the apprentice and mentor questionnaires raise questions about the representativeness of the results. Improved communication with the individual program sites about expectations for the evaluation may help. In addition, the evaluation instruments may need to be streamlined as perceived response burden can affect participation. In particular, consideration should be given to whether the parallel nature of the apprentice and mentor questionnaires is necessary, with items being asked only of the most appropriate data source. In addition, items that are collected through the new, centralized registration (e.g., demographics) and those that may provide difficult-to-interpret data should be considered for removal.

4. The number of applications for SEAP apprenticeships (810 applications for 92 funded apprenticeships) is indicative of a substantial unmet need. Although 14 Army research laboratories were designated as SEAP sites in FY14, 5 of these locations did not host apprentices, despite receiving applications. In order to sustain, and potentially increase, student participation, the program will likely need to intensify its efforts to recruit Army S&Es to serve as mentors. These efforts may require examining and modifying program- and site-level structures, processes, and resources that both enable and discourage Army S&Es' participation.

5. A small number of apprentices (2%) reported that they did not have a research project to work on during their SEAP experience. In addition, 9% indicated that they were not at all satisfied with the amount of time spent doing meaningful research, and 14% indicated that their research mentor was available only half of the time or less often. Given that the goal of SEAP is for students to gain exposure to the real world of research, it is important that the project monitors the quality of apprentices' research experiences. Apprentices who do not have positive experiences in the program are unlikely to continue their association with their original laboratory and mentor in future summers, unlikely to enroll in future AEOP programs, and unlikely to recommend AEOP programs to other students.

Introduction

The Army Educational Outreach Program (AEOP) vision is to offer a collaborative and cohesive portfolio of Army sponsored science, technology, engineering and mathematics (STEM) programs that effectively engage, inspire, and attract the next generation of STEM talent through K-college programs and expose them to Department of Defense (DoD) STEM careers. The consortium, formed by the Army Educational Outreach Program Cooperative Agreement (AEOP CA), supports the AEOP in this mission by engaging non-profit, industry, and academic partners with aligned interests, as well as a management structure that collectively markets the portfolio among members, leverages available resources, and provides expertise to ensure the programs provide the greatest return on investment in achieving the Army's STEM goals and objectives.

This report documents the evaluation of one of the AEOP elements, the Science & Engineering Apprentice Program (SEAP). SEAP is managed by the American Society for Engineering Education (ASEE). The evaluation study was performed by Virginia Tech, the Lead Organization (LO) in the AEOP CA consortium. Data analyses and reports were prepared in collaboration with Horizon Research, Inc.

AEOP Goals

Goal 1: STEM Literate Citizenry.

- Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.

Goal 2: STEM Savvy Educators.

- Support and empower educators with unique Army research and technology resources.

Goal 3: Sustainable Infrastructure.

- Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.

Program Overview

SEAP is an AEOP pre-collegiate program for talented high school students that matches these students (herein referred to as apprentices) with practicing Army Scientists and Engineers (herein referred to as mentors) for an eight-week summer apprenticeship at an Army research facility. This structure creates a direct apprentice-mentor relationship that provides apprentices training that is unparalleled at most high schools. SEAP apprentices receive firsthand research experience and exposure to Army research laboratories. The intent of the program is that apprentices will return in future summers and continue their association with their original laboratories and mentors, and upon graduation from high school participate in the College Qualified Leaders (CQL) program, or other AEOP or Army programs, to continue that relationship. Through their SEAP experience, apprentices are exposed to the real world of research, gain valuable mentorship, and learn about education and career opportunities in STEM. SEAP apprentices also learn how their research can benefit the Army as well as the civilian community.

In 2014, SEAP was guided by the following objectives:

1. Acquaint qualified high school students with the activities of DoD laboratories through summer research and engineering experiences;
2. Provide students with opportunities in and exposure to scientific and engineering practices and personnel not available in their school environment;
3. Expose those students to DoD research and engineering activities and goals in a way that encourages a positive image and supportive attitude toward our defense community;
4. Establish a pool of students preparing for careers in science and engineering with a view toward potential government service;
5. Prepare these students to serve as positive role models for their peers thereby encouraging other high school students to take more science and math courses; and
6. Involve a larger percentage of students from previously underrepresented segments of our population, such as women, African Americans, and Hispanics, in pursuing science and engineering careers.

As can be seen in Table 1, apprenticeships were completed at 9 of the 14 Army research laboratories receiving applications (as compared to 11 laboratories in 2013). The 92 participants reflect a 9% decrease from 101 participants in 2013, although the number of applicants was essentially unchanged (810 in 2014 vs. 814 in 2013). Several factors may have contributed to the decline in SEAP participants, including delayed opening of the 2014 SEAP application; administrative challenges presented by the security and additional background requirements needed when mentoring minors, resulting in fewer available positions; and fewer Army S&Es available to mentor SEAP apprentices over the summer.

Table 1. 2014 SEAP Site Applicant and Enrollment Numbers			
2014 SEAP Site	**Location**	**No. of Applicants**	**No. of Enrolled Participants**
US Army Aviation and Missile Research Development and Engineering Center – Aviation Applied Technology Directorate (AATD)	Langley-Eustis, VA	5	0
US Army Aviation and Missile Research Development and Engineering Center – Aviation Engineering Directorate (AED)	Corpus Christ, TX	6	0
US Army Aviation and Missile Research Development and Engineering Center – Aeroflightdynamics Directorate (AFDD)	Moffett Field, CA	9	0
US Army Aviation and Missile Research Development and Engineering Center – Redstone Arsenal (AMRDEC)	Huntsville, AL	100	22
US Army Aviation and Missile Research Development and Engineering Center – System Simulation and Development Directorate (SSDD)	Colorado Springs, CO	1	0
US Army Center for Environmental Health Research at Fort Detrick (USACEHR)	Fort Detrick, MD	76	4
US Army Medical Research Institute of Chemical Defense (USAMRICD)	Aberdeen, MD	74	15
US Army Medical Research Institute for Infectious Diseases at Fort Detrick (USAMRIID)	Fort Detrick, MD	10	5
US Army Research Laboratory – Aberdeen Proving Grounds (ARL-APG)	Aberdeen, MD	99	11
US Army Research Laboratory – Adelphi (ARL-A)	Adelphi, MD	117	17
Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL)	Champaign, IL	24	7
Engineer Research & Development Center – Mississippi (ERDC-MS)	Vicksburg, MS	17	0
Engineer Research & Development Center – Topographic Engineering Center (ERDC-TEC)	Alexandria, VA	85	3
Walter Reed Army Institute of Research (WRAIR)	Silver Spring, MD	187	8
TOTAL		**810**	**92**

The total cost of the 2014 SEAP program was $259,719. This cost includes administrative costs of $38,753 and $220,966 for participant stipends. The average cost per participant was $2,823. Table 2 summarizes these and other 2014 SEAP program costs.

Table 2. 2014 SEAP Program Costs	
2014 SEAP - Cost Per Participant	
Total Student Participants	92
Total Program Cost	$259,719
Cost Per Participant	**$2,823**
2014 SEAP - Cost Breakdown Per Participant	
Average Administrative Cost to ASEE	$421
Average Participant Stipend	$2,402
Cost Per Participant	**$2,823**

Evidence-Based Program Change

Based on recommendations from the FY13 summative evaluation report, the AEOP identified three key priorities for programs in FY14: (1) increase outreach to populations that are historically underserved and underrepresented in STEM; (2) increase participants' awareness of Army/DoD STEM careers; and (3) increase participants' awareness of other AEOP opportunities. ASEE initiated the following program changes/additions to the FY14 administration of the SEAP program in light of the key AEOP priorities, the FY13 SEAP evaluation study, and site visits conducted by ASEE and the LO.

I. **Increase outreach to populations that are historically underserved and underrepresented in STEM.**
   a. ASEE wrote and implemented a 2014 Outreach Plan for SEAP that included:
      i. A mass email campaign targeting 4,000+ teachers, guidance counselors, and principals in schools that are in close proximity to SEAP program sites; and
      ii. Outreach efforts at conferences/expos that serve diverse audiences.
         1. Invent it. Build it. Career Expo at the Society of Women Engineers Conference
         2. Hispanic Association for Colleges and Universities Conference

II. **Increase participants' awareness of other AEOP opportunities.**
   a. ASEE did a direct mailing of AEOP promotional materials upon request from teachers.
   b. ASEE emailed current and previous SEAP participants with links to AEOP social media.

FY14 Evaluation At-A-Glance

Virginia Tech, in collaboration with ASEE, conducted a comprehensive evaluation study of the SEAP program. The SEAP logic model below presents a summary of the expected outputs and outcomes for the SEAP program in relation to the AEOP and SEAP-specific priorities. This logic model provided guidance for the overall SEAP evaluation strategy.

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• Army sponsorship • ASEE providing oversight of site programming • Operations conducted by nine Army labs • Ninety-two students participating in SEAP apprenticeships • Ninety-five Army S&Es serving as SEAP mentors • Stipends for apprentices to support means and travel • Centralized branding and comprehensive marketing • Centralized evaluation	• Students engage in authentic STEM research experiences through hands-on summer apprenticeships at Army labs • Army S&Es supervise and mentor students' research • Program activities that expose students to AEOP programs and/or STEM careers in the Army or DoD	• Number and diversity of student participants engaged in SEAP • Number and diversity of Army S&Es engaged in SEAP • Number and Title 1 status of high schools served through student engagement • Students, Army S&Es, site coordinators, and ASEE contributing to evaluation	• Increased student STEM competencies (confidence, knowledge, skills, and/or abilities to do STEM) • Increased student interest in future STEM engagement • Increased students awareness of and interest in other AEOP opportunities • Increased student awareness of and interest in STEM research and careers • Increased student awareness of and interest in Army/DoD STEM research and careers • Implementation of evidence-based recommendations to improve SEAP programs	• Increased student participation in other AEOP opportunities and Army/DoD-sponsored scholarship/ fellowship programs • Increased student pursuit of STEM coursework in secondary and post-secondary schooling • Increased student pursuit of STEM degrees • Increased student pursuit of STEM careers • Increased student pursuit of Army/DoD STEM careers • Continuous improvement and sustainability of SEAP

The SEAP evaluation gathered information from multiple participant groups about SEAP processes, resources, activities, and their potential effects in order to address key evaluation questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and SEAP program objectives.

Key Evaluation Questions

- What aspects of SEAP motivate participation?
- What aspects of SEAP structure and processes are working well?
- What aspects of SEAP could be improved?
- Did participation in SEAP:
  - Increase apprentices' STEM competencies?
  - Increase apprentices' interest in future STEM engagement?
  - Increase apprentices' awareness of and interest in other AEOP opportunities?
  - Increase apprentices' awareness of and interest in Army/DoD STEM research and careers?

The assessment strategy for SEAP included apprentice and mentor questionnaires, 4 focus groups with apprentices and 4 with mentors, and an annual program report submitted by ASEE. Tables 3-7 outline the information collected in

apprentice and mentor questionnaires and focus groups, as well as the program report that is relevant to this evaluation report.

Table 3. 2014 Apprentice Questionnaire	
Category	**Description**
Profile	**Demographics:** Participant gender, age, grade level, race/ethnicity, and socioeconomic status indicators
	Education Intentions: Degree level, confidence to achieve educational goals, field sought
Satisfaction & Suggestions	Benefits to participants, suggestions for improving programs, overall satisfaction
AEOP Goal 1	**Capturing the Apprentice Experience:** In-school vs. In-program experience, mentored research experience and products
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	STEM Identity: Gains in STEM identity, intentions to participate in STEM, STEM-oriented education and career aspirations, contribution of AEOP
	AEOP Opportunities: Past participation, awareness of, and interest in participating in other AEOP programs; contribution of AEOP; impact of AEOP resources
	Army/DoD STEM: Exposure to Army/DoD STEM jobs, attitudes toward Army/DoD STEM research and careers, change in interest for STEM and Army/DoD STEM jobs; contribution of AEOP, impact of AEOP resources
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies (apprentices respond to a subset)
	Comprehensive Marketing Strategy: How apprentices learn about AEOP, motivating factors for participation, impact of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers

Table 4. 2014 Mentor Questionnaire	
Category	**Description**
Profile	**Demographics:** Participant gender, race/ethnicity, occupation, past participation
Satisfaction & Suggestions	Awareness of SEAP, motivating factors for participation, satisfaction with and suggestions for improving SEAP programs, benefits to participants
AEOP Goal 1	**Capturing the Apprentice Experience:** In-program experience
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	AEOP Opportunities: Past participation, awareness of other AEOP programs; efforts to expose apprentices to AEOPs, impact of AEOP resources on efforts; contribution of AEOP in changing apprentice AEOP metrics
	Army/DoD STEM: Attitudes toward Army/DoD STEM research and careers, efforts to expose apprentices to Army/DoD STEM research/careers, impact of AEOP resources on efforts; contribution of AEOP in changing apprentice Army/DoD career metrics
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies
	Comprehensive Marketing Strategy: How mentors learn about AEOP, usefulness of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers

Table 5. 2014 Apprentice Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in SEAP, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of SEAP, motivating factors for participation, involvement in other science programs in addition to SEAP, satisfaction with and suggestions for improving SEAP, benefits to participants
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities:** Extent to which apprentices were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers: Extent to which apprentices were exposed to STEM and Army/DoD STEM jobs

Table 6. 2014 Mentor Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, occupation, organization, role in SEAP, past participation in SEAP, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of SEAP, benefits to apprentices, benefits to mentors, suggestions for improving SEAP programs
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities:** Efforts to expose apprentices to AEOP opportunities
	Army STEM: Army/DoD STEM Careers: Efforts to expose apprentices to STEM and Army/DoD STEM jobs
	Mentor Capacity: Army S&Es – Army researchers serving and developing as mentors

Table 7. 2014 Annual Program Report	
Category	**Description**
Program	Description of course content, activities, and academic level (high school or college)
AEOP Goal 1 and 2 Program Efforts	**Underserved Populations:** Mechanisms for marketing to and recruitment of students from underserved populations
	Army STEM: Army/DoD STEM Careers – Career day exposure to Army STEM research and careers; Participation of Army engineers and/or Army research facilities in career day activities
	Mentor Capacity: Army S&Es – Army researchers serving and developing as mentors

Detailed information about methods and instrumentation, sampling and data collection, and analysis are described in Appendix A, the evaluation plan. The reader is strongly encouraged to review Appendix A to clarify how data are summarized, analyzed, and reported in this document. Findings of statistical and/or practical significance are noted in the report narrative, with tables and footnotes providing results from tests for significance. Questionnaires and respective data summaries are provided in Appendix B (apprentice) and Appendix C (mentor). Focus group protocols are provided in Appendix D (apprentice) and Appendix E (mentor); the APR template is located in Appendix F. Major trends in data and analyses are reported herein.

Study Sample

Apprentices from 8 of the 9 SEAP sites responded to the questionnaire, as did mentors from 5 of the 9 sites. Table 8 shows the number of apprentice and mentor respondents by site.

Table 8. 2014 SEAP Site Survey Respondent Numbers				
2014 SEAP Site	**Apprentices**		**Mentors**	
	No. of Participants	**No. of Survey Respondents**	**No. of Participants**	**No. of Survey Respondents**
US Army Aviation and Missile Research Development and Engineering Center – Redstone Arsenal (AMRDEC)	22	8	14	0
US Army Center for Environmental Health Research at Fort Detrick (USACEHR)	4	5	4	1
US Army Medical Research Institute of Chemical Defense (USAMRICD)	15	14	12	10
US Army Medical Research Institute for Infectious Diseases at Fort Detrick (USAMRIID)	5	4	8	2
US Army Research Laboratory – Aberdeen Proving Ground (ARL-APG)	11	8	10	0
US Army Research Laboratory – Adelphi (ARL-A)	17	11	18	0
Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL)	7	3	6	3
Engineer Research & Development Center – Topographic Engineering Center (ERDC-TEC)	3	0	NA	0
Walter Reed Army Institute of Research (WRAIR)	8	5	14	1
TOTAL	**92**	**58**	**86**	**17**

Table 9 provides an analysis of apprentice and mentor participation in the SEAP questionnaires, the response rate, and the margin of error at the 95% confidence level (a measure of how representative the sample is of the population). The margin of error for both the apprentice and mentor surveys is larger than generally acceptable, indicating that the samples may not be representative of their respective populations. The mentor response rate in FY14 is similar to that of FY13 (18% and 14% respectively). However, it is worth noting that the apprentice response rate is substantially higher than last year (40% in 2013).

Table 9. 2014 SEAP Questionnaire Participation				
Participant Group	**Respondents (Sample)**	**Total Participants (Population)**	**Participation Rate**	**Margin of Error @ 95% Confidence[2]**
Apprentices	58	92	64%	±7.9%
Mentors	17	86	20%	±21.4%

Four focus groups were conducted with apprentices from 4 of the 9 SEAP sites, and included 16 apprentices (8 females, 8 males) ranging from rising 10th graders to rising first-year college students. Four mentor focus groups were also conducted, which included 12 mentors (5 females, 7 males) from the same four sites. Mentors included STEM professionals and a STEM student (either an undergraduate or graduate student). Focus groups were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of apprentice questionnaire data. They add to the overall narrative of SEAP's efforts and impact, and highlight areas for future exploration in programming and evaluation.

Respondent Profiles

Apprentice Demographics

Demographic information collected from SEAP questionnaire respondents is summarized in Table 10.[3] SEAP appears to have had limited success in attracting female participants as more males (51%) than females (46%) completed the FY14 questionnaire. However, this ratio is much more balanced than FY13 when the survey was completed by 70% males and 30% females. SEAP has also had limited success attracting students from racial/ethnic groups historically underserved and underrepresented in STEM. About two-thirds of responding apprentices in FY14 identified with the race/ethnicity category of White (42%) or Asian (24%), which are slightly lower percentages than in FY13 (53% White and 35% Asian). These data are similar to those gathered through the application process and described in the APR (59% male, 43% White, 27% Asian).

Many responding apprentices were rising first-year college students (42%); about a third were rising 12th graders (34%) and the remaining either rising 11th graders (19%) or rising 10th graders (3%). Only one respondent (2%) reported qualifying for free or reduced-price lunch (FRL)—a common indicator of low-income status. As can be seen in Table 11, the vast majority of respondents attended public schools (86%); nearly as many attended schools in suburban areas (79%).

[2] "Margin of error @ 95% confidence" means that 95% of the time, the true percentage of the population who would select an answer lies within the stated margin of error. For example, if 47% of the sample selects a response and the margin of error at 95% confidence is calculated to be 5%, if you had asked the question to the entire population, there is a 95% likelihood that between 42% and 52% would have selected that answer. A 2-5% margin of error is generally acceptable at the 95% confidence level.

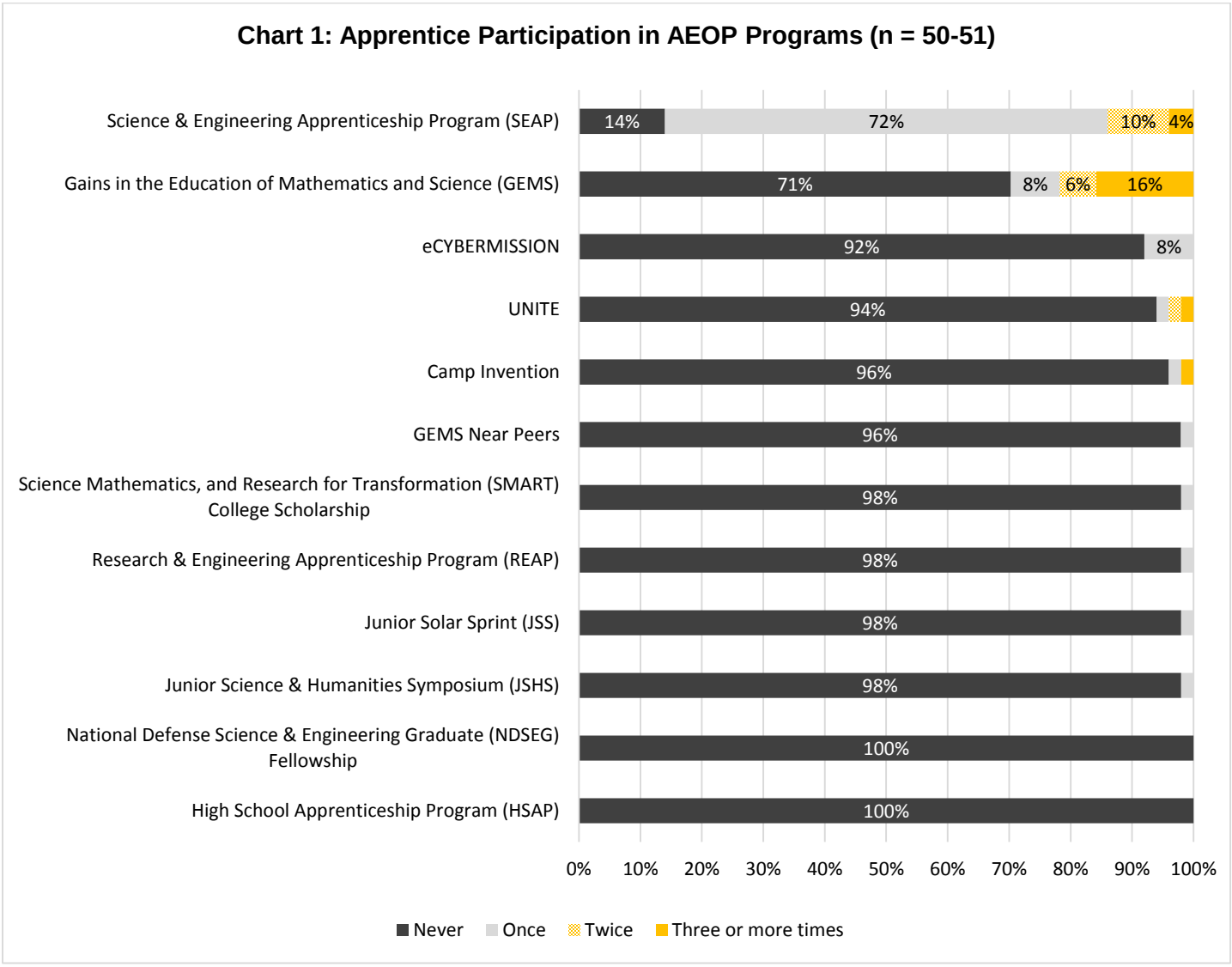
[3] In FY15 the AEOP developed and implemented a new application tool through the vendor, CVENT. This centralized tool will facilitate accurate and improved collection of demographic information from participants across the portfolio of AEOP initiatives.

Table 10. 2014 SEAP Apprentice Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 59)		
Female	27	46%
Male	30	51%
Choose not to report	2	3%
Respondent Race/Ethnicity (n = 59)		
Asian	14	24%
Black or African American	6	10%
Hispanic or Latino	3	5%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	2	3%
White	25	42%
Other race or ethnicity, (specify):†	4	7%
Choose not to report	5	8%
Respondent Grade Level (n = 59)		
Rising 10th	2	3%
Rising 11th	11	19%
Rising 12th	20	34%
Rising First-Year College Student	25	42%
Choose not to report	1	2%
Respondent Eligible for Free/Reduced-Price Lunch (n = 58)		
Yes	1	2%
No	54	93%
Choose not to report	3	5%

† Other = “Indian,” “Lebanese,” and “multiracial.”

Table 11. 2014 SEAP Apprentice Respondent School Information		
Demographic Category	**Questionnaire Respondents**	
Respondent School Location (n = 58)		
Suburban	46	79%
Rural (country)	7	12%
Urban (city)	5	9%
Frontier or tribal school	0	0%
Respondent School Type (n = 58)		
Public school	50	86%
Private school	6	10%
Home school	1	2%
Online school	1	2%
Department of Defense school (DoDDS or DoDEA)	0	0%

Apprentices were asked how many times they participated in each of the AEOP programs. As can be seen in Chart 1, 86% of responding apprentices reported participating in SEAP at least once and 29% in GEMS at least once. Consistent with 2013, few apprentices (16% or less) reported participating in any of the other AEOP programs. However, 14% of apprentices indicated that they have participated in SEAP two or more times, a finding that demonstrates student retention in the AEOP pipeline.



Mentor Demographics

The 2014 Mentor Questionnaire collected more extensive demographic information on the mentors than past years, which is summarized in Table 12. Two-thirds of responding mentors were male and the large majority identified themselves as White (82%). Because of the nature of the SEAP program, nearly all mentors were scientists, engineers, or mathematics professionals (94%), and most were research mentors (88%) as compared to research team members (13%). (Note, there were more mentors participating in SEAP than apprentices, some apprentices worked with more than one mentor.) Additional characteristics of the mentor respondents are included in Appendix C.

Table 12. 2014 SEAP Mentor Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 17)		
Female	6	35%
Male	11	65%
Respondent Race/Ethnicity (n = 17)		
Asian	1	6%
Black or African American	0	0%
Hispanic or Latino	1	6%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	14	82%
Other race or ethnicity, (specify):	0	0%
Choose not to report	1	6%
Respondent Occupation (n = 17)		
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	1	6%
Scientist, Engineer, or Mathematics professional	16	94%
Respondent Role in SEAP (n = 16)		
Research Mentor	14	88%
Research Team Member but not a Principal Investigator	2	13%
Other, (specify)	0	0%

Actionable Program Evaluation

Actionable Program Evaluation is intended to provide assessment and evaluation of program processes, resources, and activities for the purpose of recommending improvements as the program moves forward. This section highlights information outlined in the Satisfaction & Suggestions sections of Tables 3-7.

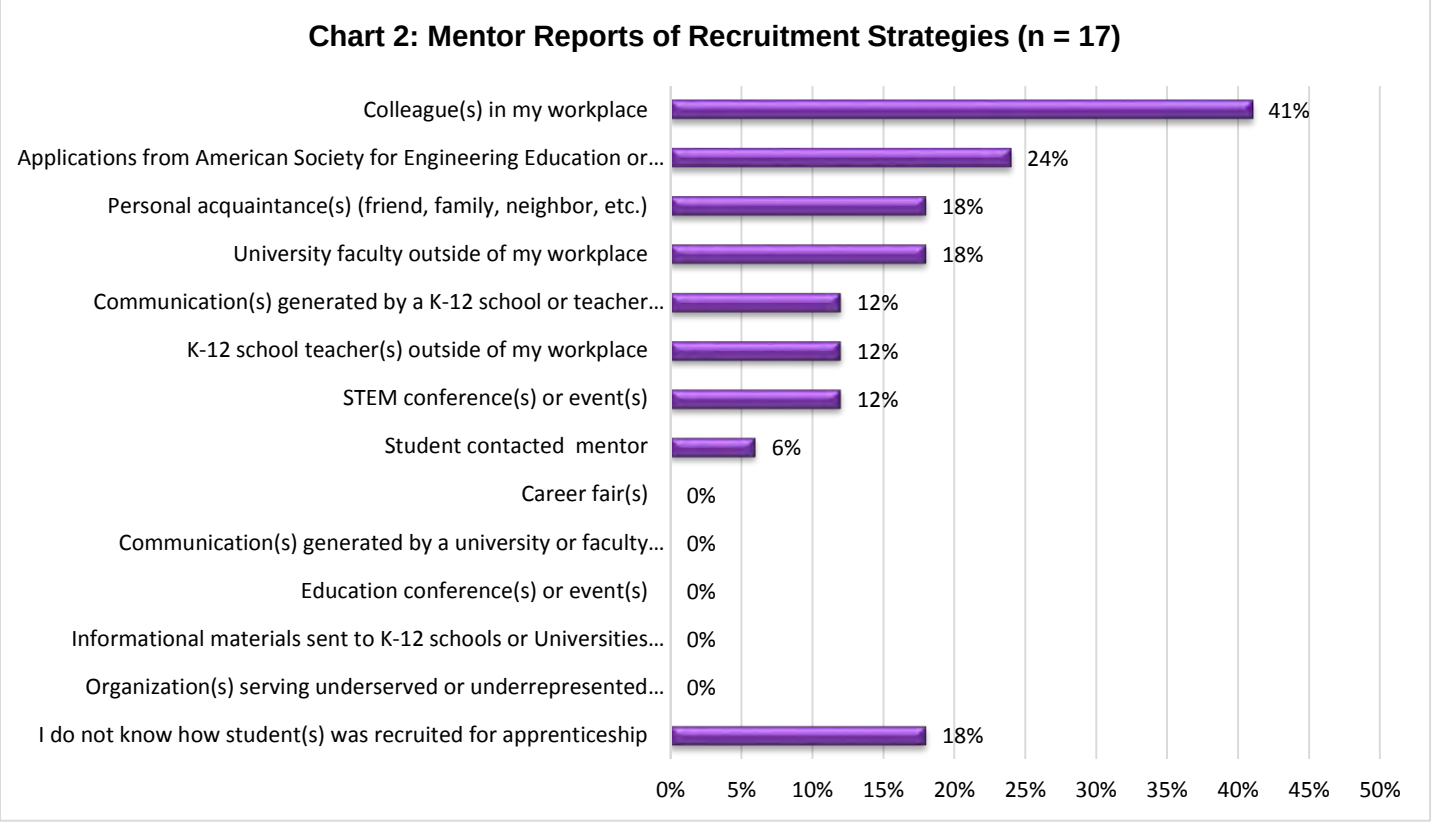
A focus of the Actionable Program Evaluation is efforts toward the long-term goal of SEAP and all of the AEOP to increase and diversify the future pool of talent capable of contributing to the nation's scientific and technology progress. SEAP sites reach out to members of traditionally underrepresented and underserved populations. Thus, it is important to consider how SEAP is marketed to and ultimately recruits participants, the factors that motivate students to participate in SEAP, participants' perceptions of and satisfaction with activities, what value participants place on program activities, and what recommendations participants have for program improvement. The following sections report perceptions of apprentices, mentors, and site program coordinators (from their program reports) in an effort to both understand current efforts and recommend evidence-based improvements toward expanding and supporting the participation of students from underserved groups in achieving outcomes related to AEOP and program objectives.

Marketing to and Recruiting Underrepresented and Underserved Populations

According to the annual program report submitted by ASEE, a number of strategies were used to disseminate information about the SEAP program to a diverse audience:

- Email blasts were sent to over 4,000 teachers, guidance counselors, and principals in areas nearby participating SEAP labs; and
- Information about SEAP was shared at the following events:
  - Invent it. Build it. Career Expo at the Society of Women Engineers Conference; and
  - Hispanic Association for Colleges and Universities Conference.

The mentor questionnaire also included an item asking how apprentices were recruited. As can be seen in Chart 2, many mentors indicated recruiting their apprentices through a personal network such as workplace colleagues (41%), personal acquaintances (18%), and university faculty (18%). About a quarter indicated using the applications from ASEE or AEOP (24%) for recruitment. Interestingly, 18% reported that they had no knowledge of how their apprentices were recruited.

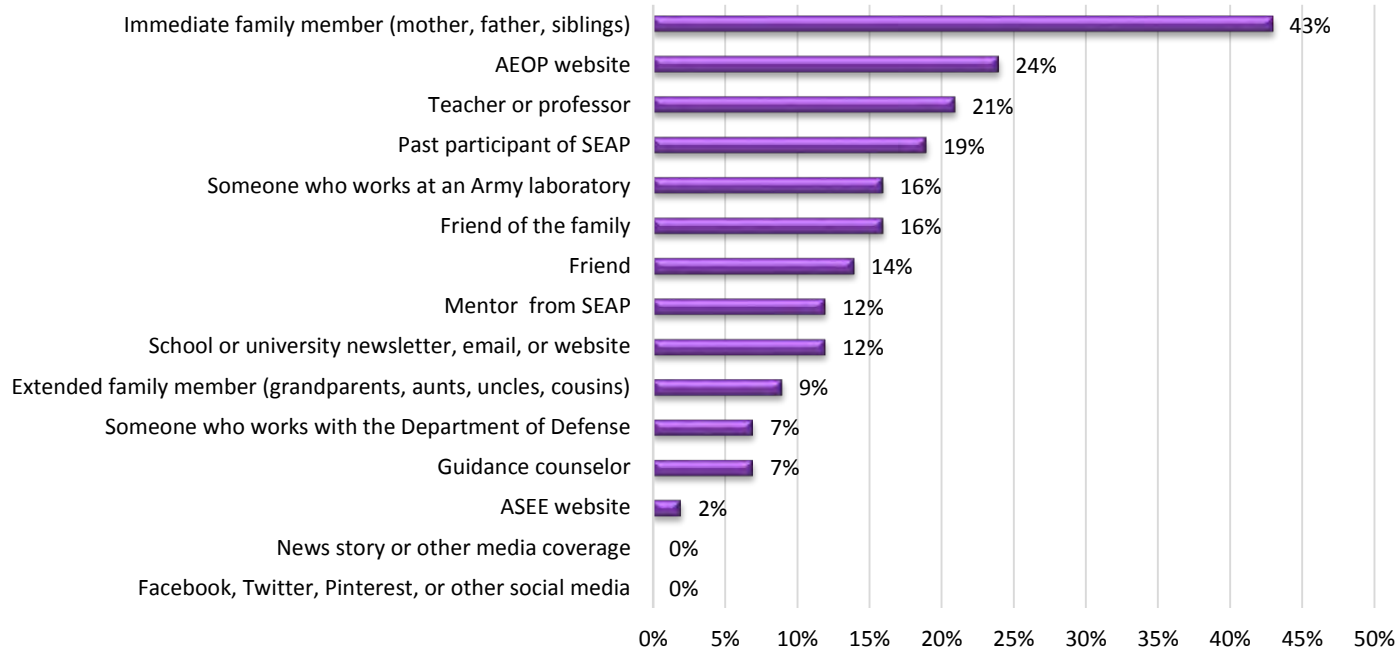


In order to understand which recruitment methods are most effective, the questionnaire asked apprentices to select all of the different ways they heard about SEAP. Chart 3 summarizes their responses. The most frequently mentioned source

of information about SEAP was an immediate family member (43%). Nearly a quarter of respondents indicated learning about SEAP from the AEOP website. The other sources mentioned relatively frequently were mainly personal acquaintances of some form such as a teacher or professor (21%), past participant of SEAP (19%), an Army laboratory employee (16%), friend of the family (16%), or friend (14%). These data were analyzed by apprentice gender, race/ethnicity, and whether they are from urban/rural areas (vs. suburban).[4] No meaningful differences were found in how apprentices learned about SEAP by any of these factors. These findings align with those from the mentors, indicating that most apprentices are recruited via personal connections rather than through broad advertisement of the program.

Although personal connections were the most common means of recruiting SEAP apprentices in 2014, the program may want to consider the impact that this method of recruitment has on the selection process (e.g., are mentors more likely to accept applicants that already have a personal connection to the laboratory) and on the limitations that the method may place on attracting a diverse applicant pool.

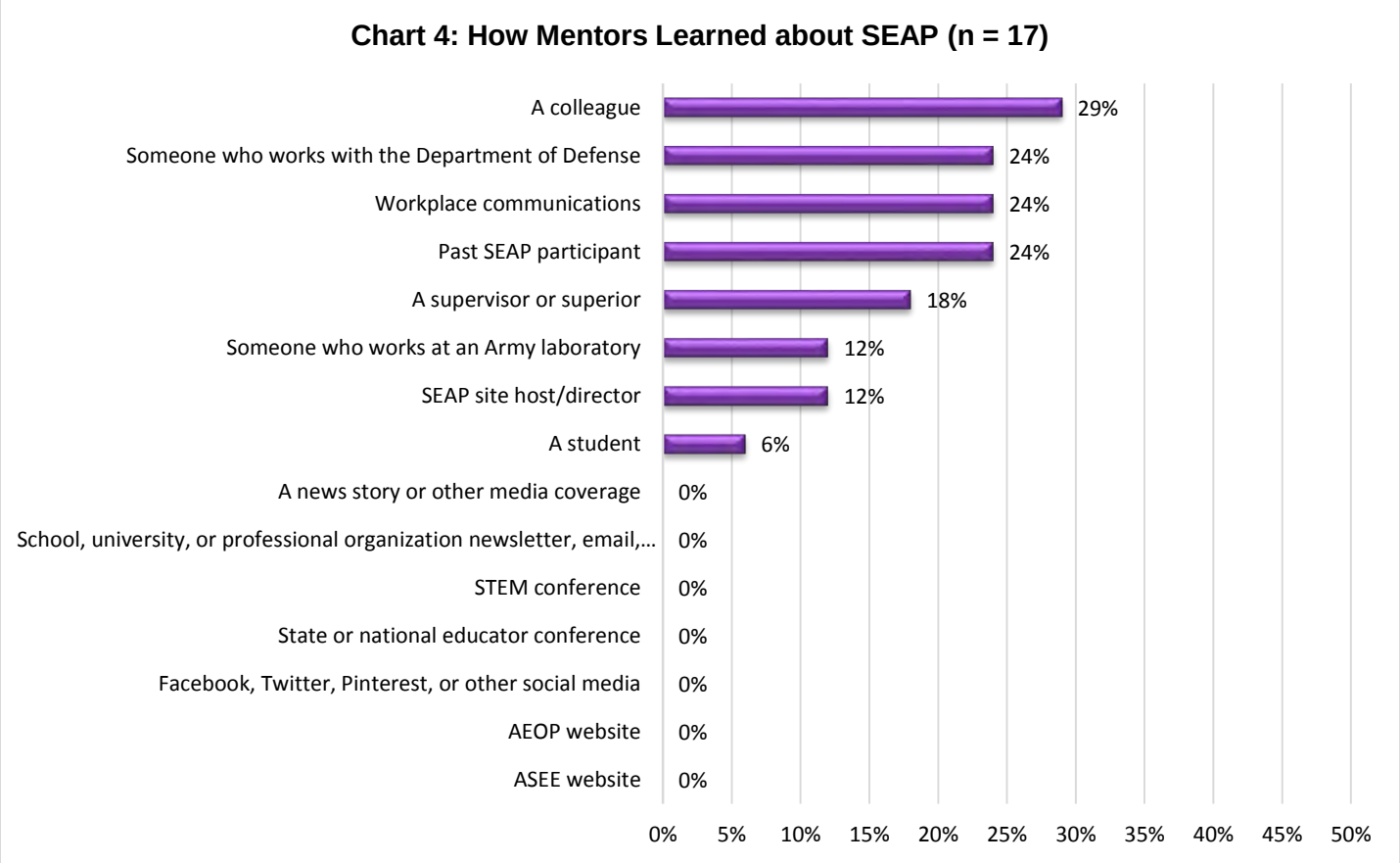
Chart 3: How Apprentices Learned about SEAP (n = 58)



Mentors were also asked how they learned about SEAP (see Chart 4). The vast majority of responding mentors learned about SEAP through a colleague (29%), workplace communications (24%), or a supervisor (18%). Many indicated learning

[4] Item-level tests were conducted without a Type I error control, increasing the possibility of false positives (i.e., detecting a significant difference when no difference truly exists).

about SEAP from someone who works with the DoD (24%), a past SEAP participant (24%), an Army laboratory (12%), or a SEAP site host/director (12%). This pattern of results indicates that mentors are learning about the SEAP program from localized sources without important contextual information about the larger AEOP and SEAP's role in fulfilling the Army's AEOP mission.



To examine whether mentors are expanding their participation in AEOP programs, the questionnaire asked how many times they participated in each of the AEOP programs. For the most part, mentors have either never heard of, or never participated in, most of the AEOP programs. For example, 98% indicated never hearing about or participating in CQL and 71% in GEMS, programs that are also located at Army research laboratories. However, many mentors participate in SEAP multiple times, with 29% reporting that they have participated twice and 47% indicating their involvement "three or more times." Taken with the finding directly above, the pattern of results indicates that SEAP mentors are not actively aware that SEAP is part of a larger portfolio of AEOP programs, even those programs that occur in the same physical location as SEAP such as GEMS and CQL.

Factors Motivating Apprentice Participation

The questionnaires and focus groups included questions to explore what motivated apprentices to participate in SEAP. Specifically, the questionnaire asked how motivating a number of factors were in their decision to participate. As can be seen in Table 13, the vast majority were motivated by their interest in STEM (88%), the opportunity to learn in ways not possible in school (82%), and/or the desire to learn something new or interesting (79%). Building their college application or résumé (68%), the desire to expand their laboratory or research skills (68%), the opportunity to explore a unique work environment (65%), networking opportunities (61%), and the opportunity to use advanced laboratory technology (51%) were each described as "very much" motivating by a majority of respondents.

Table 13. Factors Motivating Apprentices "Very Much" to Participate in SEAP (n = 56-57)

Item	Questionnaire Respondents
Interest in science, technology, engineering, or mathematics (STEM)	88%
Learning in ways that are not possible in school	82%
Desire to learn something new or interesting	79%
Building college application or résumé	68%
Desire to expand laboratory or research skills	68%
Exploring a unique work environment	65%
Networking opportunities	61%
Opportunity to use advanced laboratory technology	51%
Earning stipend or award while doing STEM	49%
Having fun	47%
Parent encouragement	46%
Interest in STEM careers with the Army	39%
Serving the community or country	39%
The program mentor(s)	37%
Teacher or professor encouragement	23%
Opportunity to do something with friends	18%
An academic requirement or school grade	9%

A number of these factors were described in the focus groups. For example:

> *I was actually looking for experience because I'm a rising senior and I'm trying to decide my future career. Also, I'm trying to get my senior project done for high school…so the experience.* (SEAP Apprentice)

> *I needed to find something productive to do with my summer because this is the year before I apply to college. And I've always been interested in science.* (SEAP Apprentice)

I took the job because getting into college is much more competitive than it used to be. So I think that this is a very good stepping stone to make some connections, get some recommendations that would be very beneficial in that regard. I was also allured by the money, and by the stimulation of it. (SEAP Apprentice)

For each item in Table 13, differences between females and males, minority students and non-minority students, and those from urban/rural areas vs. suburban areas were tested to identify whether different factors were more or less motivating for different apprentices. Overall, there were few significant differences. Males were more likely than females to indicate being motivated by the opportunity to do something with their friends[5] (a medium effect size[6] of 0.60 standard deviations). Minority students were more likely to be motivated by an academic requirement or school grade[7] (a medium effect size of 0.73 standard deviations).

The SEAP Experience

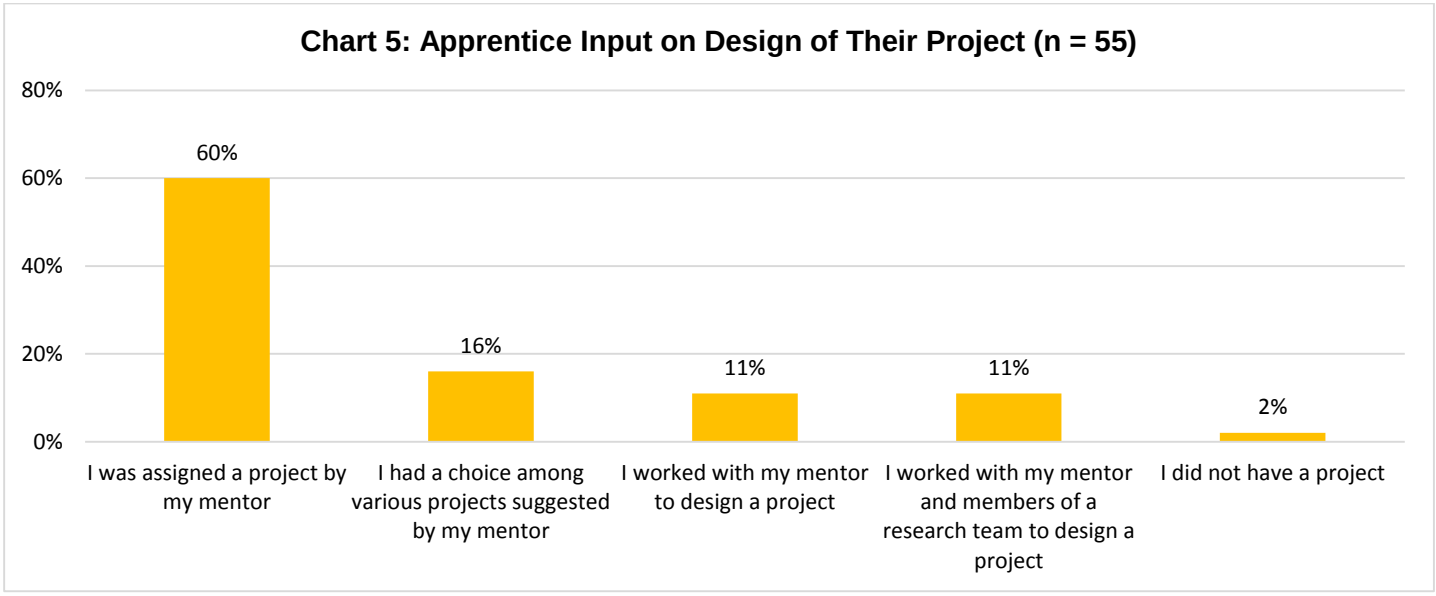
The apprentice questionnaire included several items asking about the nature of the SEAP experience,[8] and how that experience compared to STEM learning opportunities in school. When asked what field their SEAP experience focused on, 63% of responding apprentices selected science, 22% technology, and 8% engineering. As can be seen in Chart 5, about three-quarters indicated that they were assigned a project by their mentor (60%) or had a choice among various projects suggested by their mentor (16%). The remaining apprentices reported working with their mentor to design a project (11%), working with the mentor and research team to design a project (11%), or not having a project at all (2%).

[5] Two-tailed independent samples t-test, $t(53) = 2.17$, $p = 0.034$.

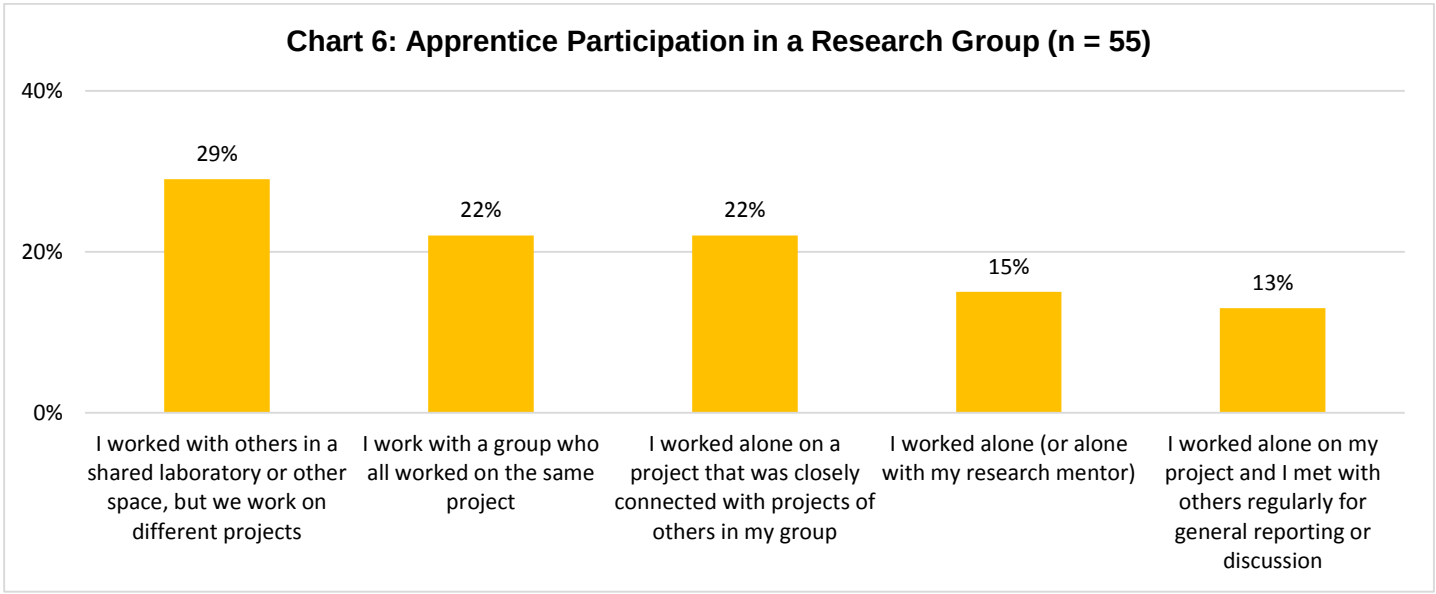
[6] Effect sizes are used to facilitate comparison of the magnitude of differences across different outcomes and/or studies by putting differences on a standardized metric. For difference between means, effect size is calculated as Cohen's d: the difference in means of the two groups divided by the pooled standard deviation. For Cohen's d, effect sizes of about 0.20 are typically considered small, 0.50 medium, and 0.80 large. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

[7] Two-tailed independent samples t-test, $t(55) = 2.07$, $p = 0.043$.

[8] The mentor questionnaire asked parallel items. Results were similar and all responses can be found in Appendix C.



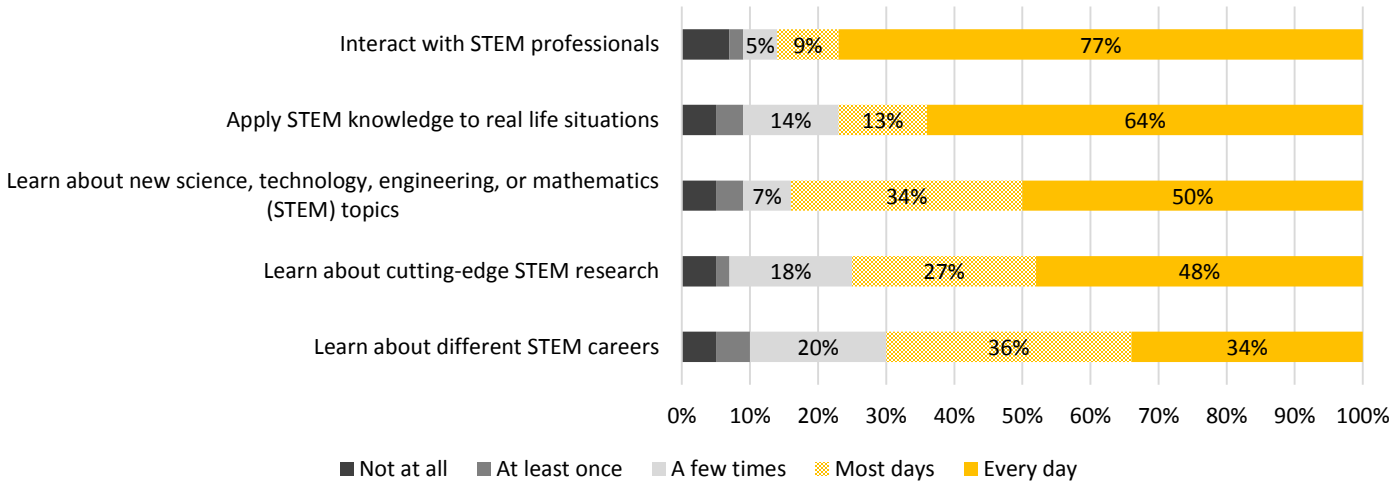
Although most apprentices worked in close proximity with others during their experience (see Chart 6), they tended to work independently on their projects. For example, 29% reported working in a shared laboratory/space with others, but on different projects. Similarly, 22% indicated working alone on a project closely connected to other projects in their group, while 15% reported working alone (or along with their research mentor) and 13% alone with regular meetings for reporting progress. Only 22% indicated they worked with a group on the same project.



Apprentices were also asked about the types of activities they engaged in during their experience. As can be seen in Chart 7, the vast majority of respondents indicated interacting with STEM professionals (86%), learning about new STEM topics (84%), applying STEM knowledge to real life situations (77%), learning about cutting-edge STEM research (75%), and learning about different STEM careers (70%) on most days or every day.

Mentors were asked similar questions about the nature of their apprentices' experiences. However, because of the extremely low response rate on the mentor questionnaire, it is impossible to determine whether any differences between the two datasets are real or an artifact of which mentors provided data. In addition, as mentors typically worked with multiple apprentices, it is not clear which apprentices mentors were considering when responding to these items. Given these concerns, mentor responses to these items are not described in the body of this report, but can be found in Appendix C.

Chart 7: Nature of Apprentice Activities in SEAP (n = 56)

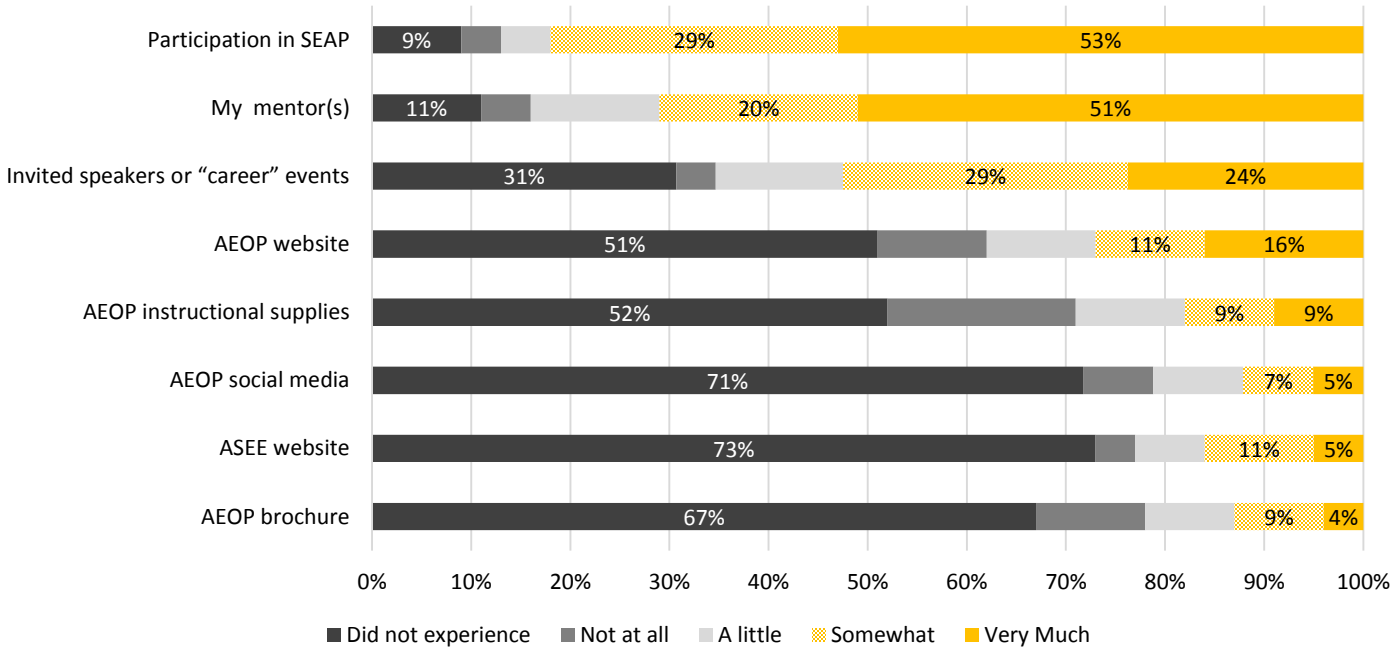


Because increasing the number of those who purse STEM careers is one goal of the SEAP program, the questionnaire also asked how many jobs/careers in STEM in general, and STEM jobs/careers in the DoD more specifically, apprentices learned about during their experience. As can be seen in Table 14, all responding apprentices reported learning about at least one STEM job/career, and the majority (57%) reported learning about five or more. Similarly, 92% reported learning about at least one DoD STEM job/career, with 35% reporting learning about five or more.

Table 14. Number of STEM Jobs/Careers Apprentices Learned about During SEAP (n = 51)		
	STEM Jobs/Careers	DoD STEM Jobs/Careers
None	0%	8%
1	6%	10%
2	14%	20%
3	16%	20%
4	8%	8%
5 or more	57%	35%

Apprentices were also asked which resources impacted their awareness of DoD STEM careers. Participation in SEAP (82%), their mentors (71%), and invited speakers or career events (53%) were most often reported as being somewhat or very much responsible for this impact (see Chart 8). Interestingly, the majority of responding apprentices indicated not experiencing any of the AEOP resources.

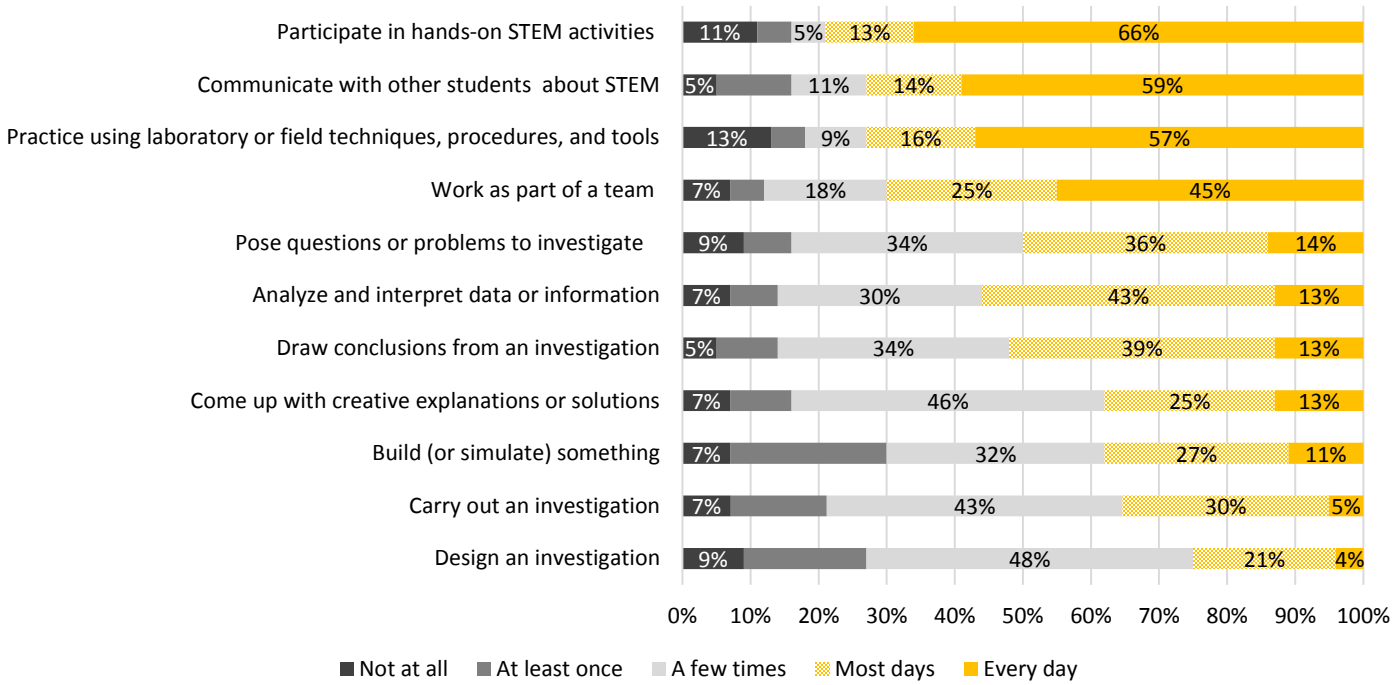
Chart 8: Impact of Resources on Apprentice Awareness of DoD STEM Careers (n = 54-55)



The questionnaire also asked apprentices how often they engaged in various STEM practices during their SEAP experience. Results appear to indicate that the apprentices had experiences consistent with doing authentic STEM (see Chart 9). For example, about three-quarters of apprentices had opportunities to participate in hands-on STEM activities (79%),

communicate with other students about STEM (73%), and practice using laboratory or field techniques, procedures, and tools (73%) on most days or every day of their experience. In addition, nearly all apprentices reported posing questions or problems to investigate, designing an investigation, carrying out an investigation, analyzing and interpreting data, and drawing conclusions from an investigation at least once during their experience. These same items were also asked of mentors, with responding mentors generally indicating that apprentices had greater opportunities to engage in these practices than the apprentices themselves reported.

Chart 9: Apprentice Engagement in STEM Practices in SEAP (n = 56)



A composite score[9] was calculated for each of these two sets of items, the first titled "Learning about STEM in SEAP,"[10] and the second "Engaging in STEM Practices in SEAP."[11] Response categories were converted to a scale of 1 = "Not at all" to 5 = "Every day" and the average across all items in the scale was calculated. The composite scores were used to test

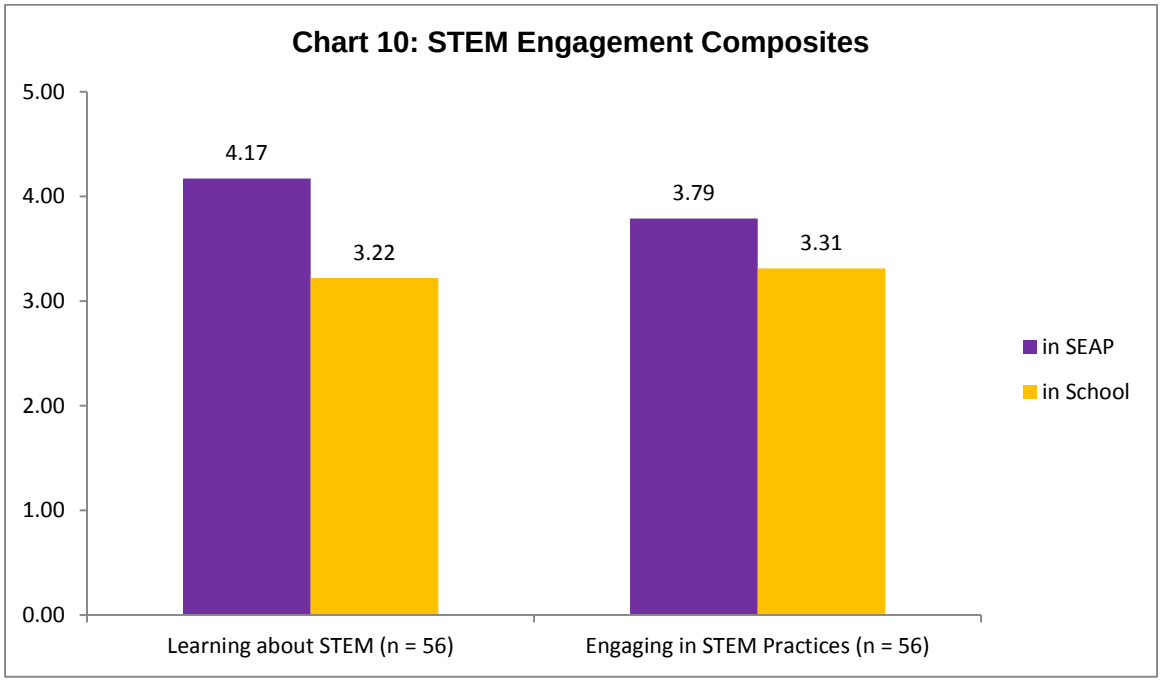
[9] Using multiple statistical tests on related outcomes requires the use of a Type I error rate adjustment to reduce the likelihood of false positives (i.e., detecting a difference when one does not truly exist). However, Type I error rate adjustments lead to a reduction in statistical power (i.e., the ability to detect a difference if it does exist). The use of a composite score helps avoid both of these problems by reducing the total number of statistical tests used. In addition, composite scores are typically more reliable than individual questionnaire items.

[10] The Cronbach's alpha reliability for these 6 items was 0.924.

[11] The Cronbach's alpha reliability for these 10 items was 0.940.

whether there were differences in apprentice experiences by gender, race/ethnic group (minority vs. non-minority students), and school location. There were no significant differences across subgroups on either of these composites, indicating that apprentices had similar experiences regardless of demographic background.

To examine how the SEAP experience compares to their typical school experience, apprentices were asked how often they engaged in the same activities in school (individual item responses can be found in Appendix B). These responses were also combined into two composite variables: "Learning about STEM in School,"[12] and "Engaging in STEM Practices in School"[13] that are parallel to the ones asking about SEAP. As can be seen in Chart 10, scores were significantly higher on the "in SEAP" versions of both composites than on the in school versions (a large effect of d = 0.993 standard deviations for Learning about STEM; a moderate effect of 0.431 standard deviations for Engaging in STEM practices).[14] These data indicate that SEAP provides participants with more intensive STEM learning experiences than they would typically receive in school.



[12] Cronbach's alpha reliability of 0.912.

[13] Cronbach's alpha reliability of 0.946.

[14] Two-tailed independent samples t-tests: Learning about STEM, $t(55) = 7.34$, $p < 0.001$; Engaging in STEM Practices, $t(55) = 3.23$, $p = 0.002$.

The Role of Mentors

Mentors play a critical role in the SEAP program. The nature and quality of mentoring is a critical factor in maximizing apprentice participation in these opportunities, and sustaining or inspiring their interest in future STEM work. Consequently, both the apprentice and mentor questionnaires asked about the role of mentors in the program. Of the mentors responding to the questionnaire, 75% indicated working with 1 apprentice, 19% reported working with 2 apprentices, and 6% with 3 apprentices.

Mentors were asked whether or not they used a number of strategies when working with their apprentices (note: the questionnaires used the term "students"; consequently, the data in this section are reported using that term as well). These strategies comprised five main areas of effective mentoring:[15]

1. Establishing the relevance of learning activities;
2. Supporting the diverse needs of students as learners;
3. Supporting students' development of collaboration and interpersonal skills;
4. Supporting students' engagement in "authentic" STEM activities; and
5. Supporting students' STEM educational and career pathways.

Large proportions of responding mentors used several strategies to help make the learning activities relevant to students (see Table 15). For example, 88% reported finding out about students' backgrounds and interests at the beginning of the program, and 82% giving students real-life problems to investigate or solve. Given the nature of SEAP (and other AEOP apprentice programs), it is not that surprising that fewer mentors used the other listed strategies (e.g., selecting readings or activities that relate to students' backgrounds).

[15] Mentoring strategies examined in the evaluation were best practices identified in various articles including:

Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among US students. *Science Education*, *95*(5), 877-907.

Ornstein, A. (2006). The frequency of hands-on experimentation and student attitudes toward science: A statistically significant relation (2005-51-Ornstein). *Journal of Science Education and Technology*, *15*(3-4), 285-297.

Sadler, P. M., Sonnert, G., Hazari, Z., & Tai, R. (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science Education*, *96*(3), 411-427.

Table 15. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 46-47)	
Item	**Questionnaire Respondents**
Finding out about students' backgrounds and interests at the beginning of the program	88%
Giving students real-life problems to investigate or solve	82%
Making explicit provisions for students who wish to carry out independent studies	59%
Helping students become aware of the roles STEM plays in their everyday lives	53%
Encouraging students to suggest new readings, activities, or projects	47%
Selecting readings or activities that relate to students' backgrounds	47%
Helping students understand how STEM can help them improve their communities	44%
Asking students to relate outside events or activities to topics covered in the program	29%

Mentors were also asked about their use of strategies to support the diverse needs of students as learners. As can be seen in Table 16, 94% of responding mentors reported treating all students the same way, regardless of gender or race/ethnicity. Many mentors used gender neutral language (81%), helped students find additional support if needed (76%), provided extra readings, activities, or other support for students who lacked essential background knowledge (71%), and used diverse teaching/mentoring activities to address a broad spectrum of students (65%).

Table 16. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 16-17)	
Item	**Questionnaire Respondents**
Interacting with all students in the same way regardless of their gender or race and ethnicity	94%
Using gender neutral language	81%
Directing students to other individuals or programs if I can only provide limited support	76%
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	71%
Using diverse teaching/mentoring activities to address a broad spectrum of students	65%
Finding out about students' learning styles at the beginning of the program	53%
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	29%

Most mentors also reported using a variety of strategies to support students' development of collaboration and interpersonal skills (see Table 17). For example, roughly three-quarters of those responding to the questionnaire indicated having students work on collaborative activities or projects as a member of a team (76%), participate in giving and receiving feedback (76%), explain difficult ideas to others (71%), or listen to the ideas of others with an open mind (71%).

Table 17. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 17)	
Item	**Questionnaire Respondents**
Having students participate in giving and receiving feedback	76%
Having students work on collaborative activities or projects as a member of a team	76%
Having students explain difficult ideas to others	71%
Having students listen to the ideas of others with an open mind	71%
Having students tell others about their backgrounds and interests	65%
Having students develop ways to resolve conflict and reach agreement among the team	53%
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	47%
Having students pay attention to the feelings of all team members	47%

When asked about strategies used to support student engagement in authentic STEM activities, all responding mentors reported allowing students to work independently as appropriate, demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use, and giving constructive feedback to improve students' STEM competencies (see Table 18). Most mentors also encouraged students to seek support from other team members (88%), helped students practice STEM skills (88%), encouraged opportunities in which students could learn from others (82%), and had students access and critically review technical texts or media (76%).

Table 18. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 16-17)	
Item	**Questionnaire Respondents**
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	100%
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	100%
Giving constructive feedback to improve students' STEM competencies	100%
Encouraging students to seek support from other team members	88%
Helping students practice STEM skills with supervision	88%
Teaching (or assigning readings) about specific STEM subject matter	88%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	82%
Having students access and critically review technical texts or media to support their work	76%

The last series of items about mentoring strategies focused on supporting students' STEM educational and career pathways (see Table 19). All of the responding mentors reported asking students about their educational and career

interests. Most also indicated sharing their own experiences, attitudes, and values about STEM (88%), discussing STEM career opportunities, either outside the DoD/government (82%) or inside the DoD/government (76%), and providing guidance about educational pathways that would prepare students for a STEM career (82%). Given the interest in having students graduate into other AEOP opportunities, it is surprising that only 53% of mentors recommended other AEOP programs to students. A subset of these items was also asked of apprentices (see Appendix B). In general, smaller percentages of apprentices reported that their mentors used these strategies to support their STEM educational and career pathways.

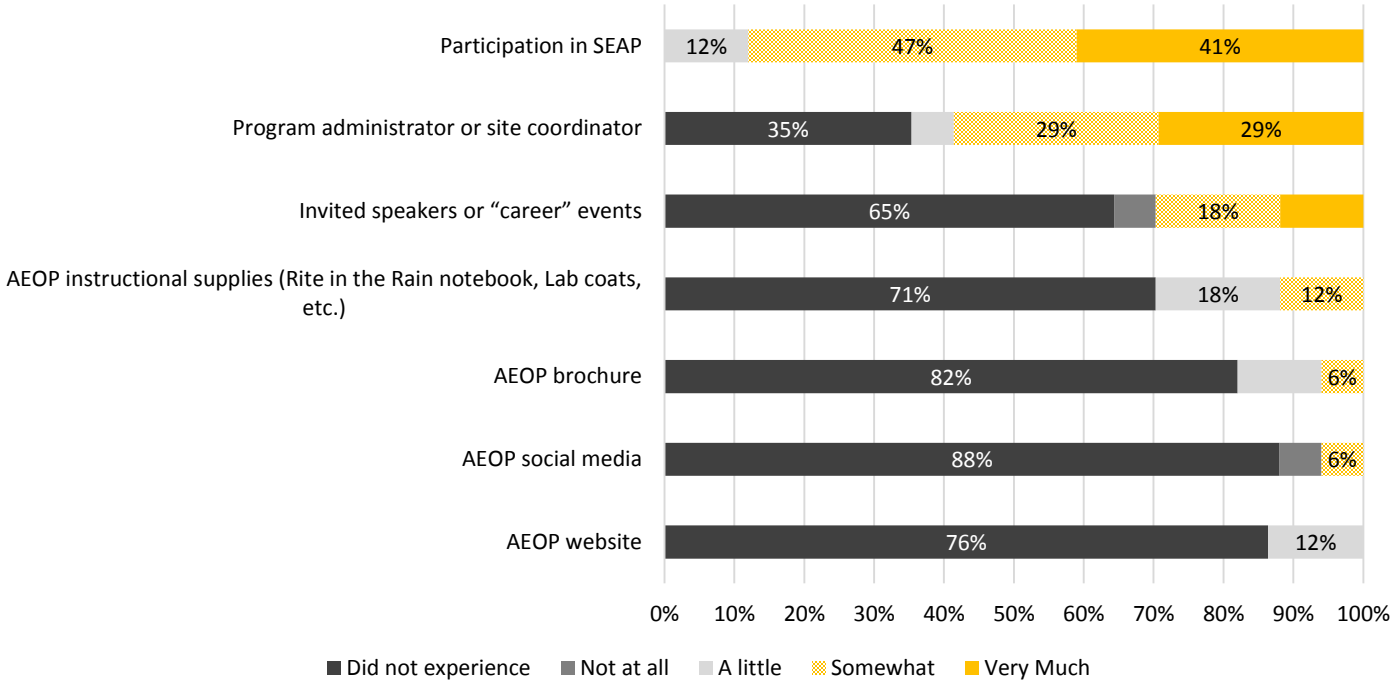
Table 19. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 17)	
Item	**Questionnaire Respondents**
Asking about students' educational and career interests	100%
Sharing personal experiences, attitudes, and values pertaining to STEM	88%
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	82%
Providing guidance about educational pathways that would prepare students for a STEM career	82%
Discussing STEM career opportunities with the DoD or other government agencies	76%
Critically reviewing students' résumé, application, or interview preparations	59%
Helping students build effective STEM networks	53%
Recommending Army Educational Outreach Programs that align with students' educational goals	53%
Recommending extracurricular programs that align with students' educational goals	53%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	35%
Recommending student and professional organizations in STEM	29%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	24%

A separate item on the mentor questionnaire asked which of the AEOP programs mentors explicitly discussed with their apprentices during SEAP. Not surprisingly, the most frequently discussed program was SEAP (71%), as can be seen in Table 20. About a third discussed GEMS with their apprentices, and a quarter GEMS Near Peers or SMART. A quarter also indicated discussing AEOP, but not any specific program.

Table 20. Mentors Explicitly Discussing AEOPs with Apprentices (n = 16-17)	
Item	**Questionnaire Respondents**
Science & Engineering Apprenticeship Program (SEAP)	71%
Gains in the Education of Mathematics and Science (GEMS)	35%
I discussed AEOP with my student(s) but did not discuss any specific program	25%
GEMS Near Peers	24%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	24%
College Qualified Leaders (CQL)	18%
UNITE	12%
Junior Science & Humanities Symposium (JSHS)	6%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	6%
Undergraduate Research Apprenticeship Program (URAP)	6%
High School Apprenticeship Program (HSAP)	0%
Research & Engineering Apprenticeship Program (REAP)	0%

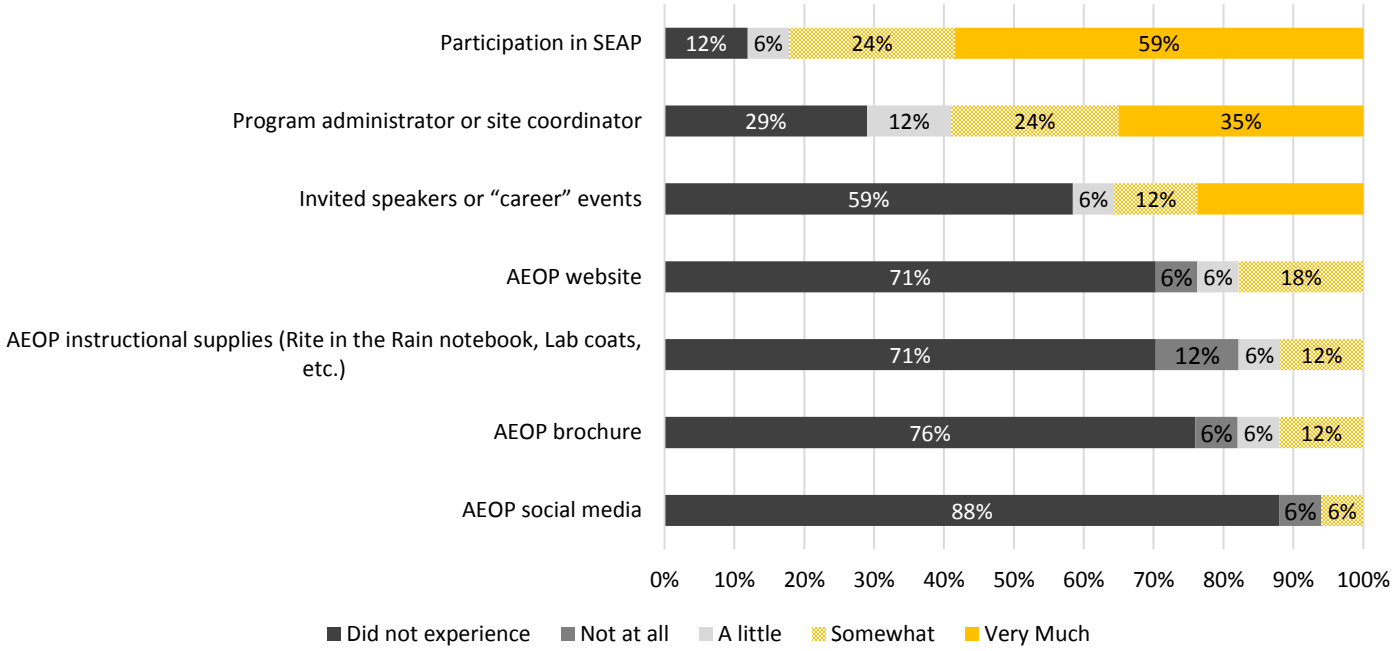
Mentors were asked how useful various resources were in their efforts to expose their apprentices to the different AEOPs. As can be seen in Chart 11, participation in SEAP (41%), program administrators or site coordinators (29%), and invited speakers or career events (12%) were the only resources rated as “very much” useful. Materials provided by the AEOP program tended not to be seen as very useful, with large majorities of mentors indicating they did not experience these resources. For example, 71% of responding mentors reported not experiencing AEOP instructional supplies (e.g., Rite in the Rain notebooks, lab coats), and 76-88% did not experience the AEOP website, brochure, or social media.

Chart 11: Usefulness of Resources for Exposing Apprentices to AEOPs (n = 17)



Mentors were also asked how useful these resources were for exposing apprentices to DoD STEM careers (see Chart 12). As with the previous item, mentors were most likely to rate participation in SEAP as useful, with 59% selecting "very much." Program administrators or site coordinators (35%) and invited speakers or career events (24%) were also seen as very useful by some of the responding mentors. Again, most mentors indicated not experiencing the AEOP materials (a range of 71-88%) or the AEOP website (71%).

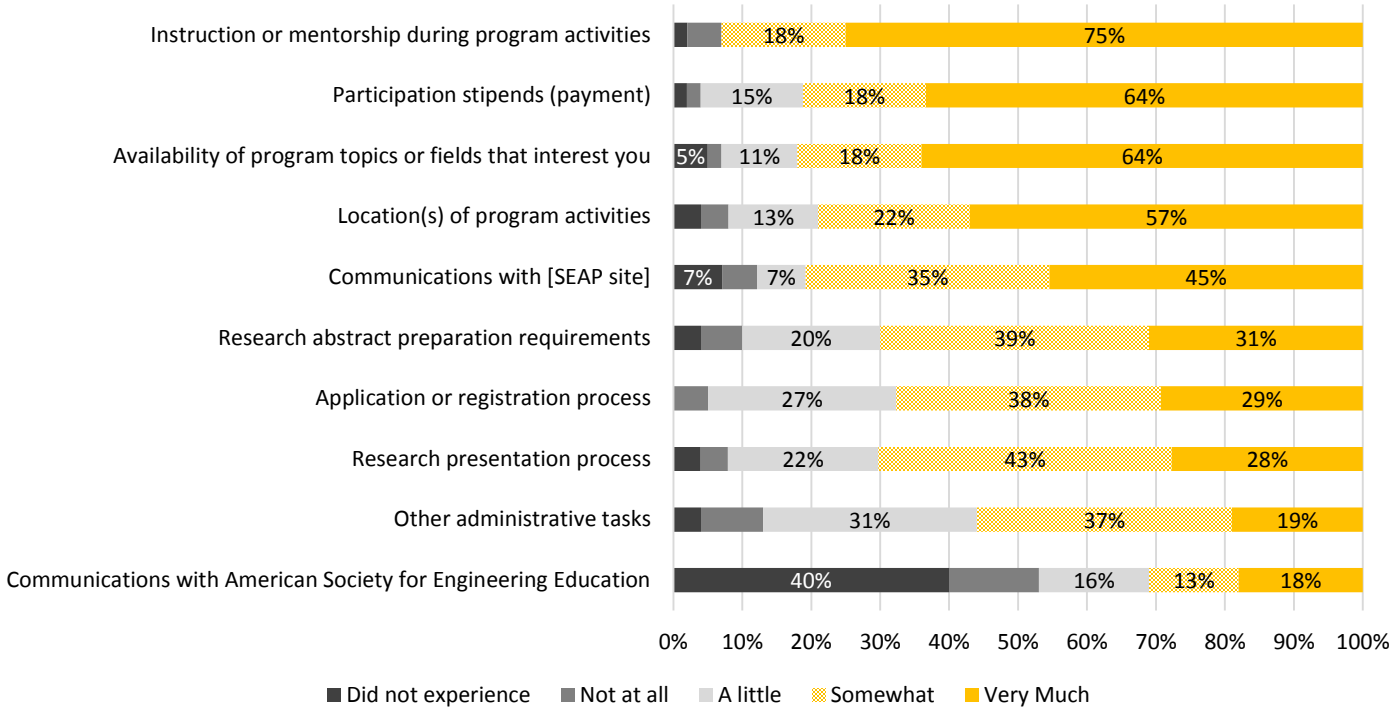
Chart 12: Usefulness of Resources for Exposing Apprentices to DoD STEM Careers (n = 17)



Satisfaction with SEAP

Apprentices and mentors were asked how satisfied they were with a number of features of the SEAP program. As can be seen in Chart 13, a majority of responding apprentices were somewhat or very much satisfied with almost all of the listed program features. For example, 93% of apprentices were somewhat or very much satisfied with the instruction or mentorship during program activities, 82% with participation stipends, 82% with the availability of program topics, and 79% with the location of program activities. The one feature apprentices did not rate as highly was communications with ASEE, with 40% indicating not experiencing any such communication. Other areas where more that 10% of apprentices reported dissatisfaction include administrative tasks and communication with SEAP sites. In all, it appears that SEAP apprentices express the most dissatisfaction with communication and administrative functions of the program.

Chart 13: Apprentice Satisfaction with SEAP Program Features (n = 54-55)



Apprentices were also asked about access to their mentor. As can be seen in Table 21, 44% of responding apprentices indicated their mentor was always available, and 42% that their mentor was available more than half of the time. Few apprentices indicated that their mentor was available half of the time or less.

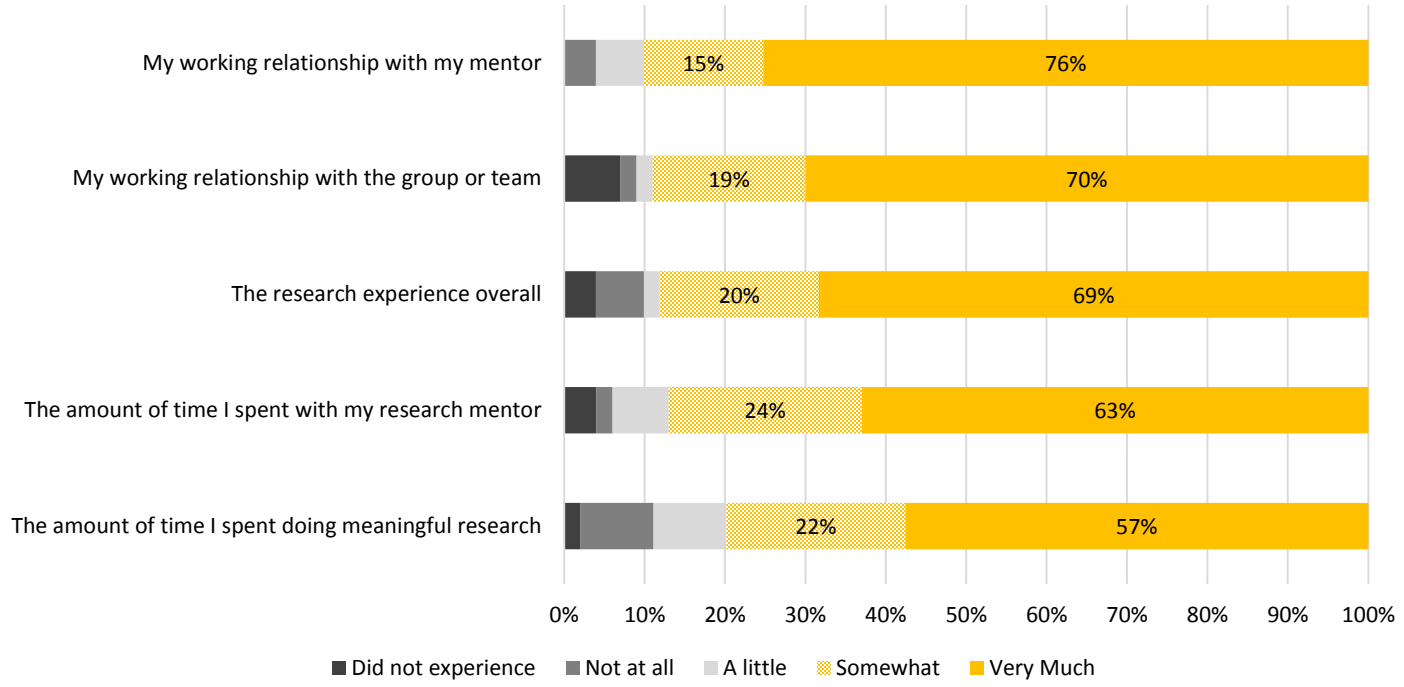
Table 21. Apprentice Reports of Availability of Mentors (n = 55)

Item	Questionnaire Respondents
The mentor was always available	44%
The mentor was available more than half of the time	42%
The mentor was available about half of the time of my project	11%
The mentor was available less than half of the time	4%

Apprentices were also asked about their satisfaction with their mentors and the research experience (see Chart 14). The majority of apprentices indicated being "very much" satisfied with each of the features, with the vast majority being at least somewhat satisfied with each feature. For example, 76% of apprentices indicated "very much" when asked about their relationship with their mentor, with another 15% indicating "somewhat." Similarly, 89% were at least somewhat

satisfied with their relationship with the group or team and the research experience overall; 87% reported being at least somewhat satisfied with the time they spent with their mentor, and 79% with the time spent doing meaningful research.

Chart 14: Apprentice Satisfaction with Their Experience (n = 54)



An open-ended item on the apprentice questionnaire asked apprentices about their overall satisfaction with their SEAP experience. The responses were overwhelmingly positive. Of the 39 apprentices who answered this question, 33 (85%) commented on only positive aspects of the program. For example:

> *I was very satisfied with the SEAP experience. Working on an actual project designed to benefit the team (and overall team project) was especially joyful. It made me feel like I was actually contributing to something worthwhile, not doing unnecessary projects to have a better understanding of STEM. In my team, they were quite willing to help out when I got into trouble. Overall, SEAP helped get me a better understanding of all the STEM research going on, and helped to shape what career path I decide to take. Before SEAP, I had an understanding of possible STEM careers to take. Now, I have a more defined sense of what path I would like to take. (SEAP Apprentice)*

> *I really enjoyed my summer with the SEAP program. I not only learned a lot about the field my mentor does research in, but I also learned what it is like working in a lab and being part of the scientific community. My mentor*

has encouraged me to submit my research to a scientific journal for high school students, so she is helping me to write it and go through the process. I think submitting my work to a journal will be a great experience and a great accomplishment. I also discovered exactly what it's like to work in a lab, and I was never really sure what this would be like before SEAP. (SEAP Apprentice)

SEAP has been the deciding factor in what I want to do in college and what kind of career I want to pursue after my education. Working in a real lab removed all of my uncertainties of what research is like. I know that I can do work in research that will directly benefit the well-being of countless people. I also better understand the responsibilities a scientist has such as the importance of publishing research and requesting funding. All of these things I learned from work in the lab as well as talking with other scientists and my mentor. SEAP has been the greatest experience of my educational career thus far. I hope that AEOP can continue their work in finding students like me who want nothing more than to experience work in a STEM field while also serving their country. (SEAP Apprentice)

The six (15%) other responses included positive comments, but had some caveats. In the words of two apprentices:

I learned a lot both through my own lab work and observing different scientists in the research lab and how people contribute to reaching a common goal. The paperwork and administrative process was fairly tedious at times and I felt could've been organized better. The pay was also lower than past participants had informed me about, however the knowledge gained I think makes up for the lesser monetary amount received. (SEAP Apprentice)

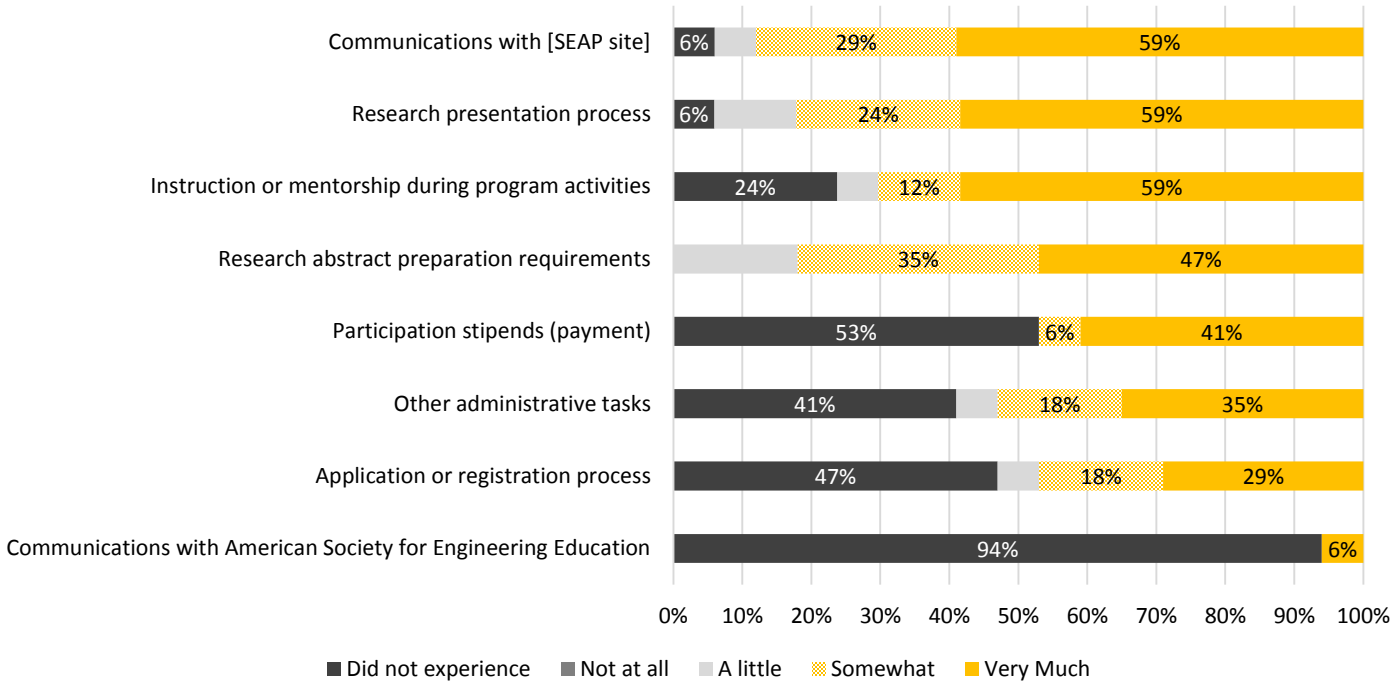
I was happy with what I learned, but I never actually met any kids my age. I was always in the lab, and during lunch I was alone, if there were activities so the students could get to know each other, that would be a lot less lonely. (SEAP Apprentice)

When asked how the SEAP program could be improved, 38 apprentices provided an answer. Of these, 18 (47%) suggested improved communication and sharing of information (e.g., between coordinators, mentors, and apprentices) and 18 (47%) suggested that the program needs to be better organized. Other suggestions included more money (23%), a more efficient application process (18%) and increased collaboration among SEAP apprentices (13%).

"SEAP has been the greatest experience of my educational career thus far. I hope that AEOP can continue their work in finding students like me who want nothing more than to experience work in a STEM field while also serving their country."-- SEAP Apprentice

Mentors also reported being somewhat or very much satisfied with many of the program components they experienced (see Chart 15). For example 88% were at least somewhat satisfied with communication from the local SEAP site, 83% with the research presentation process, 82% with the research abstract preparation requirements, and 71% with instruction or mentorship during program activities. Although large proportions of mentors did not experience them, most who did were at least somewhat satisfied with the participation stipends, administrative tasks, application or registration process, and communications with ASEE.

Chart 15: Mentor Satisfaction with SEAP Program Features (n = 16-17)



As with the apprentice questionnaire, the mentor questionnaire included open-ended items asking for their opinions about the program. One item asked mentors to identify the three most important strengths of SEAP; 13 mentors responded to this question. Although several important aspects of the program were listed, the most frequent were opportunities for apprentices to have hands-on/real-life research experiences (8 of 13, 61%), introduction to STEM at an early age (2 of 13, 15%), and interactions with STEM professionals (2 of 13, 15%). These sentiments were also echoed in the mentor focus group. As four mentors said:

> *I work in a lab environment. My student gains technical skills that would stand him in really good stead when he becomes an undergraduate. Getting a job working in somebody's research lab experience. Probably skills that you wouldn't learn until you are a sophomore or junior in college typically. (SEAP Mentor)*

They learn things in school, they have an idea of what they may be interested in, and then they come in and put their hands on it and either they change their mind or they love it. And that is huge because a lot of times, at least for my generation, you didn't find it out until later, way later. (SEAP Mentor)

I feel like [SEAP] gives the high school students a chance to see how the work for us really is, if they decided to stay in the sciences, how it works. It gives them a head start on how things work...I think it is a good program to let them know, just for them to get an idea of things that they might be interested in in the future. (SEAP Mentor)

Just an idea of how science works here and sort of all the different roles people can play in science. Unless you're in the field, you sort of have a monolithic view of scientists in the lab. But there are so many other different jobs associated with the lab, and you get to see those even if you're not actually doing them. It is just sort of horizon broadening in general to be in a setting like this. (SEAP Mentor)

Mentors were also asked to note three ways in which SEAP should be improved for future participants. The 11 mentors who responded to this question offered a variety of suggestions, though none was mentioned by more than two individuals. Suggestions included lengthening the internship (18%), improved access to computers/technology, increased communication (18%), more time to interview students (9%), and offering a student orientation session (9%).

Lastly, mentors were asked to share their overall satisfaction with their SEAP experience. Nine individuals responded to this question. Seven of the responses were very positive. In the words of two:

I have been mentor or SEAP coordinator for [many] years; it is a great program!! I have had kids go on to science/medicine careers both in DoD and without. I am very proud of all their achievements and the fact that our lab contributed in some way to their success. (SEAP Mentor)

I *have been participating in this program for many years. I believe it is an excellent opportunity for students to gain unique experiences and allow them the opportunity to make decisions regarding their career path. (SEAP Mentor)*

Two other mentors described both areas of satisfaction as well as areas of dissatisfaction. Said one:

Overall, I think the SEAP program is really valuable. I have had some very talented students in my laboratory. However, the timelines for receiving the applications, interviewing candidates, and candidate selection are too short. In addition, I think there should be a SEAP-specific orientation for the students to let them know what is expected of them as well as talk about professional behavior in the workplace. I think some of the SEAP students come into the program thinking this is a summer camp where they will be entertained each day. Prior to starting

in the laboratory, I think it is very important for the students to fully understand the intent of the program and what behavior is expected. (SEAP Mentor)

In summary, findings from the Actionable Program Evaluation indicate that the program is having limited success in attracting participation of females and students from race/ethnic groups historically underrepresented and underserved in many STEM fields, indicating that this is one area in which SEAP can continue to improve.

Once in the SEAP program, apprentices are working both independently and collaboratively on research projects. The vast majority of apprentices are consistently interacting with STEM professionals, learning about new STEM topics, applying STEM to real-life situations, and learning about cutting-edge STEM research. Apprentices are also learning about at least one DoD or STEM job/career, with most mentors crediting participation in the program, program administrators/site coordinators, and invited speakers as useful in this process. In an attempt to catalyze continued engagement in the AEOP programs, mentors are also discussing other AEOPs with apprentices, including GEMS, GEMS Near Peers, SMART, CQL, and UNITE.

The SEAP program actively engages apprentices in learning about STEM and in STEM practices, more than they would typically experience in school. As part of this engagement, large proportions of mentors employed strategies to help make the learning activities relevant to apprentices, support the diverse needs of apprentices as learners, support apprentices' development of collaboration and interpersonal skills, and support apprentice engagement in authentic STEM activities. Although apprentices and mentors did offer some suggestions for program improvement (e.g., program organization, communication with ASEE), overall, participants were somewhat or very much satisfied with many of the SEAP program components they experienced.

Outcomes Evaluation

The evaluation of SEAP included measurement of several outcomes relating to AEOP and program objectives, including impacts on apprentices' STEM competencies (e.g., knowledge and skills), STEM identity and confidence, interest in and intent for future STEM engagement (e.g., further education, careers), attitudes toward research, and their knowledge of and interest in participating in additional AEOP opportunities.[16] STEM competencies are necessary for a STEM-literate

[16] The outcomes measured in the evaluation study were informed by the following documents:

Committee on STEM Education. (2013*). Federal Science, Technology, Engineering, and Mathematics (STEM) education 5-year strategic plan: A report from the Committee on STEM Education, National Science and Technology Council.* Washington, DC: The White House, Office of Science and Technology Policy.

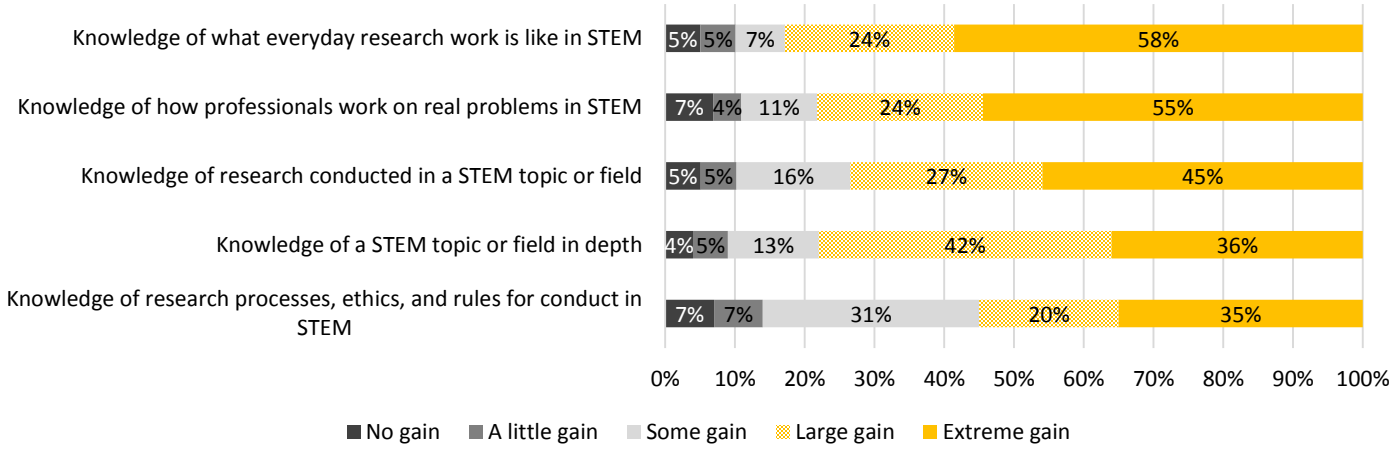
National Research Council. (2009). Learning Science in Informal Environments: People, Places, and Pursuits. Committee on Learning Science in Informal Environments. Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, Editors. Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

citizenry. STEM competencies include foundational knowledge, skills, and abilities in STEM, as well as the confidence to apply them appropriately. STEM competencies are important for those engaging in STEM enterprises, but also for all members of society as critical consumers of information and effective decision makers in a world that is heavily reliant on STEM. The evaluation of SEAP measured apprentices' self-reported gains in STEM competencies and engagement in opportunities intended to develop what is considered to be a critical STEM skill in the 21st century—collaboration and teamwork.

STEM Knowledge and Skills

As can be seen in Chart 16, nearly all responding apprentices reported gains in their STEM knowledge as a result of the SEAP program, with large majorities indicating large or extreme gains in each area. For example, large or extreme gains were reported by 82% of apprentices on their knowledge of what everyday research is like in STEM, and 79% on their knowledge of how professionals work on real problems in STEM. Similar impacts were reported on knowledge of a STEM topic or field in depth (78%), knowledge of research conducted in a STEM topic or field (72%), and knowledge of research processes, ethics, and rules for conduct in STEM (55%). Mentors were also asked about impacts on apprentices in these areas; in general, their reports of impacts were substantially lower than those of the apprentices.

Chart 16: Apprentice Report of Impacts on STEM Knoweldge (n = 55)



President's Council of Advisors on Science and Technology (P-CAST). (February 2012). *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics.* Executive Office of the President.

Report of the Academic Competitiveness Council (ACC). (2007). U.S. Department of Education. Available on the Department's Web site at: http://www.ed.gov/about/inits/ed/competitiveness/acc-mathscience/index.html.

These apprentice questionnaire items were combined into a composite variable[17] to test for differential impacts across subgroups of apprentices. There were no significant differences by gender, race/ethnicity, or school location. In other words, apprentices from different backgrounds reported similar impacts.

The questionnaire also asked about perceived impacts on STEM skills, i.e., apprentices' abilities to use STEM practices. Apprentices were presented with different sets of items depending on the focus of their SEAP experience (science vs. technology/engineering). Of the apprentices with a science-related experience, three-quarters reported large or extreme gains in their ability to communicate information about their investigations and explanations in different formats (see Table 22). About two-thirds reported large or extreme gains in their ability to carry out procedures for an investigation and record data accurately (69%), support a proposed explanation with data from an investigation (66%), identify the limitations of data collected in an investigation (65%), display numeric data in charts or graphs to identify patterns and relationships (64%), and integrate information from multiple sources to support their explanations of phenomena (63%). Substantial numbers of apprentices reported other gains from their experience, likely specific to the type of experience they had.

[17] The Cronbach's alpha reliability for these 5 items was 0.951.

Table 22. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Science Practices (n = 31-32)	
Item	**Questionnaire Respondents**
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	75%
Carrying out procedures for an investigation and recording data accurately	69%
Supporting a proposed explanation (for a phenomenon) with data from investigations	66%
Identifying the limitations of data collected in an investigation	65%
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	64%
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	63%
Integrating information from multiple sources to support your explanations of phenomena	63%
Deciding what type of data to collect in order to answer a question	60%
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	60%
Testing how changing one variable affects another variable, in order to understand relationships between variables	59%
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	57%
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	56%
Asking questions to understand the data and interpretations others use to support their explanations	56%
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	56%
Asking a question (about a phenomenon) that can be answered with one or more investigations	53%
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	53%
Using data or interpretations from other researchers or investigations to improve an explanation	53%
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	50%
Using mathematics or computers to analyze numeric data	50%
Asking questions based on observations of real-world phenomena	49%
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	44%
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	41%
Making a model to represent the key features and functions of an observed phenomenon	41%

Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	38%

Table 23 shows data for apprentices whose experience focused on technology or engineering, specifically self-reported impacts on their abilities related to key engineering practices. As with the science practices, a majority of responding apprentices reported large or extreme gains on many of the engineering practices such as designing procedures for investigations (64%), applying knowledge, logic and creativity to propose solutions that can be tested with investigations (63%), asking questions to understand the data and interpretations others use to support their solutions (63%), carrying out procedures for an investigation and recording data accurately (63%), considering alternative interpretations of data when deciding if a solution functions as intended (63%), and identifying real-world problems based on social, technological, or environmental issues (63%). Interestingly, mentors' reports of apprentice gains in these two areas varied substantially from apprentices'. In some cases mentors reported greater gains than did apprentices, and in other cases apprentices' reported gains were higher.

Table 23. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Engineering Practices (n = 18-19)	
Item	**Questionnaire Respondents**
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	64%
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	63%
Asking questions to understand the data and interpretations others use to support their solutions	63%
Carrying out procedures for an investigation and recording data accurately	63%
Considering alternative interpretations of data when deciding if a solution functions as intended	63%
Identifying real-world problems based on social, technological, or environmental issues	63%
Deciding what type of data to collect in order to test if a solution functions as intended	58%
Making a model that represents the key features or functions of a solution to a problem	58%
Using data or interpretations from other researchers or investigations to improve a solution	58%
Defining a problem that can be solved by developing a new or improved object, process, or system	55%
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	53%
Identifying the limitations of the data collected in an investigation	53%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	53%
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	53%
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	48%
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	48%
Displaying numeric data in charts or graphs to identify patterns and relationships	47%
Supporting a proposed solution (for a problem) with data from investigations	47%
Using computer-based models to investigate cause and effect relationships of a simulated solution	47%
Deciding what additional data or information may be needed to find the best solution to a problem	42%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	42%
Integrating information from multiple sources to support your solution to a problem	42%
Using mathematics or computers to analyze numeric data	37%
Using data from investigations to defend an argument that conveys how a solution meets design criteria	27%

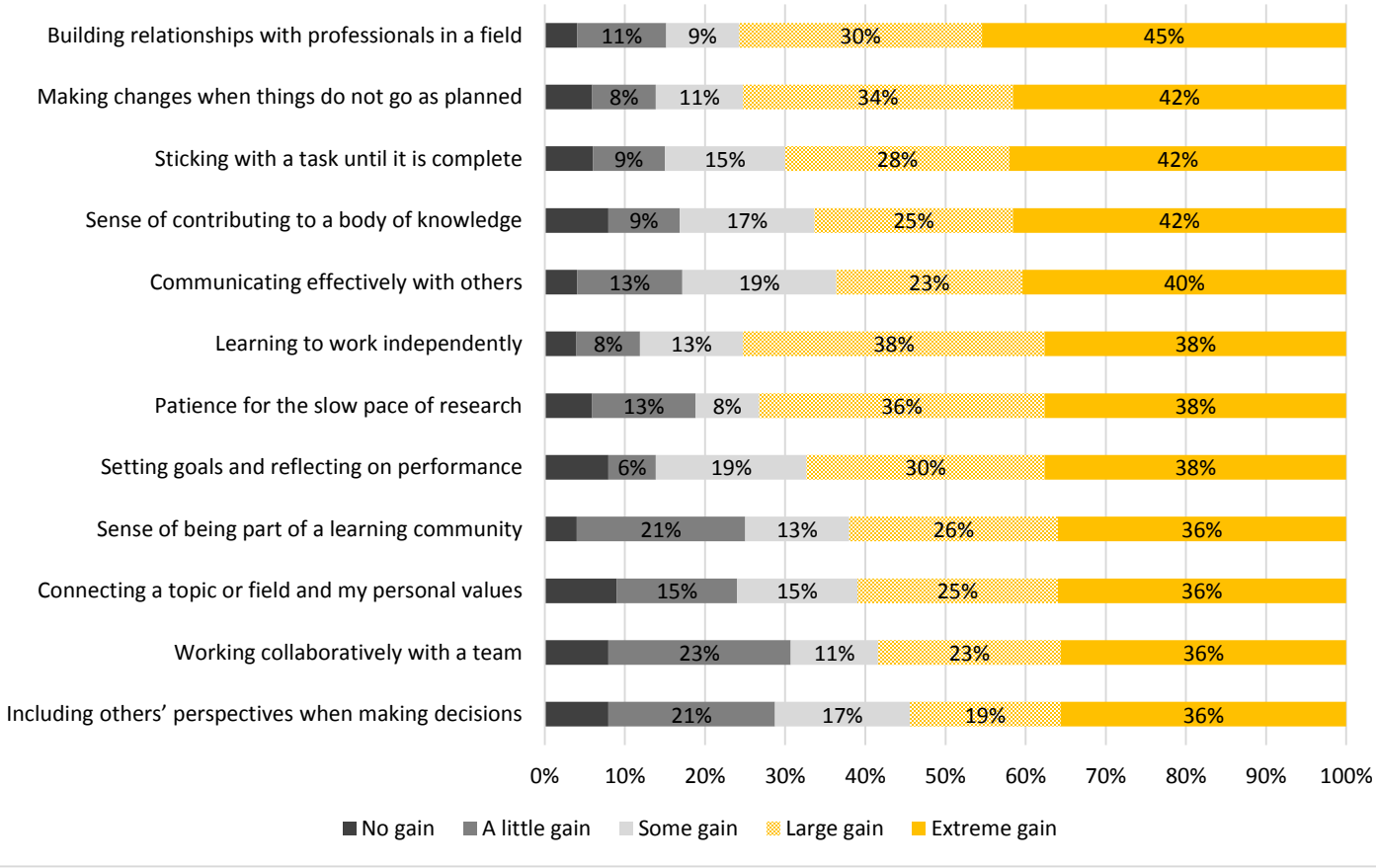
Composite scores were calculated for each set of practices items[18] on the apprentice questionnaire to examine whether the SEAP program had differential impacts on subgroups of apprentices. There were no significant differences among subgroups, indicating that apprentices from different genders, races/ethnicities, and community types reported similar impacts in these areas.

The apprentice questionnaire also asked apprentices about the impact of SEAP on their "21st Century Skills" that are necessary across a wide variety of fields. As can be seen in Chart 17, a majority of responding apprentices reported large or extreme gains on each of these skills, including making changes when things do not go as planned (76%), building relationships with professionals in a field (75%), sticking with a task until it is complete (70%), the sense of contributing to a body of knowledge (67%), and communicating effectively with others (63%). Apprentices reported similar gains regardless of gender, race/ethnicity, or community type.[19] In addition, mentor reports of apprentice gains in this area are generally similar to those of the apprentices.

[18] The science practices composite has a Cronbach's alpha reliability of 0.977; the engineering practices composite has a Cronbach's alpha reliability of 0.986.

[19] The 21st Century Skills composite has a Cronbach's alpha reliability of 0.967.

Chart 17: Apprentice Report of Impacts on 21st Century Skills (n = 52-53)



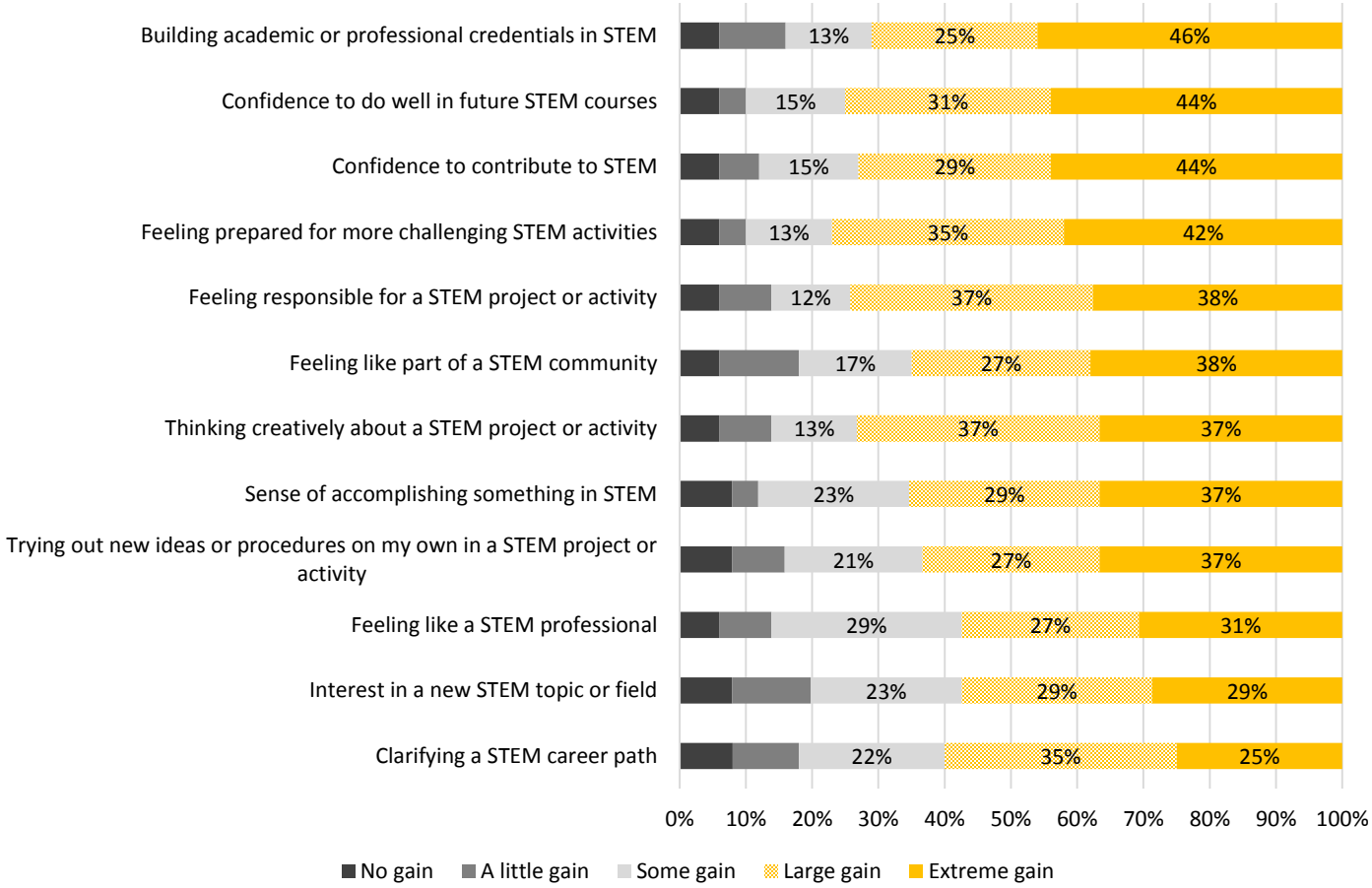
STEM Identity and Confidence

Deepening apprentices' STEM knowledge and skills are important for increasing the likelihood that they will pursue STEM further in their education and/or careers. However, they are unlikely to do so if they do not see themselves as capable of succeeding in STEM.[20] Consequently, the apprentice questionnaire included a series of items intended to measure the impact of SEAP on their STEM identity. These data are shown in Chart 18 and strongly suggest that the program has had a positive impact in this area. For example, 77% of responding apprentices reported a large or extreme gain in their preparedness for more challenging STEM activities. Similarly, substantial proportions of apprentices reported large or greater gains in their confidence to do well in future STEM courses (75%), confidence to contribute to STEM (73%), and

[20] Chang, M. J., Sharkness, J., Hurtado, S. and Newman, C. B. (2014), What matters in college for retaining aspiring scientists and engineers from underrepresented racial groups. J. Res. Sci. Teach., 51: 555–580.

their academic credentials in STEM (71%). Again, there were no differences among subgroups of apprentices on a composite variable created from these items.[21]

Chart 18: Apprentice Report of Impacts on STEM Identity (n = 51-52)



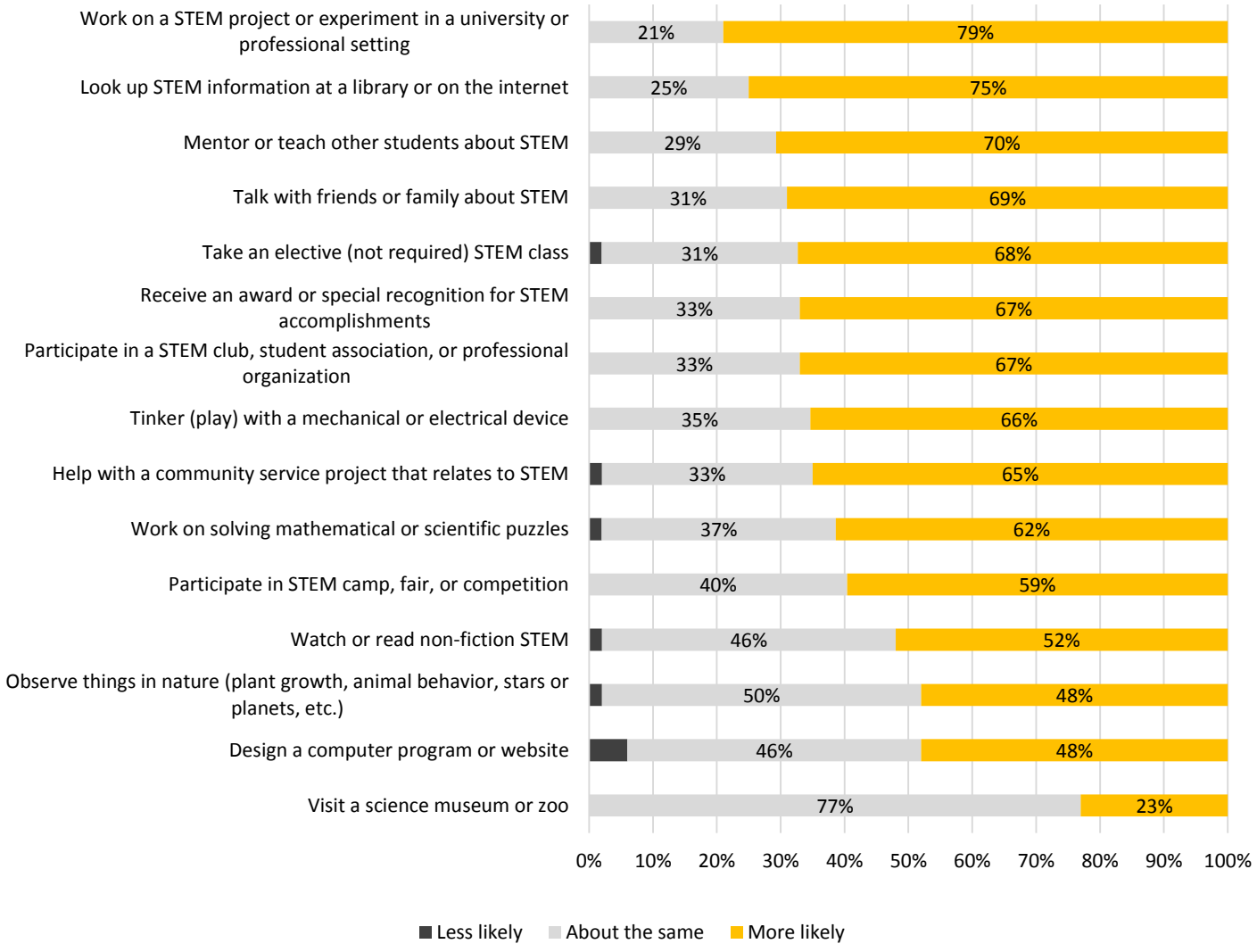
Interest and Future Engagement in STEM

A key goal of the AEOP program is to develop a STEM-literate citizenry. To do so, participants need to be engaged in and out of school with high quality STEM activities. In order to examine the impact of SEAP on apprentices' interest in future engagement in STEM, the questionnaire asked them to reflect on whether the likelihood of their engaging in STEM activities outside of school changed as a result of their experience, as well as their interest level in participating in future AEOP programs. As can be seen in Chart 19, apprentices indicated they were more likely to engage in many of these activities as a result of SEAP. For example, 79% reported being more likely to work on a STEM project or experiment in a

[21] The Cronbach's alpha reliability for these 8 items was 0.978.

university or professional setting; 75% to look up STEM information at the library or on the internet; 70% to mentor or teach other students about STEM; and 69% to talk with friends or family about STEM. A composite score was created from these items,[22] and composite scores were compared across subgroups of apprentices. There were no statistically significant differences by gender, race/ethnicity, or school location.

Chart 19: Change in Likelihood Apprentices Will Engage in STEM Activities Outside of School (n = 51-52)

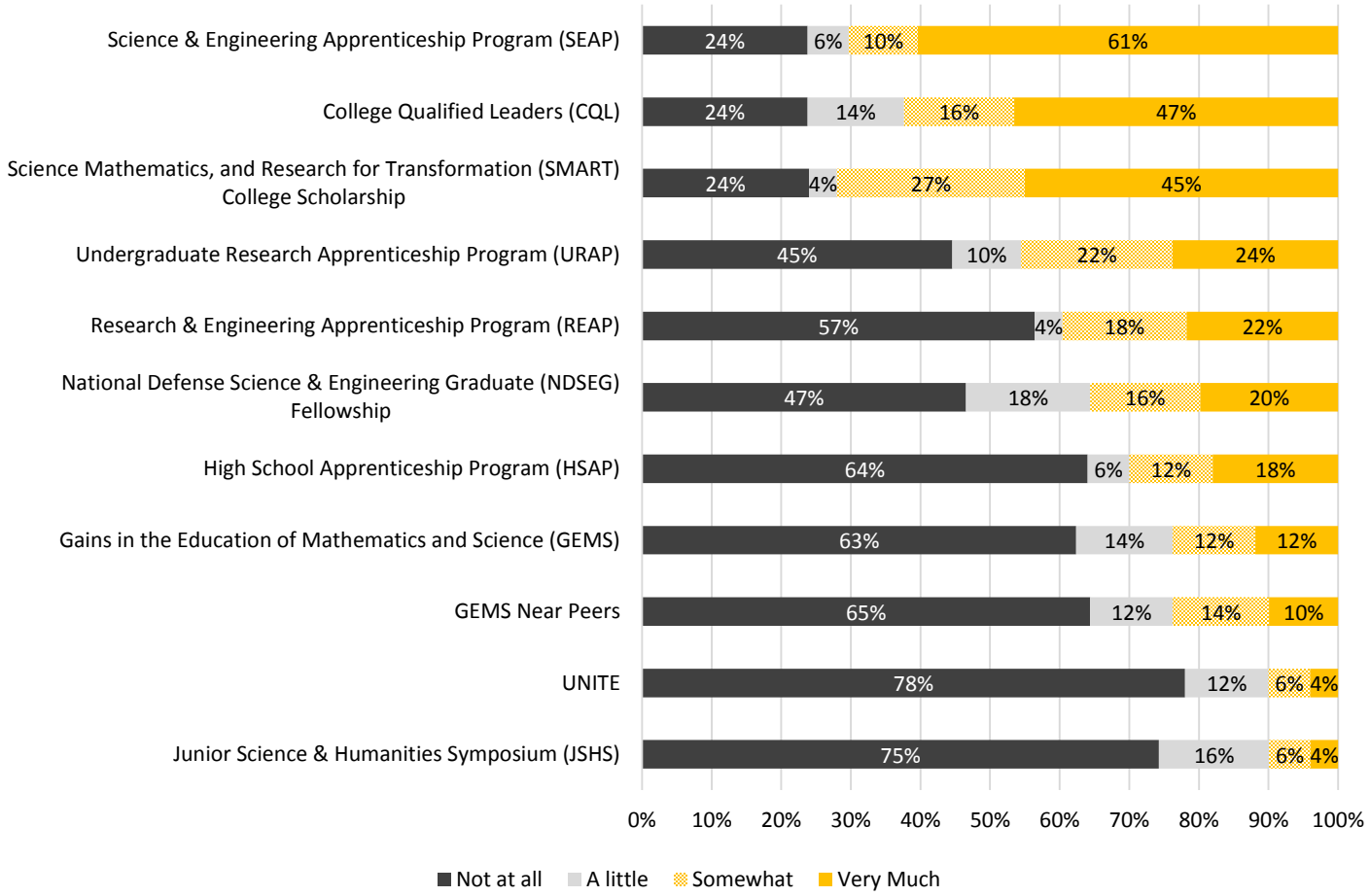


Note. Response scale: 1 = "Much less likely," 2 = "Less likely," 3 = "About the same before and after," 4 = "More likely," 5 = "Much more likely".

[22] These 15 items had a Cronbach's alpha reliability of 0.892.

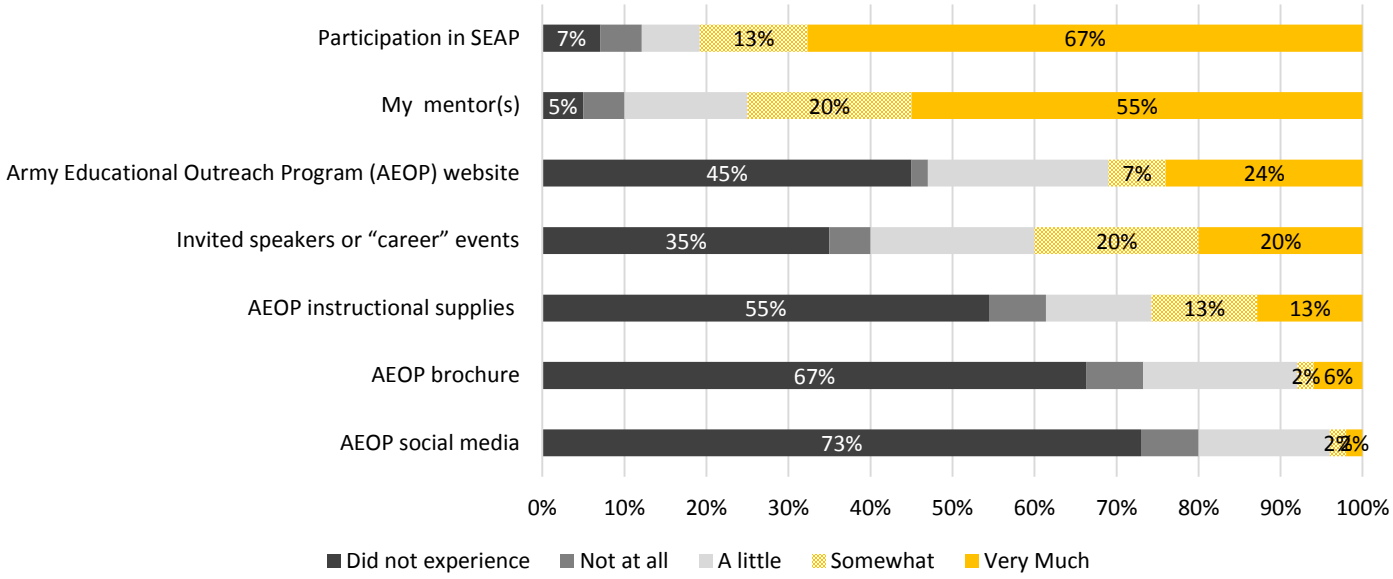
When asked how interested they are in participating in future AEOP programs, a majority of responding apprentices (61%) indicated being "very much" interested in participating in SEAP again; 47% in CQL, and 45% in SMART (see Chart 20). Conversely, large proportions expressed having no interest in HSAP, GEMS, GEMS Near Peers, UNITE, or JSHS.

Chart 20: Apprentice Interest in Future AEOP Programs (n = 50-51)



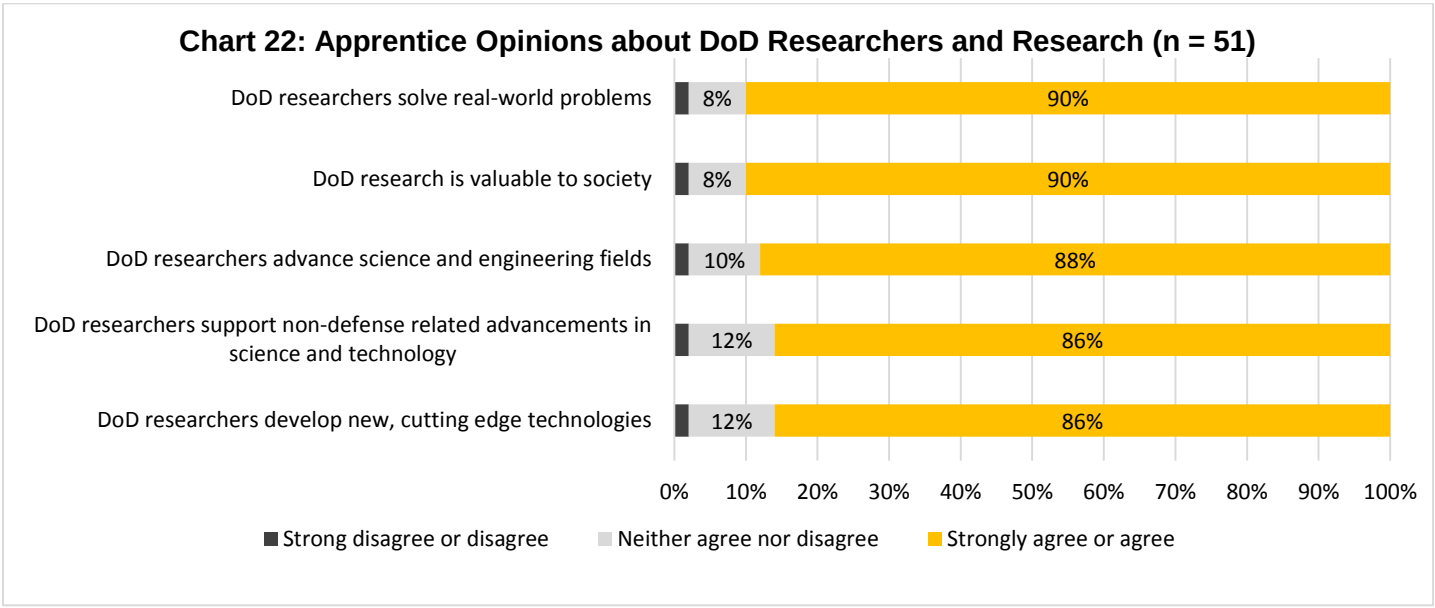
Apprentices were asked which resources impacted their awareness of the various AEOPs. As can be seen in Chart 21, simply participating in SEAP was most likely to be rated as impacting their awareness "somewhat" or "very much" (81%). Their mentor (75%) was also rated by a majority of apprentices as having at least some impact on their awareness of AEOP programs. On the other hand, apprentices indicated that they did not experience many resources intended to familiarize them with AEOP programs, including AEOP social media (73%) and the AEOP brochure (67%).

Chart 21: Impact of Resources on Apprentice Awareness of AEOPs (n = 54-55)



Attitudes toward Research

Students' attitudes about the importance of DoD research are an important prerequisite to their continued interest in the field and potential involvement in the future. In order to gauge apprentices' attitudes in this area, the apprentice questionnaire also asked about their opinions of what DoD researchers do and the value of DoD research more broadly. The data indicate that the vast majority of responding apprentices have favorable opinions (see Chart 22). For example, 90% agreed or strongly agreed that DoD researchers solve real-world problems and that DoD research is valuable to society.



Education and Career Aspirations

The evaluation also examined the program's impact on apprentices' education and career aspirations. In terms of education, the questionnaire asked apprentices how far they wanted to go in school before and after participating in SEAP. As can be seen in Table 24, when asked to think back on how far they wanted to go in school before participating in SEAP, 18% indicated wanting to finish college, 27% to get a masters' degree, and 22% a Ph.D. In contrast, after SEAP, only 8% reported wanting to finish college while 29% reported wanting to get a master's degree and 35% a Ph.D. However, this shift towards more education was not statistically significant.

Table 24. Apprentice Education Aspirations (n = 51-52)

	Before SEAP	After SEAP
Graduate from high school	8%	0%
Go to a trade or vocational school	0%	0%
Go to college for a little while	2%	0%
Finish college (get a Bachelor's degree)	18%	8%
Get more education after college	6%	6%
Get a master's degree	27%	29%
Get a Ph.D.	22%	35%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	14%	12%
Get a combined M.D. / Ph.D.	4%	12%
Get another professional degree (law, business, etc.)	0%	0%

In terms of career aspirations, apprentices were asked what kind of work they expect to be doing at age 30, both reflecting on what their aspiration was before participating in SEAP and after SEAP (see Table 25). A substantial portion of responding apprentices expressed uncertainty about their career aspirations, both before and after participating in SEAP. The remaining apprentices generally expressed interest in STEM-related careers both before and after participating in SEAP. To examine whether the SEAP program increased apprentice interest in STEM-related careers, each career option was coded as being STEM related or non-STEM related. Although some apprentices switched their aspirations from a non-STEM field to a STEM field, a similar proportion switched from STEM to non-STEM. Thus, there was not a statistically significant increase in the proportion of apprentices aspiring to a STEM-related career.

Table 25. Apprentice Career Aspirations (n = 51)

	Before SEAP	After SEAP
Undecided	45%	47%
Physical science (physics, chemistry, astronomy, materials science, etc.)	12%	12%
Biological science	8%	12%
Medicine (doctor, dentist, veterinarian, etc.)	12%	10%
Computer science	6%	6%
Science (no specific subject)	6%	6%
English/language arts	2%	2%
Health (nursing, pharmacy, technician, etc.)	2%	2%
Mathematics or statistics	0%	2%
Military, police, or security	2%	0%
Technology	2%	0%
Agricultural science	0%	0%
Art (writing, dancing, painting, etc.)	0%	0%
Business	0%	0%
Earth, atmospheric or oceanic science	0%	0%
Engineering	0%	0%
Environmental science	0%	0%
Farming	0%	0%
Law	0%	0%
Social science (psychologist, sociologist, etc.)	0%	0%
Skilled trade (carpenter, electrician, plumber, etc.)	0%	0%
Teaching, non-STEM	0%	0%
Teaching, STEM	0%	0%
Other, (specify):	4%	2%

Note: Other = "Motion Picture and Television – Editing," and "Journalism."

Apprentices were also asked the extent to which they expect to use their STEM knowledge, skills, and/or abilities in their work when they are age 30. As can be seen in Table 26, all apprentices expect to use STEM somewhat in their career. A majority (72%) expect to use STEM 76-100% of the time in their work, and 22% expect to use STEM 51-75% of the time.

Table 26. Apprentices Expecting to use STEM in Their Work at Age 30 (n = 50)	
	Questionnaire Respondents
Not at all	4%
Less than 25% of the time	0%
26% to 50% of the time	2%
51% to 75% of the time	22%
76% to 100% of the time	72%

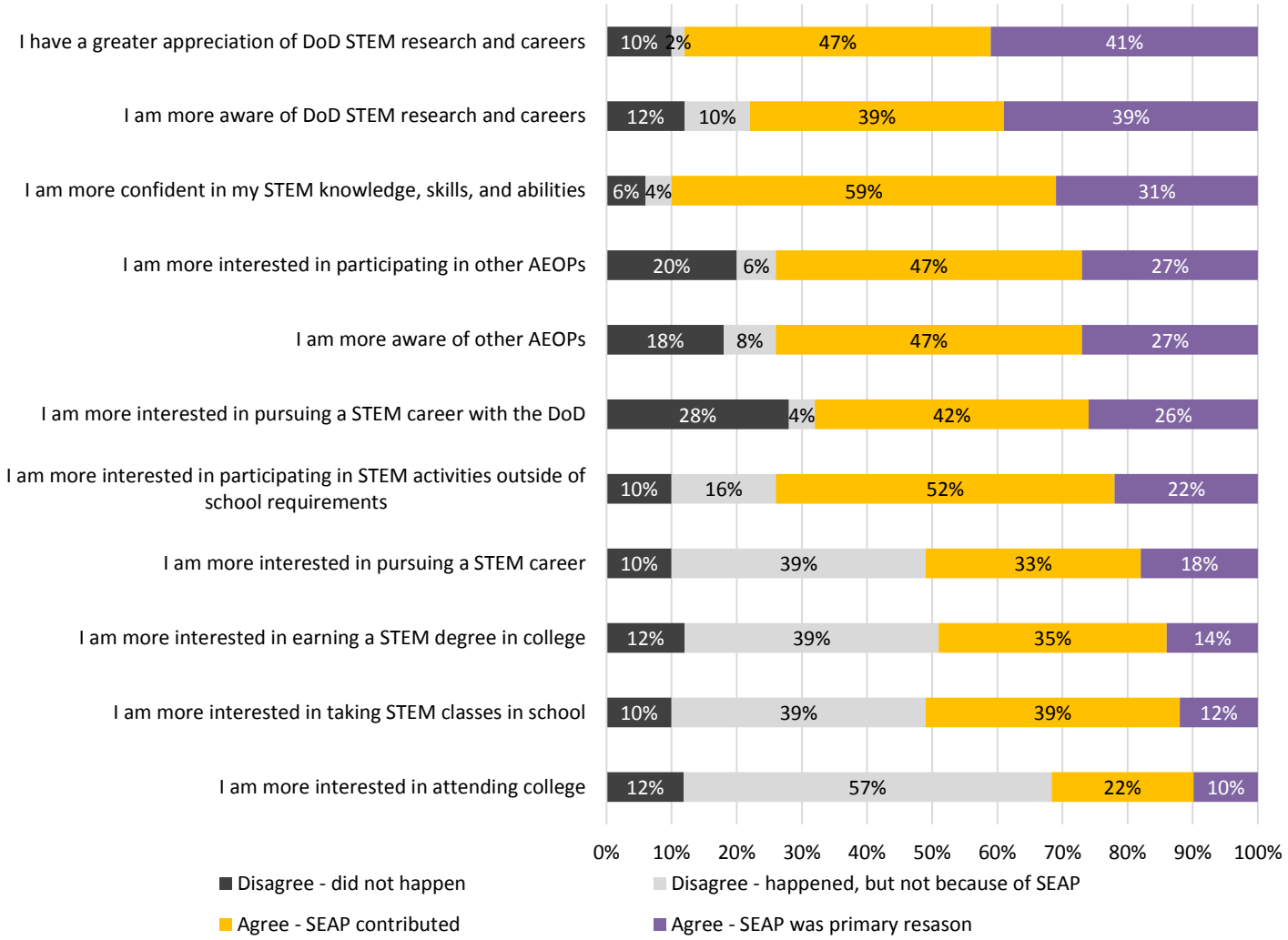
Overall Impact

Lastly, apprentices were asked about impacts of participating in SEAP more broadly. From these data, it is clear that apprentices thought the program had substantial impacts on them (see Chart 23). For example, a large majority of responding apprentices indicated being more confident in their STEM knowledge, skills, and abilities after participation, with 59% reporting that SEAP contributed to this impact and another 31% reporting that SEAP was the primary reason for this impact. Similarly, apprentices indicated a greater appreciation of DoD STEM research and careers (47% reporting that SEAP contributed, 41% reporting that SEAP was primary reason) and more awareness of DoD STEM research and careers (39% and 39%). Apprentices also reported increased awareness of other AEOPs (47% and 27%) and greater interest in participating in other AEOPs (47% and 27%). These items were combined into a composite variable[23] to test for differences among subgroups of students, with males reporting greater impacts than females[24] (d = -0.640). There were no differences between minority students and non-minority students, or those from urban/rural areas vs. suburban areas. Mentors were also asked about impacts on apprentices in these areas; in general, their reports of impacts were similar to those of the apprentices.

[23] The Cronbach's alpha reliability for these 11 items was 0.926.

[24] Two-tailed independent samples t-test, $t(48) = -2.21$, $p = 0.032$.

Chart 23: Apprentice Opinions of SEAP Impacts (n = 49-51)



An open-ended item on the questionnaire asked apprentices to list the three most important ways they benefited from the program; 44 apprentices provided at least one answer to the question. Apprentice responses addressed a variety of themes. More than half (66%) wrote about experiences they gained, either in general or in a specific area (e.g., "hands-on experience with STEM research"). More than half (57%) also indicated that the program increased their knowledge of such things as STEM content, STEM research, and careers in the DoD/Army. About one-quarter (27%) cited the skills they gained in such areas as speaking, writing, and research. One-quarter (25%) also mentioned the benefit of networking with STEM scientists/researchers. Apprentice comments from the focus group expand on some of these impacts. As three said:

"Going through the program was really helpful for me because I learned how to program and it showed me a whole new career path that I never really considered before of that I never really explored before."-- SEAP Apprentice

When I first entered this building and was put in the lab, I honestly was lost. I didn't know what most of the stuff was, but once I was given the tour and after a couple weeks of working with the equipment I've become familiar with all the different machines, and all the different tools and protocols, and the way they utilize different protocols, and how they go about things…I feel more familiar within the lab area, more comfortable. I know what I'm doing now. (SEAP Apprentice)

Going through the program was really helpful for me because I learned how to program and it showed me a whole new career path that I never really considered before of that I never really explored before. (SEAP apprentice)

It's nice to be working with people who have their Ph.D., people who are really, really, smart. It is really cool, you feel like you're playing grown-up because you have to work with people who are so smart. (SEAP Apprentice)

Summary of Findings

The FY14 evaluation of SEAP collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in Table 27.

Table 27. 2014 SEAP Evaluation Findings	
Participant Profiles	
SEAP had some success in providing outreach to participants from historically underrepresented and underserved populations.	• SEAP has been somewhat successful in attracting participation of female students; 40% of FY14 participants were female—a population that is historically underrepresented in engineering fields.
	• SEAP has had limited success in providing outreach to students from historically underrepresented and underserved race/ethnic groups. Of enrolled apprentices in FY14, 13% identify as Black or African American, 5% as Native American or Alaskan Native, and 2% as Native Hawaiian or Other Pacific Islander.
SEAP appears to have had limited success in engaging a diverse group of adult	• Of the 17 respondents to the mentor questionnaire, two-thirds (65%) were males and the large majority identified themselves at White (82%). Because of the nature of the SEAP program, nearly all responding mentors were scientists, engineers, or mathematics professionals (94%). However, because of the low

participants as STEM mentors.	response rate to the questionnaire, the respondents may not be representative of the population of SEAP mentors.
Actionable Program Evaluation	
Some efforts were made by ASEE to market SEAP to underrepresented and underserved populations. The impact of these efforts is unclear as most apprentices report learning about the program from alternative sources.	• A number of strategies were used by ASEE to market SEAP and recruit students from schools and school networks identified as serving large populations of traditionally underrepresented and underserved students. These efforts included sending email blasts to teachers, guidance counselors, and principals in areas nearby participating SEAP labs; mailing promotional materials when requested by teachers (e.g., AEOP brochures); and sharing information at events such as "Hispanic Association for Colleges and Universities Conference" and "Invent it. Build it. Career Expo at the Society of Women Engineers Conference."
	• Similar to FY13, FY14 apprentices frequently learned about the SEAP program from an immediate family member (43%), a teacher or professor (21%), or a past participant of SEAP (19%).
SEAP apprentices are motivated by opportunities to learn about STEM, typically in ways not possible in school.	• Apprentices were motivated to participate in SEAP because of their interest in STEM (88%), the opportunity to learn in ways that are not possible in school (82%), the desire to learn something new or interesting (79%), and the desire to expand laboratory or research skills (68%).
SEAP engages apprentices in meaningful STEM learning, through team-based and authentic STEM experiences.	• Most apprentices (70-86%) report interacting with STEM professionals, applying STEM to real-life situations, learning about STEM topics, learning about cutting-edge STEM research, and learning about different STEM careers on most days or every day of their SEAP experience.
	• Apprentices had opportunities to engage in a variety of STEM practices during their SEAP experience. For example, 79% reported participating in hands-on activities; 73% communicating with other students about STEM; and 73% practicing using laboratory or field techniques, procedures, and tools on most days or every day.
	• Similar to FY13, apprentices in FY14 reported greater opportunities to learn about STEM and greater engagement in STEM practices in their SEAP experience than they typically have in school.
	• Large proportions of mentors report using strategies to help make learning activities relevant to apprentices, support the needs of diverse learners, develop apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
SEAP promotes DoD STEM research and careers but can improve marketing of other AEOP opportunities.	• The vast majority of responding apprentices have favorable opinions of what DoD researchers do and the value of DoD research more broadly.
	• Most apprentices (83%) reported learning about multiple DoD STEM careers during their participation in SEAP. Mentors were most likely to rate participation in SEAP, administrators or site coordinators, and invited speakers

	or career events as "very much" useful in their efforts to expose their apprentices to different DoD STEM careers.
	• As in FY13, the vast majority of FY14 apprentices reported never hearing about or never participating in AEOP programs beyond SEAP. Similarly, responding mentors generally had no awareness of or past participation in other AEOP programs.
The SEAP experience is valued by apprentices and mentors.	• In general, responding apprentices indicated being satisfied with their SEAP experience, highlighting the instruction and mentorship they received during program activities.
	• The vast majority of responding mentors indicated having a positive experience. Further, many commented on the benefits the program provides apprentices, including opportunities for apprentices to have hands-on/real-life research experiences and the introduction of STEM at an early age.
Outcomes Evaluation	
SEAP had positive impacts on apprentices' STEM knowledge and competencies.	• A vast majority of apprentices reported large or extreme gains on their knowledge of what everyday research work is like in STEM; how professionals work on real problems in STEM; research conducted in a STEM topic or field; a STEM topic or field in depth; and the research processes, ethics, and rules for conduct in STEM. These impacts were identified across all demographic subgroups examined.
	• Many apprentices reported large or extreme gains in their abilities to do STEM, including such things as communicating information about their design processes and/or solutions in different formats, carrying out procedures for an investigation, supporting a proposed explanation with data from investigations, and displaying numeric data from an investigation in charts or graphs to identify patterns and relationships.
SEAP had positive impacts on apprentices' 21st Century Skills.	• A large majority of apprentices reported large or extreme gains on their ability to build relationships with professionals in the field, make changes when things do not go as planned, stick with a task until it is complete, and communicate effectively with others.
SEAP positively impacted apprentices' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many apprentices reported a large or extreme gain on their preparedness for more challenging STEM activities (77%), confidence to do well in future STEM courses (75%), and ability to think creatively about a STEM project or activity (74%). In addition, 63% reported increased confidence in their ability to contribute to STEM (73%) and increased sense of belonging to a STEM community (65%).
	• A majority of apprentices indicated that as a result of SEAP, they were more likely to work on a STEM project or experiment in a university or professional setting, look up STEM information at a library or on the internet, mentor or teach other students about STEM, and take an elective STEM class.
SEAP did not impact apprentices' education or	• Both before and after participating in SEAP, most apprentices indicated wanting to pursue an advanced degree after college.

career aspirations, likely because of the entry requirements of the program.	• A substantial proportion of apprentices expressed uncertainty about their career aspirations, both before and after participating in SEAP. The remaining apprentices generally indicating a desire to pursue a STEM-related career, both before and after participating in SEAP.
Apprentices show interest in future AEOP opportunities.	• Consistent with FY13, FY14 apprentices indicated being "very much" interested in participating in future AEOP programs, including SEAP (61%), CQL (47%), and SMART (45%).
SEAP raised apprentice awareness and appreciation of DoD STEM research and careers, as well as their interest in pursuing a STEM career with the DoD.	• A majority of apprentices reported that they had a greater awareness (78%) and appreciation (88%) of DoD STEM research and careers. In addition, 68% indicated that SEAP raised their interest in pursuing a STEM career with the DoD.

Recommendations

1. Although it is not an objective of SEAP in particular, the AEOP portfolio has the goal of attracting students from groups historically underrepresented and underserved in STEM. SEAP has had limited success in this area—a finding that is fairly consistent with previous years, indicating that this area is one in which SEAP can continue to improve. Although ASEE made some efforts to reach out to minority-serving schools and networks, the majority of apprentice survey respondents indicated learning about SEAP through other means (most frequently through an immediate family member (48%)). Many responding mentors indicted recruiting their apprentices through personal networks (e.g., workplace colleagues, personal acquaintances, university faculty). The lack of success in recruiting students from groups historically underrepresented and underserved in STEM to SEAP is shaped by multiple factors including the recruitment and selection process that is used by mentors and the marketing of SEAP to target groups by ASEE. Improvements can be made in all areas. The program may want to consider additional/alternate means of recruiting and selecting apprentices and mentors to ensure that SEAP includes diverse groups of highly talented participants. For example, the IPA may need to look at each site and compare its geographical reach to the target population. In addition, each site may want to compare the population of potential apprentices in its area to the applicant pool to identify gaps in its outreach to historically underrepresented and underserved populations.

2. Given the goal of having apprentices progress from SEAP into other AEOP programs, the program may want to work with sites to increase apprentices' exposure to AEOP. Small percentages of mentors explicitly discussed other AEOPs with their apprentices, typically GEMS (35%), SMART (24%), and GEMS Near Peers (24%). Further, although many apprentices expressed interest in participating in other AEOP programs, a substantial proportion indicated having no interest. The program may want to work with each site to ensure that all apprentices have access to structured opportunities that both describe the other AEOPs and provide information to apprentices on how they can apply to them. To this end, SEAP should ensure that mentors: (1) are aware of the intended focus

on exposing apprentices to AEOP/DoD programs, (2) have the resources to educate themselves and their apprentices about these programs, and (3) are equipped to help apprentices apply to other AEOP/DoD programs. In addition, given the limited use of the program website, print materials, and social media, the program should consider how these resources could be modified or leveraged to provide mentors and apprentices with more information about AEOP initiatives and facilitate increased enrollment.

3. Efforts should be undertaken to improve participation in evaluation activities, as the low response rates for both the apprentice and mentor questionnaires raise questions about the representativeness of the results. Improved communication with the individual program sites about expectations for the evaluation may help. In addition, the evaluation instruments may need to be streamlined as perceived response burden can affect participation. In particular, consideration should be given to whether the parallel nature of the apprentice and mentor questionnaires is necessary, with items being asked only of the most appropriate data source. In addition, items that are collected through the new, centralized registration (e.g., demographics) and those that may provide difficult-to-interpret data should be considered for removal.

4. The number of applications for SEAP apprenticeships (810 applications for 92 funded apprenticeships) is indicative of a substantial unmet need. Although 14 Army research laboratories were designated as SEAP sites in FY14, 5 of these locations did not host apprentices, despite receiving applications. In order to sustain, and potentially increase, student participation, the program will likely need to intensify its efforts to recruit Army S&Es to serve as mentors. These efforts may require examining and modifying program- and site-level structures, processes, and resources that both enable and discourage Army S&Es' participation.

5. A small number of apprentices (2%) reported that they did not have a research project to work on during their SEAP experience. In addition, 9% indicated that they were not at all satisfied with the amount of time spent doing meaningful research, and 14% indicated that their research mentor was available only half of the time or less often. Given that the goal of SEAP is for students to gain exposure to the real world of research, it is important that the project monitors the quality of apprentices' research experiences. Apprentices who do not have positive experiences in the program are unlikely to continue their association with their original laboratory and mentor in future summers, unlikely to enroll in future AEOP programs, and unlikely to recommend AEOP programs to other students.

Appendices

Appendix A

FY14 SEAP Evaluation Plan

Questionnaires

Purpose:
As per the approved FY14 AEOP APP, the external evaluation of SEAP conducted by VT includes two post-program questionnaires:

1. AEOP Youth Questionnaire to be completed by students (apprentices); and
2. AEOP Mentor Questionnaire to be completed by Army S&Es and/or other laboratory personnel that supervise, guide, or support apprentices during their SEAP research activities.

Questionnaires are the primary method of data collection for AEOP evaluation and collect information about participants' experiences with and perceptions of program resources, structures, and activities; potential benefits to participants; and strengths and areas of improvement for programs.

The questionnaires have been revised for FY14 to align with:

- Army's strategic plan and AEOP Priorities 1 (STEM Literate Citizenry), 2 (STEM Savvy Educators) *and* 3 (Sustainable Infrastructure);
- Federal guidance for evaluation of Federal STEM investments (e.g., inclusive of implementation and outcomes evaluation, and outcomes of STEM-specific competencies, transferrable competencies, attitudes about/identifying with STEM, future engagement in STEM-related activities, and educational/career pathways);
- Best practices and published assessment tools in STEM education, STEM informal/outreach, and the evaluation/ research communities; and
- AEOP's vision to improve the quality of the data collected, focusing on changes in intended student outcomes and contributions of AEOPs like CQL effecting those changes.

The use of common questionnaires and sets of items that are appropriate across programs will allow for comparisons across AEOP programs and, if administered in successive years, longitudinal studies of students as they advance through pipelines within the AEOP. Because the questionnaires incorporate batteries of items from existing tools that have been validated in published research, external comparisons may also be possible.

All AEOPs are expected to administer the Youth and Mentor questionnaires provided for their program. Both the Youth and Mentor questionnaires have two versions, an "advanced" version (JSHS and apprenticeship programs) or a "basic" version (all other programs). The same basic set of items are used in both, with slightly modified items and/or additional items used in the advanced version. Additionally, the surveys are customized to gather information specific structures, resources, and activities of programs.

Site Visits/Onsite Focus Groups

Purpose:
As per the approved FY14 AEOP APP, the external evaluation of SEAP conducted by VT includes site visits for 2-3 laboratories with a local GEMS-SEAP-CQL pipeline.

Site visits provide the VT evaluation team with first-hand opportunities to speak with apprentices and their mentors. We are able to observe the AEOPs in action. The information gleaned from these visits assists us in illustrating and more deeply understanding the findings of other data collected (from questionnaires). In total, VT's findings are used to highlight program successes and inform program changes so that the AEOPs can be even better in the future.

Site Selection:

VT evaluators will visit one or two sites in the National Capitol region whose site schedules would provide a range of STEM topics and grade levels impacted. In addition, we will select two distant sites with new, developing, or atypical programming, or that serve distinct populations. The sites will be mutually agreed upon by VT, ASEE, and the CAM--preliminary conversations include Adelphi, Alabama, and Champaign. VT will coordinate site visits directly with the lab coordinators at the selected sites (final site selection will be made and sites notified by mid-June).

Data Analyses

Quantitative and qualitative data were compiled and analyzed after all data collection concluded. Evaluators summarized quantitative data with descriptive statistics such as numbers of respondents, frequencies and proportions of responses, average response when responses categories are assigned to a 6-point scale (e.g., 1 = "Strongly Disagree" to 6 = "Strongly Agree"), and standard deviations. Emergent coding was used for the qualitative data to identify the most common themes in responses.

Evaluators conducted inferential statistics to study any differences among participant groups (e.g., by gender or race/ethnicity) that could indicate inequities in the SEAP program. Statistical significance indicates whether a result is unlikely to be due to chance alone. Statistical significance was determined with t-tests, chi-square tests, and various non-parametric tests as appropriate, with significance defined at $p < 0.05$. Because statistical significance is sensitive to the number of respondents, it is more difficult to detect significant changes with small numbers of respondents. Practical significance, also known as effect size, indicates the magnitude of an effect, and is typically reported when differences are statistically significant. The formula for effect sizes depends on the type of statistical test used, and is specified, along with generally accepted rules of thumb for interpretation, in the body of the report.

Appendix B

FY14 SEAP Apprentice Questionnaire and Data Summaries

2014 Science and Engineering Apprenticeship Program (SEAP): SEAP Youth Survey

Virginia Tech conducts program evaluation on behalf of the American Society for Engineering Education (ASEE) and U.S. Army to determine how well the Army Educational Outreach Programs (AEOP) is achieving its goals of promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). As part of this study Virginia Tech is surveying students (like you) who have participated in the Science and Engineering Apprenticeship Program (SEAP). The survey will collect information about you, your experiences in school, and your experiences in SEAP.

About this survey:

- While this survey is not anonymous, your responses are CONFIDENTIAL. When analyzing data and reporting results, your name will not be linked to any item responses or any comments you make.
- Responding to this survey is VOLUNTARY. You are not required to participate, although we hope you do because your responses will provide valuable information for meaningful and continuous improvement.
- If you provide your email address, the AEOP may contact you in the future to ask about your academic and career success.

If you have any additional questions or concerns, please contact one of the following people:

Tanner Bateman, Virginia Tech
Senior Project Associate, AEOPCA
(540) 231-4540, tbateman@vt.edu

Rebecca Kruse, Virginia Tech
Evaluation Director, AEOPCA
(703) 336-7922, rkruse75@vt.edu

If you are 17 and under, your parent/guardian provided permission for you to participate in the evaluation study when they authorized your participation in the AEOP program you just completed or will soon complete.

Q1. Do you agree to participate in this survey? (required)

❍ Yes, I agree to participate in this survey
❍ No, I do not wish to participate in this survey **If selected, respondent will be directed to the end of the survey**

Q2. Please provide your personal information below:

First Name: _____
Last Name: _____

Q3. What is your email address? (optional)

Email: _____

Q4. So that we can determine how diverse students respond to participation in AEOP programs please tell us about yourself and your school

What grade will you start in the fall? (select one)

- ❍ 4th
- ❍ 5th
- ❍ 6th
- ❍ 7th
- ❍ 8th
- ❍ 9th
- ❍ 10th
- ❍ 11th
- ❍ 12th
- ❍ College freshman
- ❍ Other (specify): _____
- ❍ Choose not to report

Q5. What is your gender?

- ❍ Male
- ❍ Female
- ❍ Choose not to report

Q6. What is your race or ethnicity?

- ❍ Hispanic or Latino
- ❍ Asian
- ❍ Black or African American
- ❍ Native American or Alaska Native
- ❍ Native Hawaiian or Other Pacific Islander
- ❍ White
- ❍ Other race or ethnicity (specify): _____
- ❍ Choose not to report

Q7. Do you qualify for free or reduced lunches at school?

- ❍ Yes
- ❍ No
- ❍ Choose not to report

Q8. Which best describes the location of your school?

- ❍ Frontier or tribal school
- ❍ Rural (country)
- ❍ Suburban
- ❍ Urban (city)

Q9. What kind of school do you attend?

- ❍ Public school
- ❍ Private school
- ❍ Home school
- ❍ Online school
- ❍ Department of Defense school (DoDDS or DoDEA)

Q10. Where was the SEAP program located?

- ❍ Army Center for Environmental Health Research at Fort Detrick (Frederick, MD)
- ❍ Army Medical Research Institute of Chemical Defense (Aberdeen, MD)
- ❍ Army Medical Research Institute for Infectious Diseases at Fort Detrick (Frederick, MD)
- ❍ Army Research Institute of Environmental Medicine (Natick, MA)
- ❍ Walter Reed Army Institute of Research (Silver Spring, MD)
- ❍ Edgewood Chemical Biological Center (Edgewood, MD)
- ❍ Army Aviation and Missile Research Development and Engineering Center (Huntsville, AL)
- ❍ Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)
- ❍ Army Research Laboratory-Adelphi (Adelphi, MD)
- ❍ Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)
- ❍ Engineer Research & Development Center-Mississippi (Vicksburg, MS)

Q11. How did you learn about SEAP? (Check all that apply)

- ❑ SEAP or Army Educational Outreach Program (AEOP) website
- ❑ Facebook, Twitter, Pinterest, or other social media
- ❑ School or university newsletter or email
- ❑ News story or other media coverage
- ❑ Past participant of SEAP
- ❑ Friend
- ❑ Immediate family member (e.g., mother, father, siblings)
- ❑ Extended family member (e.g., grandparents, aunts, uncles, cousins)
- ❑ Friend of the family
- ❑ Teacher or professor
- ❑ Guidance counselor
- ❑ Mentor from SEAP
- ❑ Someone who works at an Army laboratory
- ❑ Someone who works with the Department of Defense
- ❑ Other (specify): _____

Q12. How motivating were the following factors in your decision to participate in SEAP?

	Not at all motivating	A little motivating	Somewhat motivating	Very much motivating
Teacher or professor encouragement	❍	❍	❍	❍
An academic requirement or school grade	❍	❍	❍	❍
Desire to learn something new or interesting	❍	❍	❍	❍
The program mentor(s)	❍	❍	❍	❍
Building college application or résumé	❍	❍	❍	❍
Networking opportunities	❍	❍	❍	❍
Interest in science, technology, engineering, or mathematics (STEM)	❍	❍	❍	❍
Interest in STEM careers with the Army	❍	❍	❍	❍
Having fun	❍	❍	❍	❍
Earning stipend or award while doing STEM	❍	❍	❍	❍
Opportunity to do something with friends	❍	❍	❍	❍
Opportunity to use advanced laboratory technology	❍	❍	❍	❍
Desire to expand laboratory or research skills	❍	❍	❍	❍
Learning in ways that are not possible in school	❍	❍	❍	❍
Serving the community or country	❍	❍	❍	❍
Parent encouragement	❍	❍	❍	❍
Exploring a unique work environment	❍	❍	❍	❍
Other, (specify)	❍	❍	❍	❍

Q13. How often do you do each of the following in STEM classes at school this year?

	Not at all	At least once	A few times	Most days	Every day
Learn about new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍

Q14. How often did you do each of the following in SEAP this year?

	Not at all	At least once	A few times	Most days	Every day
Learn about new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍

Q15. How often do you do each of the following in STEM classes at school this year?

	Not at all	At least once	A few times	Most days	Every day
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍

Q16. How often did you do each of the following in SEAP this year?

	Not at all	At least once	A few times	Most days	Every day
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍

Q17. How often do you do each of the following in STEM classes at school this year?

	Not at all	At least once	A few times	Most days	Every day
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍

Come up with creative explanations or solutions	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍

Q18. How often did you do each of the following in SEAP this year?

	Not at all	At least once	A few times	Most days	Every day
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍

Q19. Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during SEAP:

	Not at all	A little	Somewhat	Very much
ASEE website	❍	❍	❍	❍
AEOP website	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍
Invited speakers or “career” events	❍	❍	❍	❍
Participation in SEAP	❍	❍	❍	❍

Q20. Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during SEAP:

	Not at all	A little	Somewhat	Very much
ASEE website	❍	❍	❍	❍
AEOP website	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍

Invited speakers or "career" events	❍	❍	❍	❍
Participation in SEAP	❍	❍	❍	❍

Q21. How SATISFIED were you with each of the following SEAP program features?

	Did Not Experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Other administrative tasks	❍	❍	❍	❍	❍
Communications with American Society for Engineering Education	❍	❍	❍	❍	❍
Communications with [program site]	❍	❍	❍	❍	❍
Location(s) of program activities	❍	❍	❍	❍	❍
Availability of program topics or fields that interest you	❍	❍	❍	❍	❍
Instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍
Research presentation process	❍	❍	❍	❍	❍

Q22. Which of the following best describes your primary research mentor?

❍ I did not have a research mentor
❍ Teacher
❍ Coach
❍ Parent
❍ Club or activity leader (School club, Boy/Girls Scouts, etc.)
❍ STEM researcher (private industry, university, or DoD/government employee, etc.)
❍ Other (specify) _____

Q23. Which of the following statements best reflects the input you had into your project initially?

❍ I did not have a project
❍ I was assigned a project by my mentor
❍ I worked with my mentor to design a project
❍ I had a choice among various projects suggested by my mentor
❍ I worked with my mentor and members of a research team to design a project
❍ I designed the entire project on my own

Q24. Which of the following statements best reflects the availability of your mentor?

- ❍ I did not have a mentor
- ❍ The mentor was never available
- ❍ The mentor was available less than half of the time
- ❍ The mentor was available about half of the time of my project
- ❍ The mentor was available more than half of the time
- ❍ The mentor was always available

Q25. Which of the following statements best reflects your working as part of a group or team?

- ❍ I worked alone (or alone with my research mentor)
- ❍ I worked with others in a shared laboratory or other space, but we work on different projects
- ❍ I worked alone on my project and I met with others regularly for general reporting or discussion
- ❍ I worked alone on a project that was closely connected with projects of others in my group
- ❍ I work with a group who all worked on the same project

Q26. How SATISFIED were you with each of the following:

	Did Not Experience	Not at all	A little	Somewhat	Very much
My working relationship with my mentor	❍	❍	❍	❍	❍
My working relationship with the group or team	❍	❍	❍	❍	❍
The amount of time I spent doing meaningful research	❍	❍	❍	❍	❍
The amount of time I spent with my research mentor	❍	❍	❍	❍	❍
The research experience overall	❍	❍	❍	❍	❍

Q27. Which of the following statements apply to your research experience? (Choose all that apply)

- ❑ I presented a talk or poster to other students or faculty
- ❑ I presented a talk or poster at a professional symposium or conference
- ❑ I attended a symposium or conference
- ❑ I wrote or co-wrote a paper that was/will be published in a research journal
- ❑ I wrote or co-wrote a technical paper or patent
- ❑ I will present a talk or poster to other students or faculty
- ❑ I will present a talk or poster at a professional symposium or conference
- ❑ I will attend a symposium or conference
- ❑ I will write or co-write a paper that was/will be published in a research journal
- ❑ I will write or co-write a technical paper or patent
- ❑ I won an award or scholarship based on my research

Q28. The list below describes mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies that your mentor(s) used when working directly with you in SEAP:

	Yes - my mentor used this strategy with me	No - my mentor did not use this strategy with me
Helped me become aware of the roles STEM play in my everyday life	❍	❍
Helped me understand how STEM can help me improve my community	❍	❍
Used teaching/mentoring activities that addressed my learning style	❍	❍
Provided me with extra support when I needed it	❍	❍
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	❍	❍
Allowed me to work on a collaborative project as a member of a team	❍	❍
Helped me practice a variety of STEM skills with supervision	❍	❍
Gave me constructive feedback to improve my STEM knowledge, skills, or abilities	❍	❍
Gave me guidance about educational pathways that would prepare me for a STEM career	❍	❍
Recommended Army Educational Outreach Programs that match my interests	❍	❍
Discussed STEM career opportunities with DoD or other government agencies	❍	❍

Q29. Which category best describes the focus of your SEAP experience?

❍ Science
❍ Technology
❍ Engineering
❍ Mathematics

Q30. AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extremely large gain
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q31. AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "science" in Q29**

	No gains	A little gain	Some gain	Large gain	Extremely large gains
Asking questions based on observations of real-world phenomena	❍	❍	❍	❍	❍
Asking a question (about a phenomenon) that can be answered with one or more investigations	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to answer a question	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable, in order to understand relationships between variables	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed explanation (for a phenomenon) with data from investigations	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their explanations	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	❍	❍	❍	❍	❍

Q31-CONTINUED. AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "science" in Q29**

	No gains	A little gain	Some gain	Large gain	Extremely large gains
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (e.g., orally, written, graphically, mathematically)	❍	❍	❍	❍	❍
Identifying the limitations of data collected in an investigation	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	❍	❍	❍	❍	❍
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve an explanation	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	❍	❍	❍	❍	❍
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your explanations of phenomena	❍	❍	❍	❍	❍
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	❍	❍	❍	❍	❍

Q32. AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "technology," "engineering," or "mathematics" in Q29**

	No gains	A little gain	Some gain	Large gain	Extremely large gains
Identifying real-world problems based on social, technological, or environmental issues	❍	❍	❍	❍	❍
Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	❍	❍	❍	❍	❍
Making a model that represents the key features or functions of a solution to a problem	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to test if a solution functions as intended	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍

Q32 CONTINUED. AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "technology," "engineering," or "mathematics" in Q29**

	No gains	A little gain	Some gain	Large gain	Extremely large gains
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated solution	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution functions as intended	❍	❍	❍	❍	❍
Displaying numeric data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their solutions	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how a solution meets design criteria	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best solution to a problem	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about your design processes and/or solutions in different formats (e.g., orally, written, graphically, mathematically)	❍	❍	❍	❍	❍
Supporting a proposed solution (for a problem) with data from investigations	❍	❍	❍	❍	❍

Q33. AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?

	No gains	A little gain	Some gain	Large gain	Extremely large gains
Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍
Persevering with a task	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Patience for the slow pace of research	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Sense of contributing to a body of knowledge	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and your personal values	❍	❍	❍	❍	❍

Q34. AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?

	No gains	A little gain	Some gain	Large gain	Extremely large gains
Interest in a new STEM topic or field	❍	❍	❍	❍	❍
Clarifying a STEM career path	❍	❍	❍	❍	❍
Sense of accomplishing something in STEM	❍	❍	❍	❍	❍
Building academic or professional credentials in STEM	❍	❍	❍	❍	❍
Readiness for more challenging STEM activities	❍	❍	❍	❍	❍
Confidence to do well in future STEM courses	❍	❍	❍	❍	❍
Confidence to contribute to STEM	❍	❍	❍	❍	❍
Thinking creatively about a STEM project or activity	❍	❍	❍	❍	❍
Trying out new ideas or procedures on your own in a STEM project or activity	❍	❍	❍	❍	❍
Feeling responsible for a STEM project or activity	❍	❍	❍	❍	❍
Feeling like a STEM professional	❍	❍	❍	❍	❍
Feeling like part of a STEM community	❍	❍	❍	❍	❍

Q35. AS A RESULT OF YOUR SEAP experience, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?

	Much less likely	Less likely	About the same before and after	More likely	Much more likely
Visit a science museum or zoo	❍	❍	❍	❍	❍
Watch or read non-fiction STEM	❍	❍	❍	❍	❍
Look up STEM information at a library or on the internet	❍	❍	❍	❍	❍
Tinker with a mechanical or electrical device	❍	❍	❍	❍	❍
Work on solving mathematical or scientific puzzles	❍	❍	❍	❍	❍
Design a computer program or website	❍	❍	❍	❍	❍
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	❍	❍	❍	❍	❍
Talk with friends or family about STEM	❍	❍	❍	❍	❍
Mentor or teach other students about STEM	❍	❍	❍	❍	❍
Help with a community service project that relates to STEM	❍	❍	❍	❍	❍
Participate in a STEM club, student association, or professional organization	❍	❍	❍	❍	❍
Participate in STEM camp, fair, or competition	❍	❍	❍	❍	❍
Take an elective (not required) STEM class	❍	❍	❍	❍	❍
Work on a STEM project or experiment in a university or professional setting	❍	❍	❍	❍	❍
Receive an award or special recognition for STEM accomplishments	❍	❍	❍	❍	❍

Q36. How far did you want to go in school BEFORE participating in SEAP?

❍ Graduate from high school
❍ Go to a trade or vocational school
❍ Go to college for a little while
❍ Finish college (get a Bachelor's degree)
❍ Get more education after college
❍ Get a master's degree
❍ Get a Ph.D.
❍ Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
❍ Get a combined M.D. / Ph.D.
❍ Get another professional degree (law, business, etc.)

Q37. How far do you want to go in school AFTER participating in SEAP?

- ❍ Graduate from high school
- ❍ Go to a trade or vocational school
- ❍ Go to college for a little while
- ❍ Finish college (get a Bachelor's degree)
- ❍ Get more education after college
- ❍ Get a master's degree
- ❍ Get a Ph.D.
- ❍ Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
- ❍ Get a combined M.D. / Ph.D.
- ❍ Get another professional degree (law, business, etc.)

Q38. BEFORE SEAP, what kind of work did you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career goals BEFORE SEAP)

- ❍ Undecided
- ❍ Science (no specific subject)
- ❍ Physical science (e.g., physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric or oceanic science
- ❍ Agricultural science
- ❍ Environmental science
- ❍ Computer science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Teaching, STEM
- ❍ Teaching, non-STEM
- ❍ Medicine (e.g., doctor, dentist, veterinarian, etc.)
- ❍ Health (e.g., nursing, pharmacy, technician, etc.)
- ❍ Social science (e.g., psychologist, sociologist)
- ❍ Business
- ❍ Law
- ❍ English/language arts
- ❍ Farming
- ❍ Military, police, or security
- ❍ Art (e.g., writing, dancing, painting, etc.)
- ❍ Skilled trade (carpenter, electrician, plumber, etc.)

Other _____

Q39. AFTER SEAP, what kind of work do you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career AFTER SEAP)

- ❍ Undecided
- ❍ Science (no specific subject)
- ❍ Physical science (e.g., physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric or oceanic science
- ❍ Agricultural science
- ❍ Environmental science
- ❍ Computer science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Teaching, STEM
- ❍ Teaching, non-STEM
- ❍ Medicine (e.g., doctor, dentist, veterinarian, etc.)
- ❍ Health (e.g., nursing, pharmacy, technician, etc.)
- ❍ Social science (e.g., psychologist, sociologist)
- ❍ Business
- ❍ Law
- ❍ English/language arts
- ❍ Farming
- ❍ Military, police, or security
- ❍ Art (e.g., writing, dancing, painting, etc.)
- ❍ Skilled trade (carpenter, electrician, plumber, etc.)

Other _____

Q40. When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?

- ❍ not at all
- ❍ up to 25% of the time
- ❍ up to 50% of the time
- ❍ up to 75% of the time
- ❍ up to 100% of the time

Q41. How many times have you participated in any of the following Army Educational Outreach Programs (AEOPs)?
If you have heard of an AEOP but never participated select "Never". If you have not heard of an AEOP select "Never heard of it".

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q42. How interested are you in participating in the following programs in the future?

	Not at all	A little	Somewhat	Very much
Camp Invention	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍

Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍
UNITE	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍

Q43. How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during SEAP?

❍ None
❍ 1
❍ 2
❍ 3
❍ 4
❍ 5 or more

Q44. How many Department of Defense (DoD) STEM jobs/careers did you learn about during SEAP?

❍ None
❍ 1
❍ 2
❍ 3
❍ 4
❍ 5 or more

Q45. Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍
DoD researchers support non-defense related advancements in science and technology	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

Q46. Which of the following statements describe you after participating in SEAP?

	Disagree - This did not happen	Disagree - This happened but not because of the program	Agree - The program contributed	Agree - The program was primary reason
I am more confident in my STEM knowledge, skills, and abilities	❍	❍	❍	❍
I am more interested in participating in STEM activities outside of school requirements	❍	❍	❍	❍
I am more aware of other AEOPs	❍	❍	❍	❍
I am more interested in participating in other AEOPs	❍	❍	❍	❍
I am more interested in taking STEM classes in school	❍	❍	❍	❍
I am more interested in attending college	❍	❍	❍	❍
I am more interested in earning a STEM degree in college	❍	❍	❍	❍
I am more interested in pursuing a STEM career	❍	❍	❍	❍
I am more aware of DoD STEM research and careers	❍	❍	❍	❍
I have a greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
I am more interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q47. What are the three most important ways that you have benefited from SEAP?

Benefit #1:

Benefit #2:

Benefit #3:

Q48. What are the three ways that SEAP should be improved for future participants?

Improvement #1:

Improvement #2:

Improvement #3:

Q49. Tell us about your overall satisfaction with your SEAP experience.

SEAP Youth Data Summary

So that we can determine how diverse students respond to participation in AEOP programs, please tell us about yourself and your school. What grade will you start in the fall? (select one) (Avg. = 12.17, SD = 0.86)		
	Freq.	**%**
4th	0	0%
5th	0	0%
6th	0	0%
7th	0	0%
8th	0	0%
9th	0	0%
10th	2	3%
11th	11	19%
12th	20	34%
College freshman	25	42%
Other, (specify)	0	0%
Choose not to report	1	0%
Total	**59**	**100%**

What is your gender?		
	Freq.	**%**
Male	30	51%
Female	27	46%
Choose not to report	2	3%
Total	**59**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	3	5%
Asian	14	24%
Black or African American	6	10%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	2	3%
White	25	42%

Other race or ethnicity, (specify):	4	7%
Choose not to report	5	8%
Total	**59**	**100%**

Note. Other = “Indian” (n = 2), “Lebanese”, and “Multiracial”.

Do you qualify for free or reduced lunches at school?		
	Freq.	**%**
Yes	1	2%
No	54	93%
Choose not to report	3	5%
Total	**58**	**100%**

Which best describes the location of your school?		
	Freq.	**%**
Frontier or tribal school	0	0%
Rural (country)	7	12%
Suburban	46	79%
Urban (city)	5	9%
Total	**58**	**100%**

What kind of school do you attend?		
	Freq.	**%**
Public school	50	86%
Private school	6	10%
Home school	1	2%
Online school	1	2%
Department of Defense school (DoDDS or DoDEA)	0	0%
Total	**58**	**100%**

Where was the SEAP program located? (Select ONE)						
	Freq.	%			Freq.	%
Army Center for Environmental Health Research at Fort Detrick (Frederick, MD)	5	9%		Army Aviation and Missile Research Development and Engineering Center-Aeroflightdynamics Directorate (Moffett Field, CA)	0	0%
Army Medical Research Institute of Chemical Defense (Aberdeen, MD)	14	24%		Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)	8	14%
Army Medical Research Institute for Infectious Diseases at Fort Detrick (Frederick, MD)	4	7%		Army Research Laboratory-Adelphi (Adelphi, MD)	11	19%
Army Aviation and Missile Research Development and Engineering Center-Redstone Arsenal (Huntsville, AL)	8	14%		Army Criminal Investigation Command-Defense Forensic Science Center (Forest Park, GA)	0	0%
Army Aviation and Missile Research Development and Engineering Center-Aviation Applied Technology Directorate (Langely-Eustis, VA)	0	0%		Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)	3	5%
Army Aviation and Missile Research Development and Engineering Center-Aviation Engineering Directorate (Corpus Christi, TX)	0	0%		Engineer Research & Development Center-Mississippi (Vicksburg, MS)	0	0%
Army Aviation and Missile Research Development and Engineering Center-System Simulation and Development Directorate (Colorado Springs, CO)	0	0%		Engineer Research & Development Center-Topographic Engineering Center (Alexandria, VA)	0	0%
				Walter Reed Army Institute of Research (Silver Spring, MD)	5	9%
				Total	58	100%

How did you learn about SEAP? (Check all that apply) (n = 58)						
	Freq.	%			Freq.	%
American Society for Engineering Education website	1	2%		Extended family member (grandparents, aunts, uncles, cousins)	5	9%
Army Educational Outreach Program (AEOP) website	14	24%		Friend of the family	9	16%
Facebook, Twitter, Pinterest, or other social media	0	0%		Teacher or professor	12	21%
School or university newsletter, email, or website	7	12%		Guidance counselor	4	7%
News story or other media coverage	0	0%		Mentor from SEAP	7	12%
Past participant of SEAP	11	19%		Someone who works at an Army laboratory	9	16%
Friend	8	14%		Someone who works with the Department of Defense	4	7%
Immediate family member (mother, father, siblings)	25	43%		Other, (specify):	0	0%

How motivating were the following factors in your decision to participate in SEAP?							
	1	2	3	4	n	Avg.	SD
Teacher or professor encouragement	16 (29%)	13 (23%)	14 (25%)	13 (23%)	56	**2.43**	1.14
An academic requirement or school grade	39 (68%)	6 (11%)	7 (12%)	5 (9%)	57	**1.61**	1.01
Desire to learn something new or interesting	3 (5%)	3 (5%)	6 (11%)	45 (79%)	57	**3.63**	0.82
The program mentor(s)	8 (14%)	9 (16%)	19 (33%)	21 (37%)	57	**2.93**	1.05
Building college application or résumé	4 (7%)	5 (9%)	9 (16%)	39 (68%)	57	**3.46**	0.93
Networking opportunities	6 (11%)	4 (7%)	12 (21%)	35 (61%)	57	**3.33**	1.01
Interest in science, technology, engineering, or mathematics (STEM)	4 (7%)	1 (2%)	2 (4%)	50 (88%)	57	**3.72**	0.82
Interest in STEM careers with the Army	7 (12%)	9 (16%)	19 (33%)	22 (39%)	57	**2.98**	1.03
Having fun	5 (9%)	5 (9%)	20 (35%)	27 (47%)	57	**3.21**	0.94
Earning stipend or award while doing STEM	4 (7%)	10 (18%)	15 (26%)	28 (49%)	57	**3.18**	0.97
Opportunity to do something with friends	22 (39%)	15 (26%)	10 (18%)	10 (18%)	57	**2.14**	1.13
Opportunity to use advanced laboratory technology	5 (9%)	6 (11%)	17 (30%)	29 (51%)	57	**3.23**	0.96
Desire to expand laboratory or research skills	3 (5%)	4 (7%)	11 (19%)	39 (68%)	57	**3.51**	0.85
Learning in ways that are not possible in school	4 (7%)	2 (4%)	4 (7%)	47 (82%)	57	**3.65**	0.86
Serving the community or country	5 (9%)	12 (21%)	18 (32%)	22 (39%)	57	**3.00**	0.98
Parent encouragement	10 (18%)	8 (14%)	13 (23%)	26 (46%)	57	**2.96**	1.15

Exploring a unique work environment	3 (5%)	4 (7%)	13 (23%)	37 (65%)	57	**3.47**	0.85
Other, (specify)	9 (69%)	0 (0%)	0 (0%)	4 (31%)	13	**1.92**	1.44

Note. Response scale: **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much". Other = "mentorship for senior capstone", "experience", and "Advice for the future".

How often do you do each of the following in STEM classes at school this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn about new science, technology, engineering, or mathematics (STEM) topics	6 (11%)	2 (4%)	9 (16%)	17 (30%)	22 (39%)	56	**3.84**	1.29
Apply STEM knowledge to real life situations	6 (11%)	3 (5%)	19 (34%)	23 (41%)	5 (9%)	56	**3.32**	1.08
Learn about cutting-edge STEM research	8 (15%)	6 (11%)	26 (47%)	7 (13%)	8 (15%)	55	**3.02**	1.19
Learn about different STEM careers	11 (20%)	4 (7%)	26 (46%)	8 (14%)	7 (13%)	56	**2.93**	1.23
Interact with STEM professionals	18 (32%)	15 (27%)	12 (21%)	6 (11%)	5 (9%)	56	**2.38**	1.29

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in SEAP this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn about new science, technology, engineering, or mathematics (STEM) topics	3 (5%)	2 (4%)	4 (7%)	19 (34%)	28 (50%)	56	**4.20**	1.09
Apply STEM knowledge to real life situations	3 (5%)	2 (4%)	8 (14%)	7 (13%)	36 (64%)	56	**4.27**	1.17
Learn about cutting-edge STEM research	3 (5%)	1 (2%)	10 (18%)	15 (27%)	27 (48%)	56	**4.11**	1.11
Learn about different STEM careers	3 (5%)	3 (5%)	11 (20%)	20 (36%)	19 (34%)	56	**3.88**	1.11
Interact with STEM professionals	4 (7%)	1 (2%)	3 (5%)	5 (9%)	43 (77%)	56	**4.46**	1.16

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in STEM classes at school this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Practice using laboratory or field techniques, procedures, and tools	6 (11%)	4 (7%)	18 (32%)	21 (38%)	7 (13%)	56	**3.34**	1.13
Participate in hands-on STEM activities	4 (7%)	6 (11%)	19 (34%)	17 (30%)	10 (18%)	56	**3.41**	1.12
Work as part of a team	6 (11%)	1 (2%)	12 (21%)	26 (46%)	11 (20%)	56	**3.63**	1.15
Communicate with other students about STEM	5 (9%)	4 (7%)	11 (20%)	12 (21%)	24 (43%)	56	**3.82**	1.31

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in SEAP this year?								
	1	2	3	4	5	n	Avg.	SD
Practice using laboratory or field techniques, procedures, and tools	7 (13%)	3 (5%)	5 (9%)	9 (16%)	32 (57%)	56	**4.00**	1.43
Participate in hands-on STEM activities	6 (11%)	3 (5%)	3 (5%)	7 (13%)	37 (66%)	56	**4.18**	1.38
Work as part of a team	4 (7%)	3 (5%)	10 (18%)	14 (25%)	25 (45%)	56	**3.95**	1.23
Communicate with other students about STEM	3 (5%)	6 (11%)	6 (11%)	8 (14%)	33 (59%)	56	**4.11**	1.27

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	5 (9%)	4 (7%)	19 (34%)	20 (36%)	8 (14%)	56	**3.39**	1.11
Design an investigation	5 (9%)	10 (18%)	27 (48%)	12 (21%)	2 (4%)	56	**2.93**	0.95
Carry out an investigation	4 (7%)	8 (14%)	24 (43%)	17 (30%)	3 (5%)	56	**3.13**	0.97
Analyze and interpret data or information	4 (7%)	4 (7%)	17 (30%)	24 (43%)	7 (13%)	56	**3.46**	1.04
Draw conclusions from an investigation	3 (5%)	5 (9%)	19 (34%)	22 (39%)	7 (13%)	56	**3.45**	1.01
Come up with creative explanations or solutions	4 (7%)	5 (9%)	26 (46%)	14 (25%)	7 (13%)	56	**3.27**	1.04
Build (or simulate) something	4 (7%)	13 (23%)	18 (32%)	15 (27%)	6 (11%)	56	**3.11**	1.11

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in SEAP this year?								
	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	5 (9%)	7 (13%)	9 (16%)	19 (34%)	16 (29%)	56	**3.61**	1.27
Design an investigation	9 (16%)	5 (9%)	8 (14%)	20 (36%)	14 (25%)	56	**3.45**	1.39
Carry out an investigation	6 (11%)	4 (7%)	4 (7%)	24 (43%)	18 (32%)	56	**3.79**	1.28
Analyze and interpret data or information	4 (7%)	3 (5%)	8 (14%)	20 (36%)	21 (38%)	56	**3.91**	1.18
Draw conclusions from an investigation	5 (9%)	3 (5%)	11 (20%)	20 (36%)	17 (30%)	56	**3.73**	1.21
Come up with creative explanations or solutions	4 (7%)	4 (7%)	12 (21%)	18 (32%)	18 (32%)	56	**3.75**	1.19
Build (or simulate) something	9 (16%)	3 (5%)	11 (20%)	16 (29%)	17 (30%)	56	**3.52**	1.40

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during SEAP:								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
American Society for Engineering Education website	40 (73%)	2 (4%)	6 (11%)	3 (5%)	4 (7%)	55	**2.60**	1.06
Army Educational Outreach Program (AEOP) website	25 (45%)	1 (2%)	12 (22%)	4 (7%)	13 (24%)	55	**2.97**	1.00
AEOP social media	40 (73%)	4 (7%)	9 (16%)	1 (2%)	1 (2%)	55	**1.93**	0.80
AEOP brochure	36 (67%)	4 (7%)	10 (19%)	1 (2%)	3 (6%)	54	**2.17**	0.99
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	30 (55%)	4 (7%)	7 (13%)	7 (13%)	7 (13%)	55	**2.68**	1.07
My mentor(s)	3 (5%)	3 (5%)	8 (15%)	11 (20%)	30 (55%)	55	**3.31**	0.94
Invited speakers or "career" events	19 (35%)	3 (5%)	11 (20%)	11 (20%)	11 (20%)	55	**2.83**	0.97
Participation in SEAP	4 (7%)	3 (5%)	4 (7%)	7 (13%)	37 (67%)	55	**3.53**	0.88

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during SEAP:								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
American Society for Engineering Education website	40 (73%)	2 (4%)	4 (7%)	6 (11%)	3 (5%)	55	**2.67**	0.98
Army Educational Outreach Program (AEOP) website	28 (51%)	6 (11%)	6 (11%)	6 (11%)	9 (16%)	55	**2.67**	1.18
AEOP social media	39 (71%)	4 (7%)	5 (9%)	4 (7%)	3 (5%)	55	**2.38**	1.09
AEOP brochure	37 (67%)	6 (11%)	5 (9%)	5 (9%)	2 (4%)	55	**2.17**	1.04
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	28 (52%)	10 (19%)	6 (11%)	5 (9%)	5 (9%)	54	**2.19**	1.17
My mentor(s)	6 (11%)	3 (5%)	7 (13%)	11 (20%)	28 (51%)	55	**3.31**	0.94
Invited speakers or "career" events	17 (31%)	2 (4%)	7 (13%)	16 (29%)	13 (24%)	55	**3.05**	0.87
Participation in SEAP	5 (9%)	2 (4%)	3 (5%)	16 (29%)	29 (53%)	55	**3.44**	0.79

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

How SATISFIED were you with each of the following SEAP program features?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Application or registration process	0 (0%)	3 (5%)	15 (27%)	21 (38%)	16 (29%)	55	**2.91**	0.89
Other administrative tasks	2 (4%)	5 (9%)	17 (31%)	20 (37%)	10 (19%)	54	**2.67**	0.90
Communications with American Society for Engineering Education	22 (40%)	7 (13%)	9 (16%)	7 (13%)	10 (18%)	55	**2.61**	1.14
Communications with [SEAP site]	4 (7%)	3 (5%)	4 (7%)	19 (35%)	25 (45%)	55	**3.29**	0.86
Location(s) of program activities	2 (4%)	2 (4%)	7 (13%)	12 (22%)	31 (57%)	54	**3.38**	0.87
Availability of program topics or fields that interest you	3 (5%)	1 (2%)	6 (11%)	10 (18%)	35 (64%)	55	**3.52**	0.78
Instruction or mentorship during program activities	1 (2%)	3 (5%)	0 (0%)	10 (18%)	41 (75%)	55	**3.65**	0.76
Participation stipends (payment)	1 (2%)	1 (2%)	8 (15%)	10 (18%)	35 (64%)	55	**3.46**	0.82
Research abstract preparation requirements	2 (4%)	3 (6%)	11 (20%)	21 (39%)	17 (31%)	54	**3.00**	0.89
Research presentation process	2 (4%)	2 (4%)	12 (22%)	23 (43%)	15 (28%)	54	**2.98**	0.83

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Which of the following best describes your primary research mentor?		
	Freq.	**%**
I did not have a research mentor	1	2%
Teacher	2	4%
Coach	0	0%
Parent	1	2%
Club or activity leader (School club, Boy/Girls Scouts)	0	0%
STEM researcher (university, industry, or DoD/government employee)	50	91%
Other (specify)	1	2%
Total	**55**	**100%**

Note. Other = "a PI".

Which of the following statements best reflects the input you had into your project initially?		
	Freq.	**%**
I did not have a project	1	2%
I was assigned a project by my mentor	33	60%
I worked with my mentor to design a project	6	11%
I had a choice among various projects suggested by my mentor	9	16%
I worked with my mentor and members of a research team to design a project	6	11%
I designed the entire project on my own	0	0%
Total	**55**	**100%**

Which of the following statements best reflects the availability of your mentor?		
	Freq.	**%**
I did not have a mentor	0	0%
The mentor was never available	0	0%
The mentor was available less than half of the time	2	4%
The mentor was available about half of the time of my project	6	11%
The mentor was available more than half of the time	23	42%
The mentor was always available	24	44%
Total	**55**	**100%**

Which of the following statements best reflects your working as part of a group or team?		
	Freq.	**%**
I worked alone (or alone with my research mentor)	8	15%
I worked with others in a shared laboratory or other space, but we work on different projects	16	29%
I worked alone on my project and I met with others regularly for general reporting or discussion	7	13%
I worked alone on a project that was closely connected with projects of others in my group	12	22%
I work with a group who all worked on the same project	12	22%
Total	**55**	**100%**

How SATISFIED were you with each of the following?								
	0	1	2	3	4	n	Avg.	SD
My working relationship with my mentor	0 (0%)	2 (4%)	3 (6%)	8 (15%)	41 (76%)	54	**3.63**	0.76
My working relationship with the group or team	4 (7%)	1 (2%)	1 (2%)	10 (19%)	38 (70%)	54	**3.70**	0.61
The amount of time I spent doing meaningful research	1 (2%)	5 (9%)	5 (9%)	12 (22%)	31 (57%)	54	**3.30**	0.99
The amount of time I spent with my research mentor	2 (4%)	1 (2%)	4 (7%)	13 (24%)	34 (63%)	54	**3.54**	0.73
The research experience overall	2 (4%)	3 (6%)	1 (2%)	11 (20%)	37 (69%)	54	**3.58**	0.80

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Which of the following statements apply to your research experience? (choose all that apply) (n = 51)						
	Freq.	%			Freq.	%
I presented a talk or poster to other students or faculty	22	43%		I will present a talk or poster to other students or faculty	31	61%
I presented a talk or poster at a professional symposium or conference	8	16%		I will present a talk or poster at a professional symposium or conference	14	27%
I attended a symposium or conference	10	20%		I will attend a symposium or conference	8	16%
I wrote or co-wrote a paper that was/will be published in a research journal	7	14%		I will write or co-write a paper that was/will be published in a research journal	9	18%
I wrote or co-wrote a technical paper or patent	8	16%		I will write or co-write a technical paper or patent	9	18%
				I won an award or scholarship based on my research	1	2%

The list below describes mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies that your mentor(s) used when working directly with you for SEAP:					
		Yes - my mentor used this strategy with me		No - my mentor did not use this strategy with me	
	n	Freq.	%	Freq.	%
Helped me become aware of the roles STEM play in my everyday life	55	35	64%	20	36%
Helped me understand how STEM can help me improve my community	55	39	71%	16	29%

Used teaching/mentoring activities that addressed my learning style	55	41	75%	14	25%
Provided me with extra support when I needed it	55	50	91%	5	9%
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	55	37	67%	18	33%
Allowed me to work on a collaborative project as a member of a team	55	41	75%	14	25%
Helped me practice a variety of STEM skills with supervision	55	46	84%	9	16%
Gave me constructive feedback to improve my STEM knowledge, skills, or abilities	55	47	85%	8	15%
Gave me guidance about educational pathways that would prepare me for a STEM career	55	36	65%	19	35%
Recommended Army Educational Outreach Programs that match my interests	55	23	42%	32	58%
Discussed STEM career opportunities with DoD or other government agencies	55	30	55%	25	45%

Which category best describes the focus of your SEAP experience?

	Freq.	%
Science	34	63%
Technology	12	22%
Engineering	8	15%
Mathematics	0	0%
Total	**54**	**100%**

AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?

	1	2	3	4	5	n	Avg.	SD
Knowledge of a STEM topic or field in depth	2 (4%)	3 (5%)	7 (13%)	23 (42%)	20 (36%)	55	**4.02**	1.03
Knowledge of research conducted in a STEM topic or field	3 (5%)	3 (5%)	9 (16%)	15 (27%)	25 (45%)	55	**4.02**	1.16
Knowledge of research processes, ethics, and rules for conduct in STEM	4 (7%)	4 (7%)	17 (31%)	11 (20%)	19 (35%)	55	**3.67**	1.23
Knowledge of how professionals work on real problems in STEM	4 (7%)	2 (4%)	6 (11%)	13 (24%)	30 (55%)	55	**4.15**	1.21
Knowledge of what everyday research work is like in STEM	3 (5%)	3 (5%)	4 (7%)	13 (24%)	32 (58%)	55	**4.24**	1.15

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Asking questions based on observations of real-world phenomena	2 (6%)	3 (10%)	11 (35%)	7 (23%)	8 (26%)	31	**3.52**	1.18
Asking a question (about a phenomenon) that can be answered with one or more investigations	3 (9%)	3 (9%)	9 (28%)	10 (31%)	7 (22%)	32	**3.47**	1.22
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	0 (0%)	5 (16%)	9 (28%)	8 (25%)	10 (31%)	32	**3.72**	1.08
Making a model to represent the key features and functions of an observed phenomenon	4 (13%)	8 (25%)	7 (22%)	7 (22%)	6 (19%)	32	**3.09**	1.33
Deciding what type of data to collect in order to answer a question	2 (6%)	4 (13%)	7 (22%)	7 (22%)	12 (38%)	32	**3.72**	1.28
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	2 (6%)	6 (19%)	4 (13%)	7 (22%)	13 (41%)	32	**3.72**	1.35
Identifying the limitations of data collected in an investigation	3 (9%)	3 (9%)	5 (16%)	10 (31%)	11 (34%)	32	**3.72**	1.30
Carrying out procedures for an investigation and recording data accurately	2 (6%)	5 (16%)	3 (9%)	9 (28%)	13 (41%)	32	**3.81**	1.31
Testing how changing one variable affects another variable, in order to understand relationships between variables	3 (9%)	2 (6%)	8 (25%)	8 (25%)	11 (34%)	32	**3.69**	1.28

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	7 (22%)	7 (22%)	6 (19%)	4 (13%)	8 (25%)	32	**2.97**	1.51
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	4 (13%)	4 (13%)	11 (34%)	7 (22%)	6 (19%)	32	**3.22**	1.26

Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	3 (10%)	1 (3%)	7 (23%)	5 (16%)	15 (48%)	31	**3.90**	1.33
Using mathematics or computers to analyze numeric data	5 (16%)	1 (3%)	10 (31%)	6 (19%)	10 (31%)	32	**3.47**	1.39
Supporting a proposed explanation (for a phenomenon) with data from investigations	3 (9%)	2 (6%)	6 (19%)	7 (22%)	14 (44%)	32	**3.84**	1.32
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	2 (6%)	2 (6%)	9 (28%)	7 (22%)	12 (38%)	32	**3.78**	1.21
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	3 (9%)	3 (9%)	8 (25%)	7 (22%)	11 (34%)	32	**3.63**	1.31
Using data or interpretations from other researchers or investigations to improve an explanation	4 (13%)	3 (9%)	8 (25%)	8 (25%)	9 (28%)	32	**3.47**	1.34
Asking questions to understand the data and interpretations others use to support their explanations	3 (9%)	2 (6%)	9 (28%)	8 (25%)	10 (31%)	32	**3.63**	1.26
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	5 (16%)	4 (13%)	9 (28%)	6 (19%)	8 (25%)	32	**3.25**	1.39
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	4 (13%)	4 (13%)	7 (22%)	7 (22%)	10 (31%)	32	**3.47**	1.39
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	3 (9%)	3 (9%)	8 (25%)	6 (19%)	12 (38%)	32	**3.66**	1.33
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	6 (19%)	2 (6%)	8 (25%)	7 (22%)	9 (28%)	32	**3.34**	1.45
Integrating information from multiple sources to support your explanations of phenomena	4 (13%)	3 (9%)	5 (16%)	8 (25%)	12 (38%)	32	**3.66**	1.41
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	3 (9%)	2 (6%)	3 (9%)	10 (31%)	14 (44%)	32	**3.94**	1.29

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Identifying real-world problems based on social, technological, or environmental issues	2 (11%)	4 (21%)	1 (5%)	7 (37%)	5 (26%)	19	**3.47**	1.39
Defining a problem that can be solved by developing a new or improved object, process, or system	2 (11%)	3 (17%)	3 (17%)	6 (33%)	4 (22%)	18	**3.39**	1.33
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	3 (16%)	2 (11%)	2 (11%)	7 (37%)	5 (26%)	19	**3.47**	1.43
Making a model that represents the key features or functions of a solution to a problem	2 (11%)	3 (16%)	3 (16%)	7 (37%)	4 (21%)	19	**3.42**	1.30
Deciding what type of data to collect in order to test if a solution functions as intended	3 (16%)	2 (11%)	3 (16%)	9 (47%)	2 (11%)	19	**3.26**	1.28
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	2 (11%)	2 (11%)	3 (16%)	10 (53%)	2 (11%)	19	**3.42**	1.17
Identifying the limitations of the data collected in an investigation	2 (11%)	2 (11%)	5 (26%)	7 (37%)	3 (16%)	19	**3.37**	1.21
Carrying out procedures for an investigation and recording data accurately	3 (16%)	3 (16%)	1 (5%)	9 (47%)	3 (16%)	19	**3.32**	1.38
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	3 (16%)	2 (11%)	4 (21%)	6 (32%)	4 (21%)	19	**3.32**	1.38
Using computer-based models to investigate cause and effect relationships of a simulated solution	7 (37%)	1 (5%)	2 (11%)	5 (26%)	4 (21%)	19	**2.89**	1.66
Considering alternative interpretations of data when deciding if a solution functions as intended	3 (16%)	2 (11%)	2 (11%)	7 (37%)	5 (26%)	19	**3.47**	1.43
Displaying numeric data in charts or graphs to identify patterns and relationships	5 (26%)	2 (11%)	3 (16%)	5 (26%)	4 (21%)	19	**3.05**	1.54
Using mathematics or computers to analyze numeric data	4 (21%)	3 (16%)	5 (26%)	3 (16%)	4 (21%)	19	**3.00**	1.45
Supporting a proposed solution (for a problem) with data from investigations	2 (11%)	3 (16%)	5 (26%)	5 (26%)	4 (21%)	19	**3.32**	1.29

Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	3 (16%)	1 (5%)	6 (32%)	6 (32%)	3 (16%)	19	**3.26**	1.28
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	3 (16%)	1 (5%)	5 (26%)	7 (37%)	3 (16%)	19	**3.32**	1.29
Using data or interpretations from other researchers or investigations to improve a solution	4 (21%)	1 (5%)	3 (16%)	8 (42%)	3 (16%)	19	**3.26**	1.41

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Asking questions to understand the data and interpretations others use to support their solutions	3 (16%)	1 (5%)	3 (16%)	8 (42%)	4 (21%)	19	**3.47**	1.35
Using data from investigations to defend an argument that conveys how a solution meets design criteria	4 (21%)	5 (26%)	5 (26%)	2 (11%)	3 (16%)	19	**2.74**	1.37
Deciding what additional data or information may be needed to find the best solution to a problem	2 (11%)	4 (21%)	5 (26%)	3 (16%)	5 (26%)	19	**3.26**	1.37
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	3 (16%)	3 (16%)	4 (21%)	3 (16%)	6 (32%)	19	**3.32**	1.49
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	4 (21%)	2 (11%)	5 (26%)	4 (21%)	4 (21%)	19	**3.11**	1.45
Integrating information from multiple sources to support your solution to a problem	3 (16%)	4 (21%)	4 (21%)	4 (21%)	4 (21%)	19	**3.11**	1.41
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	3 (16%)	4 (21%)	2 (11%)	4 (21%)	6 (32%)	19	**3.32**	1.53

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**

Learning to work independently	2 (4%)	4 (8%)	7 (13%)	20 (38%)	20 (38%)	53	**3.98**	1.08
Setting goals and reflecting on performance	4 (8%)	3 (6%)	10 (19%)	16 (30%)	20 (38%)	53	**3.85**	1.22
Sticking with a task until it is complete	3 (6%)	5 (9%)	8 (15%)	15 (28%)	22 (42%)	53	**3.91**	1.21
Making changes when things do not go as planned	3 (6%)	4 (8%)	6 (11%)	18 (34%)	22 (42%)	53	**3.98**	1.17
Patience for the slow pace of research	3 (6%)	7 (13%)	4 (8%)	19 (36%)	20 (38%)	53	**3.87**	1.23
Working collaboratively with a team	4 (8%)	12 (23%)	6 (11%)	12 (23%)	19 (36%)	53	**3.57**	1.38
Communicating effectively with others	2 (4%)	7 (13%)	10 (19%)	12 (23%)	21 (40%)	52	**3.83**	1.22
Including others' perspectives when making decisions	4 (8%)	11 (21%)	9 (17%)	10 (19%)	19 (36%)	53	**3.55**	1.37
Sense of being part of a learning community	2 (4%)	11 (21%)	7 (13%)	14 (26%)	19 (36%)	53	**3.70**	1.26
Sense of contributing to a body of knowledge	4 (8%)	5 (9%)	9 (17%)	13 (25%)	22 (42%)	53	**3.83**	1.28
Building relationships with professionals in a field	2 (4%)	6 (11%)	5 (9%)	16 (30%)	24 (45%)	53	**4.02**	1.17
Connecting a topic or field and my personal values	5 (9%)	8 (15%)	8 (15%)	13 (25%)	19 (36%)	53	**3.62**	1.36

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR SEAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Interest in a new STEM topic or field	4 (8%)	6 (12%)	12 (23%)	15 (29%)	15 (29%)	52	**3.60**	1.24
Clarifying a STEM career path	4 (8%)	5 (10%)	11 (22%)	18 (35%)	13 (25%)	51	**3.61**	1.20
Sense of accomplishing something in STEM	4 (8%)	2 (4%)	12 (23%)	15 (29%)	19 (37%)	52	**3.83**	1.20
Building academic or professional credentials in STEM	3 (6%)	5 (10%)	7 (13%)	13 (25%)	24 (46%)	52	**3.96**	1.24
Feeling prepared for more challenging STEM activities	3 (6%)	2 (4%)	7 (13%)	18 (35%)	22 (42%)	52	**4.04**	1.12
Confidence to do well in future STEM courses	3 (6%)	2 (4%)	8 (15%)	16 (31%)	23 (44%)	52	**4.04**	1.14
Confidence to contribute to STEM	3 (6%)	3 (6%)	8 (15%)	15 (29%)	23 (44%)	52	**4.00**	1.17
Thinking creatively about a STEM project or activity	3 (6%)	4 (8%)	7 (13%)	19 (37%)	19 (37%)	52	**3.90**	1.16
Trying out new ideas or procedures on my own in a STEM project or activity	4 (8%)	4 (8%)	11 (21%)	14 (27%)	19 (37%)	52	**3.77**	1.25
Feeling responsible for a STEM project or activity	3 (6%)	4 (8%)	6 (12%)	19 (37%)	20 (38%)	52	**3.94**	1.16
Feeling like a STEM professional	3 (6%)	4 (8%)	15 (29%)	14 (27%)	16 (31%)	52	**3.69**	1.16
Feeling like part of a STEM community	3 (6%)	6 (12%)	9 (17%)	14 (27%)	20 (38%)	52	**3.81**	1.24

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR SEAP experience, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Visit a science museum or zoo	0 (0%)	0 (0%)	40 (77%)	7 (13%)	5 (10%)	52	**3.33**	0.65
Watch or read non-fiction STEM	0 (0%)	1 (2%)	24 (46%)	19 (37%)	8 (15%)	52	**3.65**	0.76
Look up STEM information at a library or on the internet	0 (0%)	0 (0%)	13 (25%)	27 (52%)	12 (23%)	52	**3.98**	0.70
Tinker (play) with a mechanical or electrical device	0 (0%)	0 (0%)	18 (35%)	19 (37%)	15 (29%)	52	**3.94**	0.80
Work on solving mathematical or scientific puzzles	0 (0%)	1 (2%)	19 (37%)	19 (37%)	13 (25%)	52	**3.85**	0.83
Design a computer program or website	2 (4%)	1 (2%)	24 (46%)	13 (25%)	12 (23%)	52	**3.62**	0.99
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	0 (0%)	1 (2%)	26 (50%)	16 (31%)	9 (17%)	52	**3.63**	0.79
Talk with friends or family about STEM	0 (0%)	0 (0%)	16 (31%)	20 (38%)	16 (31%)	52	**4.00**	0.79
Mentor or teach other students about STEM	0 (0%)	0 (0%)	15 (29%)	21 (41%)	15 (29%)	51	**4.00**	0.77
Help with a community service project that relates to STEM	0 (0%)	1 (2%)	17 (33%)	21 (41%)	12 (24%)	51	**3.86**	0.80
Participate in a STEM club, student association, or professional organization	0 (0%)	0 (0%)	17 (33%)	22 (42%)	13 (25%)	52	**3.92**	0.76
Participate in STEM camp, fair, or competition	0 (0%)	0 (0%)	21 (40%)	22 (42%)	9 (17%)	52	**3.77**	0.73
Take an elective (not required) STEM class	0 (0%)	1 (2%)	16 (31%)	19 (37%)	16 (31%)	52	**3.96**	0.84
Work on a STEM project or experiment in a university or professional setting	0 (0%)	0 (0%)	11 (21%)	18 (35%)	23 (44%)	52	**4.23**	0.78
Receive an award or special recognition for STEM accomplishments	0 (0%)	0 (0%)	17 (33%)	22 (43%)	12 (24%)	51	**3.90**	0.76

Note. Response scale: **1** = "Much less likely," **2** = "Less likely," **3** = "About the same before and after," **4** = "More likely," **5** = "Much more likely".

How far did you want to go in school BEFORE participating in SEAP?		
	Freq.	**%**
Graduate from high school	4	8%
Go to a trade or vocational school	0	0%
Go to college for a little while	1	2%
Finish college (get a Bachelor's degree)	9	18%

Get more education after college	3	6%
Get a master's degree	14	27%
Get a Ph.D.	11	22%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	7	14%
Get a combined M.D. / Ph.D.	2	4%
Get another professional degree (law, business, etc.)	0	0%
Total	**51**	**100%**

How far did you want to go in school AFTER participating in SEAP?		
	Freq.	**%**
Graduate from high school	0	0%
Go to a trade or vocational school	0	0%
Go to college for a little while	0	0%
Finish college (get a Bachelor's degree)	4	8%
Get more education after college	3	6%
Get a master's degree	15	29%
Get a Ph.D.	18	35%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	6	12%
Get a combined M.D. / Ph.D.	6	12%
Get another professional degree (law, business, etc.)	0	0%
Total	**52**	**100%**

BEFORE SEAP, what kind of work did you expect to be doing when you are 30 years old (select the ONE answer that best describes your career goals BEFORE SEAP)

	Freq.	**%**			**Freq.**	**%**
Undecided	23	45%		**Teaching, non-STEM**	0	0%
Science (no specific subject)	3	6%		**Medicine (doctor, dentist, veterinarian, etc.)**	6	12%
Physical science (physics, chemistry, astronomy, materials science, etc.)	6	12%		**Health (nursing, pharmacy, technician, etc.)**	1	2%
Biological science	4	8%		**Social science (psychologist, sociologist, etc.)**	0	0%
Earth, atmospheric or oceanic science	0	0%		**Business**	0	0%
Agricultural science	0	0%		**Law**	0	0%

Environmental science	0	0%		**English/language arts**	1	2%
Computer science	3	6%		**Farming**	0	0%
Technology	1	2%		**Military, police, or security**	1	2%
Engineering	0	0%		**Art (writing, dancing, painting, etc.)**	0	0%
Mathematics or statistics	0	0%		**Skilled trade (carpenter, electrician, plumber, etc.)**	0	0%
Teaching, STEM	0	0%		**Other, (specify):**	2	4%
				Total	**51**	**100%**

Note: Other = "Motion Picture and Television – Editing", and "Journalism".

AFTER SEAP, what kind of work do you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career goals AFTER SEAP)

	Freq.	**%**			**Freq.**	**%**
Undecided	24	47%		**Teaching, non-STEM**	0	0%
Science (no specific subject)	3	6%		**Medicine (doctor, dentist, veterinarian, etc.)**	5	10%
Physical science (physics, chemistry, astronomy, materials science, etc.)	6	12%		**Health (nursing, pharmacy, technician, etc.)**	1	2%
Biological science	6	12%		**Social science (psychologist, sociologist, etc.)**	0	0%
Earth, atmospheric or oceanic science	0	0%		**Business**	0	0%
Agricultural science	0	0%		**Law**	0	0%
Environmental science	0	0%		**English/language arts**	1	2%
Computer science	3	6%		**Farming**	0	0%
Technology	0	0%		**Military, police, or security**	0	0%
Engineering	0	0%		**Art (writing, dancing, painting, etc.)**	0	0%
Mathematics or statistics	1	2%		**Skilled trade (carpenter, electrician, plumber, etc.)**	0	0%
Teaching, STEM	0	0%		**Other, (specify):**	1	2%
				Total	**51**	**100%**

Note. Other = "Motion Picture and Television – Editing".

When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?

	Freq.	**%**
not at all	2	4%

less than 25% of the time	0	0%
26% to 50% of the time	1	2%
51% to 75% of the time	11	22%
76% to 100% of the time	36	72%
Total	**50**	**100%**

How many times have you participated in any of the following Army Educational Outreach Programs? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."

	0	1	2	3	4	n	Avg.	SD
Camp Invention	41 (80%)	8 (16%)	1 (2%)	0 (0%)	1 (2%)	51	**1.40**	0.97
eCYBERMISSION	30 (59%)	17 (33%)	4 (8%)	0 (0%)	0 (0%)	51	**1.19**	0.40
Junior Solar Sprint (JSS)	38 (76%)	11 (22%)	1 (2%)	0 (0%)	0 (0%)	50	**1.08**	0.29
West Point Bridge Design Contest (WPBDC)	28 (56%)	14 (28%)	8 (16%)	0 (0%)	0 (0%)	50	**1.36**	0.49
Junior Science & Humanities Symposium (JSHS)	39 (76%)	11 (22%)	1 (2%)	0 (0%)	0 (0%)	51	**1.08**	0.29
Gains in the Education of Mathematics and Science (GEMS)	7 (14%)	29 (57%)	4 (8%)	3 (6%)	8 (16%)	51	**1.77**	1.20
GEMS Near Peers	17 (33%)	32 (63%)	1 (2%)	0 (0%)	1 (2%)	51	**1.12**	0.54
UNITE	29 (59%)	17 (35%)	1 (2%)	1 (2%)	1 (2%)	49	**1.30**	0.80
Science & Engineering Apprenticeship Program (SEAP)	4 (8%)	3 (6%)	36 (72%)	5 (10%)	2 (4%)	50	**2.13**	0.58
Research & Engineering Apprenticeship Program (REAP)	22 (43%)	28 (55%)	1 (2%)	0 (0%)	0 (0%)	51	**1.03**	0.19
High School Apprenticeship Program (HSAP)	34 (67%)	17 (33%)	0 (0%)	0 (0%)	0 (0%)	51	**1.00**	0.00
College Qualified Leaders (CQL)	14 (27%)	36 (71%)	0 (0%)	0 (0%)	1 (2%)	51	**1.08**	0.49
Undergraduate Research Apprenticeship Program (URAP)	37 (73%)	14 (27%)	0 (0%)	0 (0%)	0 (0%)	51	**1.00**	0.00
Science Mathematics, and Research for Transformation (SMART) College Scholarship	25 (49%)	25 (49%)	1 (2%)	0 (0%)	0 (0%)	51	**1.04**	0.20
National Defense Science & Engineering Graduate (NDSEG) Fellowship	38 (75%)	13 (25%)	0 (0%)	0 (0%)	0 (0%)	51	**1.00**	0.00

Note. Response scale: **0** = "Never heard of it," **1** = "Never," **2** = "Once," **3**= "Twice," **4** = "Three or more times".

How interested are you in participating in the following programs in the future?

	1	2	3	4	n	Avg.	SD
Camp Invention	40 (78%)	7 (14%)	2 (4%)	2 (4%)	51	**1.33**	0.74

eCYBERMISSION	40 (78%)	6 (12%)	2 (4%)	3 (6%)	51	**1.37**	0.82
Junior Solar Sprint (JSS)	41 (80%)	7 (14%)	1 (2%)	2 (4%)	51	**1.29**	0.70
West Point Bridge Design Contest (WPBDC)	34 (67%)	10 (20%)	4 (8%)	3 (6%)	51	**1.53**	0.88
Junior Science & Humanities Symposium (JSHS)	38 (75%)	8 (16%)	3 (6%)	2 (4%)	51	**1.39**	0.78
Gains in the Education of Mathematics and Science (GEMS)	32 (63%)	7 (14%)	6 (12%)	6 (12%)	51	**1.73**	1.08
GEMS Near Peers	33 (65%)	6 (12%)	7 (14%)	5 (10%)	51	**1.69**	1.05
UNITE	39 (78%)	6 (12%)	3 (6%)	2 (4%)	50	**1.36**	0.78
Science & Engineering Apprenticeship Program (SEAP)	12 (24%)	3 (6%)	5 (10%)	31 (61%)	51	**3.08**	1.28
Research & Engineering Apprenticeship Program (REAP)	29 (57%)	2 (4%)	9 (18%)	11 (22%)	51	**2.04**	1.28
High School Apprenticeship Program (HSAP)	32 (64%)	3 (6%)	6 (12%)	9 (18%)	50	**1.84**	1.22
College Qualified Leaders (CQL)	12 (24%)	7 (14%)	8 (16%)	24 (47%)	51	**2.86**	1.25
Undergraduate Research Apprenticeship Program (URAP)	23 (45%)	5 (10%)	11 (22%)	12 (24%)	51	**2.24**	1.26
Science Mathematics, and Research for Transformation (SMART) College Scholarship	12 (24%)	2 (4%)	14 (27%)	23 (45%)	51	**2.94**	1.21
National Defense Science & Engineering Graduate (NDSEG) Fellowship	24 (47%)	9 (18%)	8 (16%)	10 (20%)	51	**2.08**	1.20

Note. Response scale: **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during SEAP?

	Freq.	**%**
None	0	0%
1	3	6%
2	7	14%
3	8	16%
4	4	8%
5 or more	29	57%
Total	**51**	**100%**

How many Department of Defense (DoD) STEM jobs/careers did you learn about during SEAP?

	Freq.	**%**
None	4	8%
1	5	10%
2	10	20%
3	10	20%

4	4	8%
5 or more	18	35%
Total	**51**	**100%**

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	1 (2%)	0 (0%)	5 (10%)	16 (31%)	29 (57%)	51	**4.41**	0.83
DoD researchers develop new, cutting edge technologies	1 (2%)	0 (0%)	6 (12%)	22 (43%)	22 (43%)	51	**4.25**	0.82
DoD researchers support non-defense related advancements in science and technology	1 (2%)	0 (0%)	6 (12%)	21 (41%)	23 (45%)	51	**4.27**	0.83
DoD researchers solve real-world problems	1 (2%)	0 (0%)	4 (8%)	19 (37%)	27 (53%)	51	**4.39**	0.80
DoD research is valuable to society	1 (2%)	0 (0%)	4 (8%)	16 (31%)	30 (59%)	51	**4.45**	0.81

Note. Response scale: **1** = "Strongly Disagree," **2** = "Disagree," **3** = "Neither Agree nor Disagree," **4** = "Agree," **5** = "Strongly Agree".

Which of the following statements describe you after participating in SEAP?

	1	2	3	4	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	3 (6%)	2 (4%)	30 (59%)	16 (31%)	51	**3.16**	0.76
I am more interested in participating in STEM activities outside of school requirements	5 (10%)	8 (16%)	26 (52%)	11 (22%)	50	**2.86**	0.88
I am more aware of other AEOPs	9 (18%)	4 (8%)	24 (47%)	14 (27%)	51	**2.84**	1.03
I am more interested in participating in other AEOPs	10 (20%)	3 (6%)	24 (47%)	14 (27%)	51	**2.82**	1.05
I am more interested in taking STEM classes in school	5 (10%)	20 (39%)	20 (39%)	6 (12%)	51	**2.53**	0.83
I am more interested in attending college	6 (12%)	29 (57%)	11 (22%)	5 (10%)	51	**2.29**	0.81
I am more interested in earning a STEM degree in college	6 (12%)	19 (39%)	17 (35%)	7 (14%)	49	**2.51**	0.89
I am more interested in pursuing a STEM career	5 (10%)	20 (39%)	17 (33%)	9 (18%)	51	**2.59**	0.90
I am more aware of DoD STEM research and careers	6 (12%)	5 (10%)	20 (39%)	20 (39%)	51	**3.06**	0.99
I have a greater appreciation of DoD STEM research and careers	5 (10%)	1 (2%)	24 (47%)	21 (41%)	51	**3.20**	0.89
I am more interested in pursuing a STEM career with the DoD	14 (28%)	2 (4%)	21 (42%)	13 (26%)	50	**2.66**	1.15

Note. Response scale: **1** = "Disagree – This did not happen," **2** = "Disagree – This happened but not because of SEAP," **3** = "Agree – SEAP contributed," **4** = "Agree – SEAP was the primary reason".

Appendix C

FY14 SEAP Mentor Questionnaire and Data Summaries

2014 Science and Engineering Apprenticeship Program (SEAP): SEAP Mentor Survey

Virginia Tech is conducting an evaluation study on behalf of the American Society for Engineering Education and the U.S. Army to determine how well SEAP is achieving its goals of promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). As part of this study Virginia Tech is surveying adults who participate in SEAP in the capacity of STEM mentors (e.g., instructors, research mentors, or competition advisors). The questionnaire will collect information about you, your experiences in school, and your experiences in SEAP. The results of this survey will be used to help us improve SEAP and to report to the organizations that support SEAP.

About this survey:

- This research protocol has been approved for use with human subjects by the Virginia Tech IRB office.
- Although this questionnaire is not anonymous, it is CONFIDENTIAL. Prior to analysis and reporting responses will be de-identified and no one will be able to connect your responses to you or your apprentice's name.
- Only AEOP evaluation personnel will have access to completed questionnaires and personal information will be stored securely.
- Responding to this survey is VOLUNTARY. You are not required to participate, although we hope you do because your responses will provide valuable information for meaningful and continuous improvement.
- If you provide your email address, the AEOP may contact you in the future to ask about you or your students.

If you have any additional questions or concerns, please contact one of the following people:

Tanner Bateman, Virginia Tech
Senior Project Associate, AEOPCA
(540) 231-4540, tbateman@vt.edu

Rebecca Kruse, Virginia Tech
Evaluation Director, AEOPCA
(540) 315-5807, rkruse75@vt.edu

Q1 Do you agree to participate in this survey? (required)

- ❍ Yes, I agree to participate in this survey
- ❍ No, I do not wish to participate in this survey

If No, I do not wish to partic... Is Selected, Then Skip To End of Survey

Q2 Please provide your personal information below: (required)

First Name _____

Last Name _____

Q3 Please provide your email address: (optional)

Email _____

Q4 What is your gender?

- ❍ Male
- ❍ Female
- ❍ Choose not to report

Q5 What is your race or ethnicity?

- ❍ Hispanic or Latino
- ❍ Asian
- ❍ Black or African American
- ❍ Native American or Alaska Native
- ❍ Native Hawaiian or Other Pacific Islander
- ❍ White
- ❍ Other race or ethnicity, (specify): _____
- ❍ Choose not to report

Q6 Which of the following BEST describes your current occupation (select ONE)

- ❍ Teacher
- ❍ Other school staff
- ❍ University educator
- ❍ Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)
- ❍ Scientist, Engineer, or Mathematics professional
- ❍ Other, (specify): _____

Q7 Which of the following BEST describes your organization? (select ONE)

- ❍ No organization
- ❍ School or district (K-12)
- ❍ State educational agency
- ❍ Institution of higher education (vocational school, junior college, college, or university)
- ❍ Industry
- ❍ Department of Defense or other government agency
- ❍ Non-profit
- ❍ Other, (specify): _____

Q8 Which of the following best describes your primary area of research?

- ❍ Physical science (physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric, or oceanic science
- ❍ Agricultural science
- ❍ Environmental science
- ❍ Computer science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Medical, health, or behavioral science
- ❍ Social science (psychology, sociology, anthropology, etc.)
- ❍ Other, (specify) _____

Q9 Where was the SEAP program located?

- ❍ Army Center for Environmental Health Research at Fort Detrick (Frederick, MD)
- ❍ Army Medical Research Institute of Chemical Defense (Aberdeen, MD)
- ❍ Army Medical Research Institute for Infectious Diseases at Fort Detrick (Frederick, MD)
- ❍ Army Aviation and Missile Research Development and Engineering Center-Redstone Arsenal (Huntsville, AL)
- ❍ Army Aviation and Missile Research Development and Engineering Center-Aviation Applied Technology Directorate (Langely-Eustis, VA)
- ❍ Army Aviation and Missile Research Development and Engineering Center-Aviation Engineering Directorate (Corpus Christi, TX)
- ❍ Army Aviation and Missile Research Development and Engineering Center-System Simulation and Development Directorate (Colorado Springs, CO)
- ❍ Army Aviation and Missile Research Development and Engineering Center-Aeroflightdynamics Directorate (Moffett Field, CA)
- ❍ Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)
- ❍ Army Research Laboratory-Adelphi (Adelphi, MD)
- ❍ Army Criminal Investigation Command-Defense Forensic Science Center (Forest Park, GA)
- ❍ Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)
- ❍ Engineer Research & Development Center-Mississippi (Vicksburg, MS)
- ❍ Engineer Research & Development Center-Topographic Engineering Center (Alexandria, VA)
- ❍ Walter Reed Army Institute of Research (Silver Spring, MD)

Q10 Which of the following BEST describes your role during SEAP?

- ❍ Research Mentor
- ❍ Research Team Member but not a Principal Investigator (PI)
- ❍ Other, (specify) _____

Q11 How many SEAP students did you work with this year?

Q12 How did you learn about SEAP? (Check all that apply)

- ❑ Technology Student Association website
- ❑ Army Educational Outreach Program (AEOP) website
- ❑ Facebook, Twitter, Pinterest, or other social media
- ❑ State or national educator conference
- ❑ STEM conference
- ❑ School, university, or professional organization newsletter, email or website
- ❑ A news story or other media coverage
- ❑ Past SEAP participant
- ❑ A student
- ❑ A colleague
- ❑ A supervisor or superior
- ❑ SEAP event or site host/director
- ❑ Workplace communications
- ❑ Someone who works at an Army laboratory
- ❑ Someone who works with the Department of Defense
- ❑ Other, (specify): _____

Q13 How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs (AEOPs) in any capacity? If you have heard of an AEOP but never participated select "Never." If you have not heard of an AEOP select "Never heard of it."

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍

High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q14 Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply)

- ❑ Applications from American Society for Engineering Education or the AEOP
- ❑ Personal acquaintance(s) (friend, family, neighbor, etc.)
- ❑ Colleague(s) in my workplace
- ❑ K-12 school teacher(s) outside of my workplace
- ❑ University faculty outside of my workplace
- ❑ Informational materials sent to K-12 schools or Universities outside of my workplace
- ❑ Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)
- ❑ Communication(s) generated by a university or faculty (newsletter, email blast, website)
- ❑ Career fair(s)
- ❑ Education conference(s) or event(s)
- ❑ STEM conference(s) or event(s)
- ❑ Organization(s) serving underserved or underrepresented populations
- ❑ Student contacted mentor
- ❑ I do not know how student(s) was recruited for apprenticeship
- ❑ Other, Specify: _____

Q15 How SATISFIED were you with each of the following SEAP features?

	Did not experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Other administrative tasks	❍	❍	❍	❍	❍
Communications from American Society for Engineering Education	❍	❍	❍	❍	❍
Communications from [SEAP site]	❍	❍	❍	❍	❍
Instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍
Research presentation process	❍	❍	❍	❍	❍

Q16 The list below describes instructional and mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

	Yes - I used this strategy	No - I did not use this strategy
Finding out about students' backgrounds and interests at the beginning of the program	❍	❍
Giving students real-life problems to investigate or solve	❍	❍
Asking students to relate outside events or activities to topics covered in the program	❍	❍
Selecting readings or activities that relate to students' backgrounds	❍	❍
Encouraging students to suggest new readings, activities, or projects	❍	❍
Making explicit provisions for students who wish to carry out independent studies	❍	❍
Helping students become aware of the roles STEM plays in their everyday lives	❍	❍
Helping students understand how STEM can help them improve their communities	❍	❍
Other, (specify):	❍	❍

Q17 The list below describes instructional and mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

	Yes - I used this strategy	No - I did not use this strategy
Finding out about students' learning styles at the beginning of the program	❍	❍
Interacting with all students in the same way regardless of their gender or race and ethnicity	❍	❍
Using gender neutral language	❍	❍
Using diverse teaching/mentoring activities to address a broad spectrum of students	❍	❍
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	❍	❍
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	❍	❍

Directing students to other individuals or programs if I can only provide limited support	❍	❍
Other, (specify):	❍	❍

Q18 The list below describes instructional and mentoring strategies that are effective ways to support students development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

	Yes - I used this strategy	No - I did not use this strategy
Having students tell others about their backgrounds and interests	❍	❍
Having students explain difficult ideas to others	❍	❍
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	❍	❍
Having students participate in giving and receiving feedback	❍	❍
Having students work on collaborative activities or projects as a member of a team	❍	❍
Having students listen to the ideas of others with an open mind	❍	❍
Having students pay attention to the feelings of all team members	❍	❍
Having students develop ways to resolve conflict and reach agreement among the team	❍	❍
Other, (specify):	❍	❍

Q19 The list below describes instructional and mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

	Yes - I used this strategy	No - I did not use this strategy
Teaching (or assigning readings) about specific STEM subject matter	❍	❍
Having students access and critically review technical texts or media to support their work	❍	❍
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	❍	❍
Helping students practice STEM skills with supervision	❍	❍
Giving constructive feedback to improve students' STEM competencies	❍	❍

Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	❍	❍
Encouraging students to seek support from other team members	❍	❍
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	❍	❍
Other, (specify):	❍	❍

Q20 The list below describes instructional and mentoring strategies that are effective ways to support students' STEM educational and career pathways. The list also includes items that reflect AEOP and Army priorities. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

	Yes - I used this strategy	No - I did not use this strategy
Asking about students' educational and career interests	❍	❍
Recommending extracurricular programs that align with students' educational goals	❍	❍
Recommending Army Educational Outreach Programs that align with students' educational goals	❍	❍
Providing guidance about educational pathways that would prepare students for a STEM career	❍	❍
Sharing personal experiences, attitudes, and values pertaining to STEM	❍	❍
Discussing STEM career opportunities with the DoD or other government agencies	❍	❍
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	❍	❍
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	❍	❍
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	❍	❍
Recommending student and professional organizations in STEM	❍	❍
Helping students build effective STEM networks	❍	❍
Critically reviewing students' résumé, application, or interview preparations	❍	❍
Other, (specify):	❍	❍

Q21 How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during SEAP?

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍
Program manager or site coordinators	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in SEAP	❍	❍	❍	❍	❍

Q22 Which of the following AEOPs did YOU EXPLICITLY DISCUSS with your student(s) during SEAP? (check ALL that apply)

	Yes - I discussed this program with my student(s)	No - I did not discuss this program with my student(s)
Camp Invention	❍	❍
eCYBERMISSION	❍	❍
Junior Solar Sprint (JSS)	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍
GEMS Near Peers	❍	❍
UNITE	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍
College Qualified Leaders (CQL)	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍

National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍
I discussed AEOP with my student(s) but did not discuss any specific program	❍	❍

Q23 How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during SEAP?

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍
Program manager or site coordinator	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in SEAP	❍	❍	❍	❍	❍

Q24 Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍
DoD researchers support non-defense related advancements in science and technology	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

Q25 How often did YOUR STUDENT(S) have opportunities do each of the following in SEAP?

	Not at all	At least once	A few times	Most days	Every day
Learn new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍

Q26 Which category best describes the focus of your student(s)' SEAP experience?

- ❍ Science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics

Q27 AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍

Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q28 AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to respondents who selected "science" in Q26**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Asking questions based on observations of real-world phenomena	❍	❍	❍	❍	❍
Asking a question (about a phenomenon) that can be answered with one or more investigations	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to answer a question	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable, in order to understand relationships between variables	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed explanation (for a phenomenon) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve an explanation	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to	❍	❍	❍	❍	❍

support their explanations					
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your explanations of phenomena	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	❍	❍	❍	❍	❍

Q29 AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to respondents who selected "technology", "engineering", or "mathematics" in Q26**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Identifying real-world problems based on social, technological, or environmental issues	❍	❍	❍	❍	❍
Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	❍	❍	❍	❍	❍
Making a model that represents the key features or functions of a solution to a problem	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to test if a solution functions as intended	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated solution	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution functions as intended	❍	❍	❍	❍	❍
Displaying numeric data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed solution (for a problem) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their solutions	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how a solution meets design criteria	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best solution to a problem	❍	❍	❍	❍	❍

Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	❍	❍	❍	❍	❍

Q30 AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍
Sticking with a task until it is completed	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Patience for the slow pace of research	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Sense of contributing to a body of knowledge	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and their personal values	❍	❍	❍	❍	❍

Q31 Which of the following statements describe YOUR STUDENT(S) after participating in the SEAP program?

	Disagree - This did not happen	Disagree - This happened but not because of SEAP	Agree - SEAP contributed	Agree - SEAP was primary reason
More confident in STEM knowledge, skills, and abilities	❍	❍	❍	❍
More interested in participating in STEM activities outside of school requirements	❍	❍	❍	❍
More aware of other AEOPs	❍	❍	❍	❍
More interested in participating in other AEOPs	❍	❍	❍	❍
More interested in taking STEM classes in school	❍	❍	❍	❍
More interested in attending college	❍	❍	❍	❍
More interested in earning a STEM degree in college	❍	❍	❍	❍
More interested in pursuing a STEM career	❍	❍	❍	❍
More aware of Department of Defense (DoD) STEM research and careers	❍	❍	❍	❍
Greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
More interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q32 What are the three most important strengths of SEAP?

Strength #1

Strength #2

Strength #3

Q33 What are the three ways SEAP should be improved for future participants?

Improvement #1

Improvement #2

Improvement #3

Q34 Tell us about your overall satisfaction with your SEAP experience.

SEAP Mentor Data Summary

What is your gender?		
	Freq.	%
Male	11	65%
Female	6	35%
Choose not to report	0	0%
Total	17	100%

What is your race or ethnicity?		
	Freq.	%
Hispanic or Latino	1	6%
Asian	1	6%
Black or African American	0	0%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	14	82%
Other race or ethnicity, (specify):	0	0%
Choose not to report	1	6%
Total	17	100%

Which of the following BEST describes your current occupation? (select ONE)		
	Freq.	%
Teacher	0	0%
Other school staff	0	0%
University educator	0	0%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	1	6%
Scientist, Engineer, or Mathematics professional	16	94%
Other, (specify):	0	0%
Total	17	100%

Which of the following BEST describes your organization? (select ONE)		
	Freq.	%
No organization	0	0%
School or district (K-12)	0	0%
State educational agency	0	0%
Institution of higher education (vocational school, junior college, college, or university)	0	0%
Industry	0	0%
Department of Defense or other government agency	17	100%
Non-profit	0	0%
Other, (specify):	0	0%
Total	17	100%

Which of the following best describes your primary area of research?						
	Freq.	%			Freq.	%
Physical science (physics, chemistry, astronomy, materials science)	2	12%		Technology	0	0%
Biological science	10	59%		Engineering	2	12%
Earth, atmospheric, or oceanic science	0	0%		Mathematics or statistics	0	0%
Agricultural science	0	0%		Medical, health, or behavioral science	2	12%
Environmental science	0	0%		Social science (psychology, sociology, anthropology, etc.)	0	0%
Computer science	0	0%		Other, (specify)	1	6%
				Total	17	100%

Note. Other = "Safety".

Where was the SEAP program located? (Select ONE)						
	Freq.	%			Freq.	%
Army Center for Environmental Health Research at Fort Detrick (Frederick, MD)	1	6%		Army Aviation and Missile Research Development and Engineering Center-Aeroflightdynamics Directorate (Moffett Field, CA)	0	0%
Army Medical Research Institute of Chemical Defense (Aberdeen, MD)	10	59%		Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)	0	0%
Army Medical Research Institute for Infectious Diseases at Fort Detrick	2	12%		Army Research Laboratory-Adelphi (Adelphi, MD)	0	0%

(Frederick, MD)						
Army Aviation and Missile Research Development and Engineering Center-Redstone Arsenal (Huntsville, AL)	0	0%		Army Criminal Investigation Command-Defense Forensic Science Center (Forest Park, GA)	0	0%
Army Aviation and Missile Research Development and Engineering Center-Aviation Applied Technology Directorate (Langely-Eustis, VA)	0	0%		Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)	3	18%
Army Aviation and Missile Research Development and Engineering Center-Aviation Engineering Directorate (Corpus Christi, TX)	0	0%		Engineer Research & Development Center-Mississippi (Vicksburg, MS)	0	0%
Army Aviation and Missile Research Development and Engineering Center-System Simulation and Development Directorate (Colorado Springs, CO)	0	0%		Engineer Research & Development Center-Topographic Engineering Center (Alexandria, VA)	0	0%
				Walter Reed Army Institute of Research (Silver Spring, MD)	1	6%
				Total	**17**	**100%**

Which of the following BEST describes your role during SEAP?		
	Freq.	**%**
Research Mentor	14	88%
Research Team Member but not a Principal Investigator (PI)	2	13%
Other, (specify)	0	0%
Total	**16**	**100%**

How many SEAP students did you work with this year?		
# of Students	**Freq.**	**%**
1	12	75%
2	3	19%
3	1	6%
Total	**16**	**100%**

How did you learn about SEAP? (Check all that apply) (n = 17)						
	Freq.	%			Freq.	%
American Society for Engineering Education website	0	0%		A student	1	6%
Army Educational Outreach Program (AEOP) website	0	0%		A colleague	5	29%
Facebook, Twitter, Pinterest, or other social media	0	0%		A supervisor or superior	3	18%
State or national educator conference	0	0%		SEAP site host/director	2	12%
STEM conference	0	0%		Workplace communications	4	24%
School, university, or professional organization newsletter, email, or website	0	0%		Someone who works at an Army laboratory	2	12%
A news story or other media coverage	0	0%		Someone who works with the Department of Defense	4	24%
Past SEAP participant	4	24%		Other, (specify):	0	0%

How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs in any capacity? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."								
	0	1	2	3	4	n	Avg.	SD
Camp Invention	8 (50%)	7 (44%)	0 (0%)	0 (0%)	1 (6%)	16	**1.38**	1.06
eCYBERMISSION	6 (38%)	7 (44%)	1 (6%)	0 (0%)	2 (13%)	16	**1.70**	1.25
Junior Solar Sprint (JSS)	9 (56%)	7 (44%)	0 (0%)	0 (0%)	0 (0%)	16	**1.00**	0.00
West Point Bridge Design Contest (WPBDC)	10 (63%)	6 (38%)	0 (0%)	0 (0%)	0 (0%)	16	**1.00**	0.00
Junior Science & Humanities Symposium (JSHS)	6 (40%)	6 (40%)	2 (13%)	1 (7%)	0 (0%)	15	**1.44**	0.73
Gains in the Education of Mathematics and Science (GEMS)	2 (13%)	10 (63%)	0 (0%)	4 (25%)	0 (0%)	16	**1.57**	0.94
GEMS Near Peers	7 (44%)	7 (44%)	1 (6%)	1 (6%)	0 (0%)	16	**1.33**	0.71
UNITE	9 (60%)	5 (33%)	0 (0%)	1 (7%)	0 (0%)	15	**1.33**	0.82
Science & Engineering Apprenticeship Program (SEAP)	0 (0%)	0 (0%)	4 (24%)	5 (29%)	8 (47%)	17	**3.24**	0.83
Research & Engineering Apprenticeship Program (REAP)	9 (56%)	7 (44%)	0 (0%)	0 (0%)	0 (0%)	16	**1.00**	0.00
High School Apprenticeship Program (HSAP)	9 (56%)	6 (38%)	1 (6%)	0 (0%)	0 (0%)	16	**1.14**	0.38
College Qualified Leaders (CQL)	3 (20%)	7 (47%)	4 (27%)	0 (0%)	1 (7%)	15	**1.58**	0.90

Undergraduate Research Apprenticeship Program (URAP)	9 (56%)	7 (44%)	0 (0%)	0 (0%)	0 (0%)	16	**1.00**	0.00
Science Mathematics, and Research for Transformation (SMART) College Scholarship	2 (13%)	12 (75%)	1 (6%)	1 (6%)	0 (0%)	16	**1.21**	0.58
National Defense Science & Engineering Graduate (NDSEG) Fellowship	7 (44%)	9 (56%)	0 (0%)	0 (0%)	0 (0%)	16	**1.00**	0.00

Note. Response scale: **0** = "Never heard of it," **1** = "Never," **2** = "Once," **3**= "Twice," **4** = "Three or more times".

Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply) (n = 17)

	Freq.	%			Freq.	%
Applications from American Society for Engineering Education or the AEOP	4	24%		**Communication(s) generated by a university or faculty (newsletter, email blast, website)**	0	0%
Personal acquaintance(s) (friend, family, neighbor, etc.)	3	18%		**Career fair(s)**	0	0%
Colleague(s) in my workplace	7	41%		**Education conference(s) or event(s)**	0	0%
K-12 school teacher(s) outside of my workplace	2	12%		**STEM conference(s) or event(s)**	2	12%
University faculty outside of my workplace	3	18%		**Organization(s) serving underserved or underrepresented populations**	0	0%
Informational materials sent to K-12 schools or Universities outside of my workplace	0	0%		**Student contacted mentor**	1	6%
Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)	2	12%		**I do not know how student(s) was recruited for apprenticeship**	3	18%
				Other, Specify:	2	12%

Note. Other = "she was looking for science related opportunities", and "Student worked in my lab during her senior year of high school".

How SATISFIED were you with each of the following SEAP program features?

	0	1	2	3	4	n	Avg.	SD
Application or registration process	8 (47%)	0 (0%)	1 (6%)	3 (18%)	5 (29%)	17	**3.44**	0.73
Other administrative tasks	7 (41%)	0 (0%)	1 (6%)	3 (18%)	6 (35%)	17	**3.50**	0.71
Communications with American Society for Engineering Education	15 (94%)	0 (0%)	0 (0%)	0 (0%)	1 (6%)	16	**4.00**	0.00

Communications with [SEAP site]	1 (6%)	0 (0%)	1 (6%)	5 (29%)	10 (59%)	17	**3.56**	0.63
Instruction or mentorship during program activities	4 (24%)	0 (0%)	1 (6%)	2 (12%)	10 (59%)	17	**3.69**	0.63
Participation stipends (payment)	9 (53%)	0 (0%)	0 (0%)	1 (6%)	7 (41%)	17	**3.88**	0.35
Research abstract preparation requirements	0 (0%)	0 (0%)	3 (18%)	6 (35%)	8 (47%)	17	**3.29**	0.77
Research presentation process	1 (6%)	0 (0%)	2 (12%)	4 (24%)	10 (59%)	17	**3.50**	0.73

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

The list below describes mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

		Yes – I used this strategy		No – I did not use this strategy	
	n	**Freq.**	**%**	**Freq.**	**%**
Finding out about students' backgrounds and interests at the beginning of the program	17	15	88%	2	12%
Giving students real-life problems to investigate or solve	17	14	82%	3	18%
Asking students to relate outside events or activities to topics covered in the program	17	5	29%	12	71%
Selecting readings or activities that relate to students' backgrounds	17	8	47%	9	53%
Encouraging students to suggest new readings, activities, or projects	17	8	47%	9	53%
Making explicit provisions for students who wish to carry out independent studies	17	10	59%	7	41%
Helping students become aware of the roles STEM plays in their everyday lives	17	9	53%	8	47%
Helping students understand how STEM can help them improve their communities	16	7	44%	9	56%
Other, (specify):	7	0	0%	7	100%

The list below describes mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

		Yes – I used this strategy		No – I did not use this strategy	
	n	**Freq.**	**%**	**Freq.**	**%**
Finding out about students' learning styles at the beginning of the program	17	9	53%	8	47%

Interacting with all students in the same way regardless of their gender or race and ethnicity	17	16	94%	1	6%
Using gender neutral language	16	13	81%	3	19%
Using diverse teaching/mentoring activities to address a broad spectrum of students	17	11	65%	6	35%
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	17	5	29%	12	71%
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	17	12	71%	5	29%
Directing students to other individuals or programs if I can only provide limited support	17	13	76%	4	24%
Other, (specify):	5	1	20%	4	80%

Note. Other = "Both, mentee and mentor are female, gender was not an important issue".

The list below describes mentoring strategies that are effective ways to support students' development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

		Yes – I used this strategy		No – I did not use this strategy	
	n	**Freq.**	**%**	**Freq.**	**%**
Having students tell others about their backgrounds and interests	17	11	65%	6	35%
Having students explain difficult ideas to others	17	12	71%	5	29%
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	17	8	47%	9	53%
Having students participate in giving and receiving feedback	17	13	76%	4	24%
Having students work on collaborative activities or projects as a member of a team	17	13	76%	4	24%
Having students listen to the ideas of others with an open mind	17	12	71%	5	29%
Having students pay attention to the feelings of all team members	17	8	47%	9	53%
Having students develop ways to resolve conflict and reach agreement among the team	17	9	53%	8	47%
Other, (specify):	5	1	20%	4	80%

The list below describes mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Teaching (or assigning readings) about specific STEM subject matter	17	15	88%	2	12%
Having students access and critically review technical texts or media to support their work	17	13	76%	4	24%
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	17	17	100%	0	0%
Helping students practice STEM skills with supervision	17	15	88%	2	12%
Giving constructive feedback to improve students' STEM competencies	16	16	100%	0	0%
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	17	17	100%	0	0%
Encouraging students to seek support from other team members	17	15	88%	2	12%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	17	14	82%	3	18%
Other, (specify):	5	1	20%	4	80%

The list below describes mentoring strategies that are effective ways to support students' STEM educational and career pathways. The list also includes items that reflect AEOP and Army priorities. From the list below, please indicate which strategies you used when working with your student(s) in SEAP.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Asking about students' educational and career interests	17	17	100%	0	0%
Recommending extracurricular programs that align with students' educational goals	17	9	53%	8	47%
Recommending Army Educational Outreach Programs that align with students' educational goals	17	9	53%	8	47%
Providing guidance about educational pathways that would prepare students for a STEM career	17	14	82%	3	18%
Sharing personal experiences, attitudes, and values pertaining to STEM	17	15	88%	2	12%
Discussing STEM career opportunities with the DoD or other government agencies	17	13	76%	4	24%

Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	17	14	82%	3	18%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	17	6	35%	11	65%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	17	4	24%	13	76%
Recommending student and professional organizations in STEM	17	5	29%	12	71%
Helping students build effective STEM networks	17	9	53%	8	47%
Critically reviewing students' résumé, application, or interview preparations	17	10	59%	7	41%
Other, (specify):	5	0	0%	5	100%

How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during SEAP?

	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	16 (94%)	0 (0%)	0 (0%)	1 (6%)	0 (0%)	17	**3.00**	0.00
Army Educational Outreach Program (AEOP) website	13 (76%)	0 (0%)	2 (12%)	2 (12%)	0 (0%)	17	**2.50**	0.58
AEOP social media	15 (88%)	1 (6%)	0 (0%)	1 (6%)	0 (0%)	17	**2.00**	1.41
AEOP brochure	14 (82%)	0 (0%)	2 (12%)	1 (6%)	0 (0%)	17	**2.33**	0.58
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	12 (71%)	0 (0%)	3 (18%)	2 (12%)	0 (0%)	17	**2.40**	0.55
Program administrator or site coordinator	6 (35%)	0 (0%)	1 (6%)	5 (29%)	5 (29%)	17	**3.36**	0.67
Invited speakers or "career" events	11 (65%)	1 (6%)	0 (0%)	3 (18%)	2 (12%)	17	**3.00**	1.10
Participation in SEAP	0 (0%)	0 (0%)	2 (12%)	8 (47%)	7 (41%)	17	**3.29**	0.69

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Which of the following AEOPs did you EXPLICITLY DISCUSS with your student(s) during SEAP?

		Yes - I discussed this program with my student(s)		No - I did not discuss this program with my student(s)	
	n	Freq.	%	Freq.	%
Camp Invention	17	1	6%	16	94%
eCYBERMISSION	17	2	12%	15	88%
Junior Solar Sprint (JSS)	17	0	0%	17	100%

West Point Bridge Design Contest (WPBDC)	17	0	0%	17	100%
Junior Science & Humanities Symposium (JSHS)	17	1	6%	16	94%
Gains in the Education of Mathematics and Science (GEMS)	17	6	35%	11	65%
GEMS Near Peers	17	4	24%	13	76%
UNITE	17	2	12%	15	88%
Science & Engineering Apprenticeship Program (SEAP)	17	12	71%	5	29%
Research & Engineering Apprenticeship Program (REAP)	17	0	0%	17	100%
High School Apprenticeship Program (HSAP)	17	0	0%	17	100%
College Qualified Leaders (CQL)	17	3	18%	14	82%
Undergraduate Research Apprenticeship Program (URAP)	16	1	6%	15	94%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	17	4	24%	13	76%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	17	1	6%	16	94%
I discussed AEOP with my student(s) but did not discuss any specific program	16	4	25%	12	75%

How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during SEAP?

	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	15 (88%)	1 (6%)	0 (0%)	1 (6%)	0 (0%)	17	**2.00**	1.41
Army Educational Outreach Program (AEOP) website	12 (71%)	1 (6%)	1 (6%)	3 (18%)	0 (0%)	17	**2.40**	0.89
AEOP social media	15 (88%)	1 (6%)	0 (0%)	1 (6%)	0 (0%)	17	**2.00**	1.41
AEOP brochure	13 (76%)	1 (6%)	1 (6%)	2 (12%)	0 (0%)	17	**2.25**	0.96
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	12 (71%)	2 (12%)	1 (6%)	2 (12%)	0 (0%)	17	**2.00**	1.00
Program administrator or site coordinator	5 (29%)	0 (0%)	2 (12%)	4 (24%)	6 (35%)	17	**3.33**	0.78
Invited speakers or "career" events	10 (59%)	0 (0%)	1 (6%)	2 (12%)	4 (24%)	17	**3.43**	0.79
Participation in SEAP	2 (12%)	0 (0%)	1 (6%)	4 (24%)	10 (59%)	17	**3.60**	0.63

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
DoD researchers advance science and engineering fields	0 (0%)	0 (0%)	1 (6%)	9 (56%)	6 (38%)	16	**4.31**	0.60
DoD researchers develop new, cutting edge technologies	0 (0%)	0 (0%)	3 (18%)	11 (65%)	3 (18%)	17	**4.00**	0.61
DoD researchers support non-defense related advancements in science and technology	1 (6%)	0 (0%)	2 (12%)	10 (59%)	4 (24%)	17	**3.94**	0.97
DoD researchers solve real-world problems	0 (0%)	0 (0%)	1 (6%)	5 (29%)	11 (65%)	17	**4.59**	0.62
DoD research is valuable to society	0 (0%)	0 (0%)	0 (0%)	6 (35%)	11 (65%)	17	**4.65**	0.49

Note. Response scale: **1** = "Strongly Disagree," **2** = "Disagree," **3** = "Neither Agree nor Disagree," **4** = "Agree," **5** = "Strongly Agree".

How often did YOUR STUDENT(S) have opportunities do each of the following in SEAP?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	0 (0%)	1 (6%)	9 (53%)	7 (41%)	17	**4.35**	0.61
Apply STEM knowledge to real life situations	0 (0%)	0 (0%)	2 (13%)	12 (75%)	2 (13%)	16	**4.00**	0.52
Learn about cutting-edge STEM research	0 (0%)	2 (12%)	6 (35%)	8 (47%)	1 (6%)	17	**3.47**	0.80
Learn about different STEM careers	1 (6%)	1 (6%)	7 (41%)	8 (47%)	0 (0%)	17	**3.29**	0.85
Interact with STEM professionals	0 (0%)	0 (0%)	0 (0%)	5 (31%)	11 (69%)	16	**4.69**	0.48
Practice using laboratory or field techniques, procedures, and tools	0 (0%)	0 (0%)	0 (0%)	5 (29%)	12 (71%)	17	**4.71**	0.47
Participate in hands-on STEM activities	0 (0%)	0 (0%)	1 (6%)	4 (24%)	12 (71%)	17	**4.65**	0.61
Work as part of a team	1 (6%)	0 (0%)	2 (12%)	2 (12%)	12 (71%)	17	**4.41**	1.12
Communicate with other students about STEM	1 (6%)	1 (6%)	4 (24%)	6 (35%)	5 (29%)	17	**3.76**	1.15
Pose questions or problems to investigate	0 (0%)	3 (18%)	6 (35%)	5 (29%)	3 (18%)	17	**3.47**	1.01
Design an investigation	4 (24%)	2 (12%)	7 (41%)	4 (24%)	0 (0%)	17	**2.65**	1.11
Carry out an investigation	0 (0%)	1 (6%)	1 (6%)	8 (47%)	7 (41%)	17	**4.24**	0.83
Analyze and interpret data or information	0 (0%)	0 (0%)	3 (19%)	4 (25%)	9 (56%)	16	**4.38**	0.81
Draw conclusions from an investigation	0 (0%)	1 (6%)	6 (35%)	2 (12%)	8 (47%)	17	**4.00**	1.06
Come up with creative explanations or solutions	0 (0%)	3 (18%)	3 (18%)	6 (35%)	5 (29%)	17	**3.76**	1.09

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

Which category best describes the focus of your student's SEAP project?		
	Freq.	**%**
Science	14	82%
Technology	1	6%
Engineering	2	12%
Mathematics	0	0%
Total	**17**	**100%**

AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Knowledge of a STEM topic or field in depth	0 (0%)	0 (0%)	1 (6%)	14 (82%)	2 (12%)	17	**4.06**	0.43
Knowledge of research conducted in a STEM topic or field	0 (0%)	0 (0%)	1 (6%)	12 (71%)	4 (24%)	17	**4.18**	0.53
Knowledge of research processes, ethics, and rules for conduct in STEM	0 (0%)	0 (0%)	1 (6%)	12 (71%)	4 (24%)	17	**4.18**	0.53
Knowledge of how professionals work on real problems in STEM	0 (0%)	0 (0%)	1 (6%)	10 (59%)	6 (35%)	17	**4.29**	0.59
Knowledge of what everyday research work is like in STEM	0 (0%)	0 (0%)	0 (0%)	7 (41%)	10 (59%)	17	**4.59**	0.51

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Asking questions based on observations of real-world phenomena	0 (0%)	0 (0%)	6 (43%)	8 (57%)	0 (0%)	14	**3.57**	0.51
Asking a question (about a phenomenon) that can be answered with one or more investigations	0 (0%)	1 (7%)	3 (21%)	9 (64%)	1 (7%)	14	**3.71**	0.73
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	0 (0%)	1 (7%)	4 (29%)	7 (50%)	2 (14%)	14	**3.71**	0.83
Making a model to represent the key features and functions of an observed phenomenon	0 (0%)	4 (29%)	7 (50%)	1 (7%)	2 (14%)	14	**3.07**	1.00
Deciding what type of data to collect in order to answer a question	0 (0%)	2 (14%)	2 (14%)	7 (50%)	3 (21%)	14	**3.79**	0.97

Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	1 (7%)	1 (7%)	3 (21%)	6 (43%)	3 (21%)	14	**3.64**	1.15
Identifying the limitations of data collected in an investigation	0 (0%)	2 (14%)	2 (14%)	9 (64%)	1 (7%)	14	**3.64**	0.84
Carrying out procedures for an investigation and recording data accurately	0 (0%)	0 (0%)	1 (7%)	9 (64%)	4 (29%)	14	**4.21**	0.58
Testing how changing one variable affects another variable, in order to understand relationships between variables	0 (0%)	1 (7%)	5 (36%)	7 (50%)	1 (7%)	14	**3.57**	0.76
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	7 (50%)	2 (14%)	3 (21%)	1 (7%)	1 (7%)	14	**2.07**	1.33
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	0 (0%)	1 (7%)	6 (43%)	6 (43%)	1 (7%)	14	**3.50**	0.76
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	1 (7%)	0 (0%)	3 (21%)	8 (57%)	2 (14%)	14	**3.71**	0.99
Using mathematics or computers to analyze numeric data	1 (7%)	1 (7%)	2 (14%)	7 (50%)	3 (21%)	14	**3.71**	1.14
Supporting a proposed explanation (for a phenomenon) with data from investigations	0 (0%)	1 (7%)	5 (36%)	6 (43%)	2 (14%)	14	**3.64**	0.84
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	0 (0%)	4 (29%)	8 (57%)	2 (14%)	14	**3.86**	0.66
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	0 (0%)	0 (0%)	7 (50%)	5 (36%)	2 (14%)	14	**3.64**	0.74
Using data or interpretations from other researchers or investigations to improve an explanation	1 (7%)	3 (21%)	5 (36%)	3 (21%)	2 (14%)	14	**3.14**	1.17
Asking questions to understand the data and interpretations others use to support their explanations	1 (7%)	1 (7%)	6 (43%)	4 (29%)	2 (14%)	14	**3.36**	1.08
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	0 (0%)	3 (21%)	6 (43%)	3 (21%)	2 (14%)	14	**3.29**	0.99

Deciding what additional data or information may be needed to find the best explanation for a phenomenon	0 (0%)	2 (14%)	6 (43%)	4 (29%)	2 (14%)	14	**3.43**	0.94
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	1 (7%)	7 (50%)	3 (21%)	3 (21%)	14	**3.57**	0.94
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	1 (7%)	4 (29%)	4 (29%)	4 (29%)	1 (7%)	14	**3.00**	1.11
Integrating information from multiple sources to support your explanations of phenomena	0 (0%)	4 (29%)	4 (29%)	3 (21%)	3 (21%)	14	**3.36**	1.15
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	0 (0%)	1 (7%)	3 (21%)	6 (43%)	4 (29%)	14	**3.93**	0.92

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Identifying real-world problems based on social, technological, or environmental issues	0 (0%)	1 (33%)	1 (33%)	0 (0%)	1 (33%)	3	**3.33**	1.53
Defining a problem that can be solved by developing a new or improved object, process, or system	0 (0%)	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3	**4.00**	1.00
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	0 (0%)	0 (0%)	2 (67%)	0 (0%)	1 (33%)	3	**3.67**	1.15
Making a model that represents the key features or functions of a solution to a problem	0 (0%)	0 (0%)	0 (0%)	1 (33%)	2 (67%)	3	**4.67**	0.58
Deciding what type of data to collect in order to test if a solution functions as intended	0 (0%)	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3	**4.00**	1.00
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	1 (33%)	0 (0%)	0 (0%)	1 (33%)	1 (33%)	3	**3.33**	2.08
Identifying the limitations of the data collected in an investigation	0 (0%)	1 (33%)	1 (33%)	0 (0%)	1 (33%)	3	**3.33**	1.53
Carrying out procedures for an investigation and recording data accurately	0 (0%)	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3	**4.00**	1.00

Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	0 (0%)	0 (0%)	2 (67%)	0 (0%)	1 (33%)	3	**3.67**	1.15
Using computer-based models to investigate cause and effect relationships of a simulated solution	0 (0%)	0 (0%)	0 (0%)	1 (33%)	2 (67%)	3	**4.67**	0.58
Considering alternative interpretations of data when deciding if a solution functions as intended	0 (0%)	0 (0%)	2 (67%)	0 (0%)	1 (33%)	3	**3.67**	1.15
Displaying numeric data in charts or graphs to identify patterns and relationships	0 (0%)	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3	**4.00**	1.00
Using mathematics or computers to analyze numeric data	0 (0%)	0 (0%)	1 (33%)	0 (0%)	2 (67%)	3	**4.33**	1.15
Supporting a proposed solution (for a problem) with data from investigations	0 (0%)	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3	**4.00**	1.00
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3	**4.00**	1.00
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0 (0%)	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3	**4.00**	1.00
Using data or interpretations from other researchers or investigations to improve a solution	0 (0%)	0 (0%)	2 (67%)	0 (0%)	1 (33%)	3	**3.67**	1.15
Asking questions to understand the data and interpretations others use to support their solutions	0 (0%)	0 (0%)	1 (33%)	0 (0%)	2 (67%)	3	**4.33**	1.15
Using data from investigations to defend an argument that conveys how a solution meets design criteria	0 (0%)	1 (33%)	1 (33%)	0 (0%)	1 (33%)	3	**3.33**	1.53
Deciding what additional data or information may be needed to find the best solution to a problem	1 (33%)	0 (0%)	1 (33%)	0 (0%)	1 (33%)	3	**3.00**	2.00
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	1 (33%)	1 (33%)	0 (0%)	1 (33%)	3	**3.33**	1.53
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	1 (33%)	1 (33%)	0 (0%)	1 (33%)	3	**3.33**	1.53

Integrating information from multiple sources to support your solution to a problem	0 (0%)	1 (33%)	1 (33%)	0 (0%)	1 (33%)	3	**3.33**	1.53
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	0 (0%)	0 (0%)	2 (67%)	0 (0%)	1 (33%)	3	**3.67**	1.15

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?

	1	2	3	4	5	n	Avg.	SD
Learning to work independently	0 (0%)	0 (0%)	5 (29%)	6 (35%)	6 (35%)	17	**4.06**	0.83
Setting goals and reflecting on performance	0 (0%)	1 (6%)	8 (47%)	2 (12%)	6 (35%)	17	**3.76**	1.03
Sticking with a task until it is completed	0 (0%)	0 (0%)	4 (24%)	6 (35%)	7 (41%)	17	**4.18**	0.81
Making changes when things do not go as planned	0 (0%)	1 (6%)	5 (29%)	3 (18%)	8 (47%)	17	**4.06**	1.03
Patience for the slow pace of research	0 (0%)	2 (12%)	5 (29%)	5 (29%)	5 (29%)	17	**3.76**	1.03
Working collaboratively with a team	0 (0%)	1 (6%)	6 (35%)	4 (24%)	6 (35%)	17	**3.88**	0.99
Communicating effectively with others	0 (0%)	1 (6%)	4 (24%)	5 (29%)	7 (41%)	17	**4.06**	0.97
Including others' perspectives when making decisions	0 (0%)	1 (6%)	7 (41%)	5 (29%)	4 (24%)	17	**3.71**	0.92
Sense of being part of a learning community	0 (0%)	0 (0%)	6 (35%)	5 (29%)	6 (35%)	17	**4.00**	0.87
Sense of contributing to a body of knowledge	0 (0%)	0 (0%)	4 (24%)	7 (41%)	6 (35%)	17	**4.12**	0.78
Building relationships with professionals in a field	0 (0%)	3 (18%)	3 (18%)	5 (29%)	6 (35%)	17	**3.82**	1.13
Connecting a topic or field and their personal values	1 (6%)	2 (12%)	5 (29%)	4 (24%)	5 (29%)	17	**3.59**	1.23

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

Which of the following statements describe YOUR STUDENT(S) after participating in the SEAP program?

	1	2	3	4	n	Avg.	SD
More confident in STEM knowledge, skills, and abilities	0 (0%)	0 (0%)	12 (71%)	5 (29%)	17	**3.29**	0.47
More interested in participating in STEM activities outside of school requirements	1 (6%)	2 (12%)	9 (53%)	5 (29%)	17	**3.06**	0.83
More aware of other AEOPs	4 (24%)	2 (12%)	7 (41%)	4 (24%)	17	**2.65**	1.11
More interested in participating in other AEOPs	4 (24%)	2 (12%)	7 (41%)	4 (24%)	17	**2.65**	1.11
More interested in taking STEM classes in school	1 (6%)	4 (24%)	8 (47%)	4 (24%)	17	**2.88**	0.86

More interested in attending college	0 (0%)	6 (35%)	7 (41%)	4 (24%)	17	**2.88**	0.78
More interested in earning a STEM degree in college	0 (0%)	5 (29%)	7 (41%)	5 (29%)	17	**3.00**	0.79
More interested in pursuing a STEM career	0 (0%)	5 (29%)	8 (47%)	4 (24%)	17	**2.94**	0.75
More aware of Department of Defense (DoD) STEM research and careers	0 (0%)	1 (6%)	5 (29%)	11 (65%)	17	**3.59**	0.62
Greater appreciation of DoD STEM research and careers	0 (0%)	1 (6%)	5 (29%)	11 (65%)	17	**3.59**	0.62
More interested in pursuing a STEM career with the DoD	3 (18%)	2 (12%)	4 (24%)	8 (47%)	17	**3.00**	1.17

Note. Response scale: **1** = "Disagree – This did not happen," **2** = "Disagree – This happened but not because of SEAP," **3** = "Agree – SEAP contributed," **4** = "Agree – SEAP was the primary reason".

Appendix D

FY14 SEAP Apprentice Focus Group Protocol

2014 Army Educational Outreach Program

Student Focus Group

Facilitator: "Thank you for meeting with us today so that we can learn more about your experiences in [X] program. We'd like to suggest some basic ground rules to help the group's discussion proceed smoothly and respectfully for everyone:

- What is shared in the room stays in the room.
- Only one person speaks at a time.
- It is important for us to hear everyone's ideas and opinions. If you disagree, be respectful.
- It is important for us to hear all sides of an issue—both the positive and negative.
- Your participation is voluntary--you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for notetaking purposes and will delete the email after the notes have been taken."

Key Questions

1. Why did you choose to participate in [X] this year?
    - How did you hear about [X]?

2. One AEOP objective is to increase your awareness of the AEOP's pipeline of STEM programs. Did you learn about other AEOPs in [X]?
    - Which ones did you learn about?
    - How did you learn about them?
    - Which AEOPs are you interested in pursuing?

3. One AEOP objective is to increase your awareness of STEM research and career opportunities within the Department of Defense. Did you learn about DoD STEM research and careers in [X]?
    - Which ones did you learn about?
    - How did you learn about them?
    - Which AEOPs are you interested in pursuing?

4. Overall, were you happy that you chose to participate in [X]?
    - How have you benefited from participating in [X]?

5. What would you suggest for improving [X] in the future?

Ending questions:

6. Have we missed anything? Tell us anything you want us to know that we didn't ask about.

Appendix E

FY14 SEAP Mentor Focus Group Protocol

2014 Army Educational Outreach Program
Adult Focus Group

Facilitator: "Thank you for meeting with us today so that we can learn more about your experiences in [X] program. We'd like to suggest some basic ground rules to help the group's discussion proceed smoothly and respectfully for everyone:

- What is shared in the room stays in the room.
- Only one person speaks at a time--we'll call on sites, if you have something to add or wish to build on another's idea, just type 'add' in the chat window and we'll come back to you.
- It is important for us to hear everyone's ideas and opinions. If you disagree, be respectful.
- It is important for us to hear all sides of an issue—both the positive and negative.
- Your participation is voluntary--you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for notetaking purposes and will delete the email after the notes have been taken."

Key Questions

1. What do you perceive as the value of [X]?
    - How do you think students benefit from participating?
    - How have you benefited?

2. One AEOP objective is to increase participation of underserved and underrepresented populations in STEM. What strategies have you used this year to increase the diversity of participants in [X]?
    - What strategies seem to work the best?
    - What do you need in order to achieve greater success?

3. One AEOP objective is to increase participants' awareness of the AEOP's pipeline of STEM programs. What strategies have you used this year to educate participants about other AEOP initiatives?
    - What strategies seem to work the best?
    - What do you need in order to achieve greater success?

4. One AEOP objective is to increase participants' awareness of STEM research and career opportunities within the Department of Defense. What strategies have you used this year to expose participants to DoD STEM research and careers?
    - What strategies seem to work the best?
    - What do you need in order to achieve greater success?

5. What suggestions do you have for improving [X]?

Ending questions:

6. Have we missed anything? Tell us anything you want us to know that we didn't ask about.

Appendix F

APR Template

Program Overview

Provide a one or two paragraph overview of your program.

Accomplishments

Provide the following for *each* program objective listed in the Proposed Work section of the FY14 Annual Program Plan.

1. **What were the major activities conducted to accomplish the FY14 target for the objective. Report major activities undertaken by of the program adninistrator as well as a selection of 3-5 different site-level activities.**

2. **What were the results of those activities? Specifically, what progress was made toward achieving the FY14 target for the objective?**

3. **What is the proposed FY15 target for for the objective, considering the 5-year target?**

4. **What is planned to accomplish the FY15 target for the objective?**

The following structure can be used for each program objective (replicate as needed). Information in the top two rows ("Objective" and "FY14 Target") should be copied directly from the approved FY14APP.

Objective: [STATE OBJECTIVE] (**Supports AEOP Goal** [STATE GOAL #], **Objectives** [STATE OBJECTIVE LETTERS]) **Proposed Plan:** [STATE PROPOSED PLAN]
FY14 Target: [STATE TARGET]
Major activities: [REPORT ACTIVITIES OF PROGRAM ADMISTRATOR] [REPORT SELECTED SITE-LEVEL ACTIVITIES]
Results: [REPORT RESULTS] [REPORT PROGROSS TOWARD ACHEIVEING FY14 TARGET]
FY15 Target: [STATE TARGET]
FY15 Plan: [STATE PLAN TO ACCOMPLISH FY15 TARGET]

Changes / Challenges

1. **What changes (if any) were made to the plan for meeting FY14 targets for each objective? What were the reasons for the changes?**

2. **Do any of these changes have significant impact on budget/expenditures?**

3. **What challenges or delays (if any) prevented the program from meeting FY14 targets for each objective? What actions or plans were implemented to resolve those challenges or delays?**

4. **Do any of these challenges or delays require the assistance of the Army, the Consortium, or the Lead Organization to resolve? Please specify.**

Products

1. **For all programs, list and briefly describe any products resulting from the administration of the program (program administrator or site coordinator) during FY14.**
   - **Websites and social media (provide website urls, social media handles, etc.)**
   - **Instructional materials and other educational aids or resources**
   - **Audio or video products**
   - **Guiding documents**
   - **Marketing or promotional materials**
   - **Presentations[25] (provide citations)**
   - **Publications[26] (provide citations)**
   - **Educational research or evaluation assessments**
   - **Other**
2. **In addition to the above, how many of each product resulted from the Army/AEOP-sponsored research conducted by students participating in apprenticeship programs?**
   - **Abstracts**
   - **Presentations**
   - **Publications**
   - **Patents**
   - **Other**

[25] Presentations include things like conference contributions (oral or poster) or presentations to the public, news media, educational agencies, and other associations. Conference booths may also be reported.

[26] Publications include things like peer reviewed articles, technical papers and reports, books or book chapters, news media releases.

Participants

Recruitment and selection of participants

1. **Who is the audience(s) targeted by your program and how was the program was marketed to the audience(s)? Report major activities undertaken by of the program administrator as well as a selection of 3-5 different site-level activities toward marketing and recruitment.**

2. **What criteria were used to select participants for the program? Report any efforts of the program administrator (including guidance provided to sites) as well as a selection of 3-5 different site-level criteria.**

3. **AEOP Pipeline: Explain any efforts that were made to specifically recruit alumni of other AEOP initiatives into your program? Explain any efforts to specifically recruit alumni of your program into other AEOP initiatives?**

Participant numbers and demographic characteristics

1. **How many of each participant group enrolled in the program? How many of each group applied and/or were selected/invited to participate? Report data using the following categories and enter "NA" where not applicable.**

	Applied	Selected	Enrolled
Participant Group	**No.**	**No.**	**No.**
Elementary school students (grades K-5)			
Middle school students (grades 6-8)			
High school students (grades 9-12)			
Undergraduate students (including community college)			
Graduate students (including post-baccalaureates)			
In-service K-12 teachers			
Pre-service K-12 teachers			
College/university faculty or other personnel			
Army/DoD Scientists & Engineers			
Other volunteers (e.g., if a competition program)			

2. **For the target audience(s) listed in the previous section (replicate the table as needed), how many were enrolled in the program per program site? How many of each group applied and/or were selected/invited to participate per program site?**

[Identify Participant Group]	Applied	Selected	Enrolled
Site	**No.**	**No.**	**No.**

(List each site by name)			

3. **For the target audience(s) listed in the previous section (replicate the table as needed), what are the demographic characteristics of the applicants and enrolled participants? Report data using the following categories:**

Identify Participant Group]	Applied		Enrolled	
Demographic Category	**No.**	%	**No.**	%
Gender				
Male				
Female				
Choose not to report				
Race/ethnicity				
Native American or Alaskan Native				
Asian				
Black or African American				
Hispanic or Latino				
Native Hawaiian or Other Pacific Islander				
White				
Choose not to report				
School setting (students and teachers)				
Urban (city)				
Suburban				
Rural (country)				
Frontier or tribal School				
DoDDS/DoDEA School				
Home school				
Online school				
Choose not to report				
Receives free or reduced lunch (students only)				
Yes				
No				
Choose not to report				
English is a first language (students only)				

Yes				
No				
Choose not to report				
One parent/guardian graduated from college (students only)				
Yes				
No				
Choose not to report				
Documented disability (students only)				
Yes				
No				
Choose not to report				

4. For the target audience(s) listed in the previous section (replicate the table as needed), what are the rates of past AEOP participation of the applicants and enrolled participants? Report data using the following categories:

[Identify Participant Group]	Applied		Enrolled	
AEOP element	**No.**	%	**No.**	%
Camp Invention				
Junior Solar Sprint				
eCYBERMISSION				
West Point Bridge Design Competition				
Junior Science & Humanities Symposium				
Gains in the Education of Mathematics and Science				
UNITE				
Science and Engineering Apprentice Program				
Research and Engineering Apprenticeship Program				
High School Apprenticeship Program				
College Qualified Leaders				
Undergraduate Research Apprenticeship Program				
STEM Teachers Academy				
SMART Scholarship				
NDSEG Fellowship				

Organizations participating or served

1. How many of each organization are served by the program? Report data in the following categories:

Organizations	No.
K-12 schools	
Title 1 K-12 schools	
Colleges/universities (including community colleges)	
Army/DoD laboratories	
Other collaborating organizations (educational agencies, professional associations, external sponsors, etc.)	

2. Please list all colleges/universities served by the program.

3. Please list all Army/DoD laboratories served by the program.

4. Please list other collaborating organizations served by the program.

Other Impacts

Have the FY14 program activities impacted human and/or infrastructure resources in any additional areas beyond the primary objectives of the program? If so, please describe any activities and results of those activities, especially pertaining to the following:

- **Engagement opportunities for the public (beyond those persons typically considered program participants) to increase interest in STEM, perception of STEM's value to their lives, or their ability to participate in STEM**
- **Professional development for pre-service or in-service STEM teachers to improve their content knowledge and pedagogical skills**
- **Development and/or dissemination of instructional materials or educational resources**
- **Support for the development or advancement of STEM personnel (i.e., Army Scientists & Engineers, Army-sponsored university faculty and other personnel), programs, or other physical infrastructure**
- **Contributions having intellectual merit or broader impact to the field of informal science education and outreach**

If any of these activities are conducted through websites and/or social media, the summary of results should include the analysis of key website or social media analytics.

Funding, Budget, and Expenditures

1. Provide an overview of FY14 funding

FY14 Funding Overview	Amount
Carry-forward funding from FY13	
New funding received in FY14	
Total budget for FY14 (FY13 carry-over plus FY14 new funding)	
Total FY14 expenses (estimate for 30 Sept)	
Carry-forward funding from FY14 into FY15 (total FY14 budget minus estimate of total FY14 expenses)	

2. Funding to the cooperative agreement comes from a variety of sources (general purpose funds, laboratory specific stipend funds, and Navy and Air Force funds for JSHS, etc.). The type of funding is indicated on AEOP CA modifications. What type of funds supported your program in FY14 (include funding carried over from FY13 in your totals)?

FY14 AEOP CA Funding Type/Source	Amount
General purpose funds	
Laboratory specific stipend funds - [Indicate Laboratory and replicate row as needed so that each contributing laboratory is represented on a separate line]	
Total laboratory specific stipend funds	
Air Force/ Navy JSHS funds	
Total FY14 funding (add types of funding, should be equivalent to "Total budget for FY14" in table above)	

3. How do your actual FY14 expenditures (estimate for 30 Sept cut-off) compare with your approved FY14 budget? Report totals in the following categories:

	Approved FY14 Budget (includes FY13 carry-over and new FY14 funding)	Actual FY14 Expenditures (estimate through 30 Sept)	Carry-over from FY14 into FY15
Marketing & Outreach (include additional funding received through special AEOP Cross-Marketing RFP process)			
National Event (where applicable)			
Scholarships/awards			
Stipends			
Other direct costs (including salary & fringe); Number of FTEs =[Indicate number of FTEs including PT wage workers]			
Overhead – Indirect Rate= [Indicate Indirect Rate and to which costs the indirect applies (i.e. labor, direct costs, etc.)]			
TOTALS (should match totals provided in tables above)			

4. Calculate average cost per student and explain how the calculation was made.

Fast Facts

Complete the summary chart below. Report data using the following categories and enter "NA" where not applicable.

FY14 [Enter Program Name]	No.
Applications & Participants	
Student Applications	
Student Participants	
Student Participation Rate (no. participants/no. applications x 100)	%
Teacher Applications	
Teacher Participants	
Teacher Participation Rate	%
Near-Peer Mentor Applications	
Near-Peer Mentor Participants	
Near-Peer Mentor Participation Rate	%
Partners	
Participating Colleges/Universities (including community colleges)	
Participating Army/DoD Laboratories	
Science & Engineer Participants	
Apprenticeships, Awards & Stipends	
Apprenticeships Provided	
Scholarships/Awards Provided	
Expenses Toward Scholarships/Awards	$
Expenses Toward Stipends	$
Budget & Expenses	
FY14 Total Budget (including carry-over from FY13 and new FY14 funding)	$
FY14 Total Expenses (estimate through 30 Sept)	$
Carry-Over from FY14 to FY15	$
Average cost per student	$