Army Educational Outreach Program

Science & Engineering Apprenticeship Program

2015 Annual Program Evaluation Report

ARMY EDUCATIONAL OUTREACH PROGRAM

SEAP_04_05112016

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Executive Summary

The Science & Engineering Apprenticeship Program (SEAP), managed by the American Society for Engineering Education (ASEE) in 2015, 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 2015, SEAP provided outreach to 92 apprentices, 73 adult mentors, and 43 Army S&Es at 9 Army laboratory sites (1 lab selected 0 apprentices) herein called SEAP sites. There was no change in the number of apprentices from 2014 to 2015.

This report documents the evaluation of the 2015 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, two interviews with apprentices , and an annual program report compiled by ASEE.

2015 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	633 individual applicants with 1198 applications to specific SEAP sites
No. of Students (Apprentices)	92
Placement Rate	15% or 8%
No. of Army S&E Mentors	116
No. of Army Research Laboratories	9
No. of K-12 Schools	63
No. of K-12 Schools – Title I	11
No. of DoDEA Students	0
No. of DoDEA Schools	0
Total Cost	$325,223.60

Stipend Cost (paid by participating labs)	$272,418.83
Administrative Cost to ASEE	$52,804.77
Cost Per Student Participant	$3,535.04

† There are more SEAP mentors than apprentices as some apprentices receive mentorship from more than one Army S&E.

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 FY15 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.

2015 SEAP Evaluation Findings	
Participant Profiles	
SEAP continued to serve students from historically underrepresented and underserved populations, providing evidence that the program disseminated information about SEAP to a diverse audience.	The proportion of females - a population that is historically underrepresented in engineering fields - participating in SEAP increased from 40% in FY14 to 45% in FY15.
	SEAP continued to serve students from historically underrepresented and underserved race/ethnic groups at similar rates as in FY14. Of enrolled apprentices in FY15, 14% identified as Black or African American (13% in FY14) and 2% as Hispanic or Latino (1% in FY14). Although there was a small increase in the percentage of students identifying with these groups, this remains an area for potential growth.

[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.

SEAP experienced limited success in recruiting GEMS participants to SEAP.	Although no SEAP apprentices reported past participation in programs such as JSHS and JSS, 32% reported having participated in GEMS at least once. This is a slight increase over FY14 when 30% of SEAP participants reported being alumni of GEMS, but falls short of the goal for FY15 of 40% of SEAP participants being GEMS alumni. GEMS mentors (66%) in FY15 reported discussing SEAP with GEMS participants and 37% of GEMS participants indicated interest in participating in SEAP in the future.
SEAP did not reach its targeted number of program applicants.	The program fell short of its FY15 goal of 900 applicants and received fewer applications (22% decrease) in FY15 than in FY14 (633 versus 810).
Actionable Program Evaluation	
Pre-existing relationships continue to be a factor in SEAP recruitment, however website applications played an increased role in apprentice recruitment.	As in FY14, references from workplace colleagues and applications from the ASEE or AEOP websites were the most commonly reported methods of apprentice recruitment. However, in FY15, slightly more mentors reported that website applications were a key recruitment strategy (29% in FY15 versus 24% in FY14) and fewer reported personal references as a key strategy (33% in FY15 versus 41% in FY14).
	As in FY14, apprentices in FY15 most commonly learned about SEAP from personal relationships including family members (39%) and past participants of the program (36%). The AEOP website, however, was cited by only 25% of apprentices as a method of learning about SEAP.
SEAP apprentices continue to be motivated by a variety of factors, although apprentice stipends were a key motivator for participation.	A range of factors motivated apprentices to participate in SEAP. Apprentice stipends were a major motivator with 67% of respondents reporting that stipends "very much" motivated them to participate. Other factors included exploring a unique work environment (35%), SEAP mentors (27%), and learning in ways that are not possible in school (27%).
SEAP engaged apprentices in meaningful STEM learning.	Over 90% of apprentices reported interacting with scientists or engineers, applying STEM to real life situations, and learning about STEM topics new to them on most days or every day of their apprenticeship. Likewise, over half of apprentices reported communicating with other students about STEM, learning about careers that use STEM, and learning about new discoveries in STEM on most days or every day.
	Apprentices reported engaging in a variety of STEM practices during their SEAP experience. For example, a large majority of apprentices reported participating in hands-on STEM activities every day or most days (92%), analyzing data or information (91%), and using laboratory procedures and tools (81%).
	Apprentices reported markedly greater opportunities to learn about STEM and engage in STEM practices in SEAP as compared to their typical school experiences.
	All responding mentors reported using a variety of teaching and/or mentoring activities to meet students' needs. Mentors also used a variety of other strategies to support the diverse needs of their students as learners, including identifying student learning styles (79%) and directing students to other individuals or

	programs for additional support (79%). Similarly, mentors used a variety of strategies to support student collaboration and interpersonal skills. These strategies included having students listen to the ideas of others with an open mind (92%), having students explain difficult ideas to others (88%), and having students work on collaborative activities or projects (88%). Mentors also supported apprentices' engagement in authentic STEM activities using a variety of strategies including demonstrating laboratory/field techniques, procedures, and tools (92%), providing students with constructive feedback (92%), had having students work independently to improve their self-management abilities (92%).
SEAP promotes apprentice awareness of DoD STEM research and careers.	Apprentices reported overwhelmingly positive opinions about DoD researchers and research. For example, apprentices reported that they believe that DoD research is valuable to society (96%) and that DoD researchers advance science and engineering fields (94%).
	Nearly all apprentices (92%) reported learning about at least one DoD STEM career during their participation in SEAP. Apprentices found participation in SEAP and their mentors to be the most impactful resources in learning about DoD STEM careers while mentors reported that participation in SEAP and the SEAP program administrator or site coordinator were the most useful resources in their efforts to expose apprentices to DoD STEM careers.
SEAP has an opportunity to improve mentor and apprentice awareness of and marketing of other AEOP opportunities.	Most apprentices reported never hearing about or never participating in most AEOP programs beyond SEAP. One exception to this was the GEMS program; over a quarter of SEAP apprentices reported participating in GEMS at least once. Similarly, responding mentors generally had little awareness of or past participation in other AEOP programs, although a quarter reported participating in GEMS at least once in the past.
The SEAP experience is valued by apprentices and mentors.	The number of SEAP mentors increased by 18% in FY15 (compared to FY14). Apprentices and mentors were asked about their overall satisfaction with the SEAP program. Nearly all respondents had overall positive perceptions of the program. While 15% of apprentices reported being not at all satisfied with "other administrative tasks" associated with SEAP, this is an improvement over FY14 when 31% reported dissatisfaction with administrative aspects of the program. In responses to an open-ended item asking about their satisfaction with the SEAP program. The vast majority of apprentices (93%) reported being at least somewhat satisfied with instruction or mentorship during the program and 89% reported being at least somewhat satisfied with their working relationship with their group or team. Likewise, mentors reported being somewhat or very satisfied with program features such as communication with the SEAP site (88%), the research presentation process (83%) and research abstract requirements (82%).
Outcomes Evaluation	
SEAP apprentices reported gains in STEM knowledge and competencies.	A large majority of apprentices reported large or extreme gains in their STEM knowledge, including what everyday research work is like in STEM, how professionals work on real problems in STEM, and knowledge of a STEM topic or field, as a result of their SEAP participation.

	Apprentices reported large or extreme gains in a variety of STEM competencies as well, including carrying out procedures for an experiment and recording data accurately; designing procedures for an experiment appropriate for the question to be answered; identifying the limitations of methods and tools used for data collection; defining a problem that can be solved by developing a new or improved object, process, or system; and organizing data in charts or graphs to find patterns and relationships.
SEAP participants reported gains in 21st Century Skills.	Apprentices reported gains in their 21st century skills as a result of participating in SEAP. In particular, the majority of apprentices reported large or extreme gains in areas such as their ability to make changes when things do not go as planned, viewing failure as an opportunity to learn, learning to work independently, and communicating effectively with others.
SEAP participants reported increased confidence and identity in STEM.	Apprentices reported gains in their confidence and STEM identity, including large or extreme gains in areas such as a sense of accomplishing something in STEM, confidence to try out new ideas or procedures on their own in a STEM project, and deciding on a path to pursue a STEM career.
SEAP participants reported increased interest in future STEM engagement.	Apprentices reported that after participating in SEAP they were more likely to engage in STEM activities outside of school. A majority of apprentices indicated that they were more likely to engage in activities such as working on a STEM project or experiment in a university of professional setting, mentor or teach other students about STEM, and talk with friends and family about STEM.
SEAP participants reported aspiring to advanced degrees and STEM careers with little overall change in education or career aspirations after participating in the program.	Most apprentices indicated wishing to pursue an advanced degree both before and after SEAP, although somewhat more students expressed interest in a degree in a medical field after SEAP participation.
	Most apprentices expressed interest in STEM-related careers both before and after participating in SEAP.
SEAP participants show interest in future AEOP opportunities.	A majority of apprentices indicated being "very much" interested in participating in SEAP again (67%) and in CQL (51%). Another 41% were very interested in SMART, and about a quarter of participants expressed a high level of interest in both URAP and the GEMS Near Peer Mentor Program.

Recommendations

Evaluation findings indicate that FY15 was a successful year overall for the SEAP program. Notable successes for the year include an increase in the percentage of female participants over FY14, evidence of increased use of the ASEE and AEOP websites, and evidence of a growing AEOP pipeline with 32% of SEAP apprentices reporting that they were alumnae of GEMS, and 82% of apprentices indicating that they are familiar with CQL. Apprentices and mentors continue to report high levels of satisfaction with the program and with mentor-apprentice relationships. Both groups likewise report strong apprentice gains in STEM knowledge and competencies as a result of the SEAP experience.

While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY16 and beyond:

AEOP Priority: Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base

1. The AEOP goal of attracting students from groups historically underrepresented and underserved in STEM has been met with limited success in SEAP. Most apprentices reported learning about SEAP through personal connections, suggesting that the pool of SEAP applicants has not broadened considerably over previous years. This is borne out by enrollment statistics showing little increase in the numbers of students identifying as Black or African American and Hispanic or Latino. The lack of growth in SEAP apprentices from groups historically underrepresented and underserved groups is influenced by various factors including the recruitment and selection process and the marketing of SEAP to target groups. The program may want to consider additional/alternate means of broadening the pool of applicants and devising strategies for recruiting and selecting apprentices and mentors to ensure that SEAP includes diverse groups of highly talented participants. For example, the IPA may choose to place a cap on the number of students accepted in the program who are related to lab personnel; once this cap is reached, mentors would then need to select students based upon their qualifications and aptitude rather than relationships.

2. The percentage of applicants who are recruited outside of existing connections with Army Labs needs to be increased. The AEOP wants to ensure the programs (including SEAP) have a fair and competivie selection process. If only 29% of mentors are using the online application to select participants, the selection process can and should be improved substantially. It is recommended that SEAP mentors utilize the online application as the primary means of selecting participants to insure the selection process is fair and competitive in the future.

AEOP Priority: Support and empower educators with unique Army research and technology resources

1. There is a continued need for SEAP to grow the number of participating mentors in the program. Even with a reduced number of apprentice applications in FY15 as compared to FY 14 (633 versus 810), there is substantial unmet need in terms of mentor capacity with only 92 students (15% of applicants) being placed. In order to expand the program beyond its current size, the program will need to actively recruit additional Army S&Es to serve as mentors. These recruiting efforts may focus on communicating the value of the AEOP pipeline to potential mentors by highlighting success stories of apprentices who proceeded through SEAP into other AEOP programs and into successful STEM careers. It may be necessary to examine the procedures and resources used to recruit SEAP mentors and identify factors that motivate and discourage Army S&Es from assuming this role.

AEOP Priority: Develop and implement a cohesive, coordinated and sustainable STEM education outreach infrastructure across the Army

1. The effectiveness of SEAP program administration continues to be a concern. Although the level of satisfaction with administrative tasks was higher in FY15 than in FY14, apprentice and mentor responses indicate that there is yet room for improvement. While apprentices and mentors were positive overall about their SEAP experiences, concern was expressed regarding in-processing procedures such as receiving computer access and communication between SEAP organizers and apprentices. Additionally, some apprentices reported finding the application process confusing and identified this as an area for potential improvement. As the Academy of Applied Science assumes the administration of SEAP, it should be mindful of these issues and leverage its past experience with administering apprenticeship programs to streamline processes and improve communication with apprentices. It is recommended that AAS implement separate SEAP/CQL applications for each lab.

2. There is continued room for improvement in marketing of other AEOPs within the SEAP program. As a starting point for SEAP there could be much more effort in promoting other AEOP programs (e.g. welcome packet with information on applicable AEOP programs). Further, to create a robust pipeline of AEOP programs in which students progress from other AEOPs into SEAP and beyond, the program may want to consider innovative ways to work with other AEOPs to create a more seamless continuum of programs. Given the FY15 objective of encouraging more GEMS alumni to participate in SEAP, program administrators may with to work closely with the GEMS program to devise ways of disseminating SEAP information to GEMS participants and alumni. It is notable that 50% of mentors reported explicitly discussing CQL with their apprentices. At the same time, however, less than half discussed SMART (38%) and GEMS (33%), and only 9% discussed GEMS Near Peer Mentors with their apprentices. Since mentors provide much of the information apprentices receive during SEAP, efforts should be made to ensure that mentors are informed about the range of AEOPs. Other means of educating apprentices about AEOPs should be combined with mentor information, especially given the very real consideration of mentor time constraints in working with apprentices. This could include incorporating AEOP information into orientation materials and alumni communications. Given the limited use of AEOP website, print materials, and social media, the program should consider how these materials could be more effectively utilized to provide students with targeted program information.

3. The SEAP programs' participation in the overall AEOP evaluation has been less than desired. The continued low response rates for both apprentice and mentor questionnaires (50% and 21%) raise questions about the representativeness of the results. It is recommended that SEAP/AAS continue to emphasize the importance of these evaluations with individual program sites and communicating expectations for evaluation activities to take place on-site during the program. Finally, there is a need for increased Army leadership support for evaluation participation at the Army labs.

Introduction

The Army Educational Outreach Program (AEOP) vision is to develop a diverse, agile, and highly competent STEM talent pool. AEOP seeks to fulfill this mission by providing students and teachers nationwide 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. AEOP provides this portfolio of programs via a consortium, formed by the Army Educational Outreach Program Cooperative Agreement (AEOP CA), that engages non-profit, industry, and academic partners with aligned interests. The consortium provides 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.

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.

This report documents the evaluation of one of the AEOP elements, the Science & Engineering Apprentice Program (SEAP). In FY15, SEAP was managed by the American Society for Engineering Education (ASEE). The Academy of Applied Sciences will assume this role for the FY16 year. The evaluation study was performed by Purdue University in cooperation with Battelle, the Lead Organization (LO) in the AEOP CA consortium. Data analyses and reports were prepared using data collected by the former LO, Virginia Tech (VT).

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 (Army S&Es) for an eight-week summer apprenticeship at an Army research facility.). It should be noted that, while the objective is to pair each apprentice with an Army S&E, in some cases other adults employees of SEAP sites served as mentors in FY15. The use of the term "mentor" throughout this report will therefore refer to the Army S&E or other adult working directly with student apprentices. This direct apprentice-mentor relationship provides apprentices with 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 experiences, apprentices are exposed to the real world of research, experience 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 2015, 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 10 Army research laboratories receiving applications (in 2014, apprenticeships were completed at 9 of 14 sites receiving applications). The number of enrolled participants was the same as in 2014 although there was a 19% increase in the number of applicants from 2014 to 2015 (810 in 2014 vs. 1198 in 2014).

Table 1. 2015 SEAP Site Applicant and Enrollment Numbers			
2015 SEAP Site	**No. of Applicants**	**No. of Enrolled Participants**	**Placement Rate**
ALABAMA – U.S. Army Aviation & Missile Research, Development & Engineering Center (AMRDEC) - Redstone, AL	143	13	12.59%
ILLINOIS – U.S. Army Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL) - Champaign, IL	46	8	17.39%
MARYLAND – U.S. Army Research Laboratory (ARL) - Aberdeen Proving Ground, MD	140	8	5.71%
MARYLAND – U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) – Aberdeen Proving Ground/Edgewood, MD	131	10	7.63%
MARYLAND – U.S. Army Research Laboratory (ARL) – Adelphi, MD	159	12	7.55%
MARYLAND – U.S. Army Center for Environmental Health Research (USACEHR) – Fort Detrick, MD	95	2	2.11%
MARYLAND – U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) – Fort Detrick, MD	142	23	16.20%
MARYLAND – U.S. Army Medical Research and Materiel Command – Walter Reed Army Institute of Research (WRAIR) – Silver Spring, MD	243	14	5.76%
MISSISSIPPI – U.S. Army Engineer Research & Development Center (ERDC) – Vicksburg, MS*	29	0	0.00%
VIRGINIA – U.S. Army Engineer Research & Development Center – Geospatial Research Laboratory (ERDC-GRL) – Alexandria, VA	70	2	2.86%
TOTAL	1198	92	7.68%

*There have been no SEAP participants enrolled at the Mississippi site due to lack of mentors (communication with AAS IPA – April, 2016).

The total cost of the 2015 SEAP program was $325,223. This cost includes administrative costs of $52,805 and $272,418 for participant stipends. The average cost per participant was $3,535. Table 2 summarizes these and other 2014 SEAP program costs.

Table 2. 2015 SEAP Program Costs	
2015 SEAP - Cost Per Participant	
Total Student Participants	92
Total Program Cost	$325,223
Cost Per Participant	**$3,535**
2015 SEAP - Cost Breakdown Per Participant	
Average Administrative Cost to ASEE	$574
Average Participant Stipend	$2,961
Cost Per Participant	**$**3,535

Evidence-Based Program Change

Based on recommendations from the FY13 and FY14 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 FY15 administration of the SEAP program in light of the key AEOP priorities, the FY14 SEAP evaluation study, and site visits conducted by ASEE and the LO.

I. **Disseminate information about the SEAP program to a diverse audience.**
   a. Email blasts to 4,000+ teachers, guidance counselors, and principals in areas nearby participating SEAP labs.
   b. Mailed promotional materials (AEOP brochures, rack cards, etc.) when requested by teachers.
   c. Outreach Efforts included the following events:
      i. National Summer Learning Association Conference
      ii. 2015 ASEE Annual Conference
      iii. School Visit to Thomas Jefferson Science and Tech High School in Alexandria, VA
   d. Wrote 2015 Timeline for GEMS/SEAP/CQL.
   e. ASEE's Help-Desk team received 200+ phone calls, 500+ emails, and responded to each request within 72 hours of contact.
   f. Assisted with development of SEAP application developed by Virginia Tech.
   g. ASEE fielded data requests from Virginia Tech's Evaluation team by collecting the numbers of applicants, participants, and acceptance rates for the FY14 SEAP program.

II. **Encourage more participants in the GEMS program to participate in SEAP.**

a. Ensured that ASEE assists LPCs with implementation of SEAP program.

b. Promote and expand partnerships with LPCs.

III. **Increase the number of SEAP paricipants who report being provided information about other AEOP opportunities, in addition to increasing both the participants and mentors awareness of other AEOP programs.**

a. Email blasts to 4,000+ teachers, guidance counselors, and principals in areas nearby participating SEAP labs.

b. Mailed promotional materials (AEOP brochures, rack cards, etc.) when requested by teachers.

c. Outreach Efforts included the following events:

   i. National Summer Learning Association Conference

   ii. 2015 ASEE Annual Conference

   iii. School Visit to Thomas Jefferson Science and Tech High School in Alexandria, VA

d. Wrote 2015 Timeline for GEMS/SEAP/CQL.

e. ASEE's Help-Desk team received 200+ phone calls, 500+ emails, and responded to each request within 72 hours of contact.

f. Assisted with development of SEAP application developed by Virginia Tech.

g. ASEE fielded data requests from Virginia Tech's Evaluation team by collecting the numbers of applicants, participants, and acceptance rates for the FY14 SEAP program.

FY15 Evaluation At-A-Glance

Purdue University, in collaboration with ASEE and using data collected by Virginia Tech, 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 • 116 Army S&Es and other adults 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 and other adult mentors 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, mentors, 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 program	• 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, 2 interviews with apprentices, and an annual program report submitted by ASEE. Tables 3-6 outline the information collected in apprentice and mentor questionnaires and interviews, as well as the program report that is relevant to this evaluation report.

Table 3. 2015 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. 2015 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. 2015 Apprentice Interviews	
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. 2015 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 data summaries are provided in Appendix B (apprentice) and Appendix C (mentor). The apprentice interview protocol is provided in Appendix D ; and apprentice and mentor questionnaire instruments are located in Appendix E and Appendix F, respectively. Major trends in data and analyses are reported herein.

Study Sample

Apprentices representing 8 of the 9 SEAP sites responded to the questionnaire, as did mentors from 4 of the 9 sites. Table 7 shows the number of apprentice and mentor respondents by site.

Table 7. 2015 SEAP Site Survey Respondent Numbers

2015 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)	13	12	15	9
US Army Center for Environmental Health Research at Fort Detrick (USACEHR)	2	2	3	0
US Army Medical Research Institute of Chemical Defense (USAMRICD)	10	4	18	0
US Army Medical Research Institute for Infectious Diseases at Fort Detrick (USAMRIID)	23	11	22	8
US Army Research Laboratory – Aberdeen Proving Ground (ARL-APG)	8	0	6	0
US Army Research Laboratory – Adelphi (ARL-A)	12	3	19	0
Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL)	8	5	22	5
Engineer Research & Development Center – Geospacial Research Laboratory (ERDC-GRL)	2	1	2	2
Walter Reed Army Institute of Research (WRAIR)	14	1	9	0
TOTAL	**92**	**39**[†]	**116**	**24**

[†]9 apprentice survey respondents did not report their sites.

Table 8 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 FY15 is somewhat higher than that of FY14 (21% and 18% respectively). However, the apprentice response rate is lower than the FY14 response rate (64% in 2014).

Table 8. 2015 SEAP Questionnaire Participation

Participant Group	Respondents (Sample)	Total Participants (Population)	Participation Rate	Margin of Error @ 95% Confidence[2]
Apprentices	48	97	49.5%	±10.1%
Mentors	24	116	20.7%	±17.9%

Two phone interviews were conducted with apprentice participants. Interviews 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

SEAP participant demographic information is summarized in Tables 9 and 10. SEAP experienced limited success in attracting female participants as 54% of all apprentice participants were males and 45% females. More males (64%) than females (36%) completed the FY15 questionnaire. This represents a decline in female questionnaire respondents since, in 2014, 51% of respondents were females and 46% males. SEAP has also had limited success attracting students from racial/ethnic groups historically underserved and underrepresented in STEM. While 47% of all apprentice participants identified themselves as White and 27% as Asian, 14% of apprentices identified themselves with the Black or African American racial/ethnic category and only 2% as Hispanic or Latino. These results are mirrored in the demographics of questionnaire respondents (51% White, 18% Asian, 3% Hispanic or Latino) although 20% of questionnaire respondents identified with the Black or African American racial/ethnic category. The racial/ethnic demographics for 2015 are similar to those reported for all enrolled apprentices in 2014 (43% White, 27% Asian, 13% Black or African American, and 1% Hispanic or Latino).

[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.

Several apprentices were 11th graders (41%); about a third were 12th graders (33%) and the remaining either 9th (5%) or 10th (21% graders. Only two respondents (5%) reported qualifying for free or reduced-price lunch (FRL)—a common indicator of low-income status.

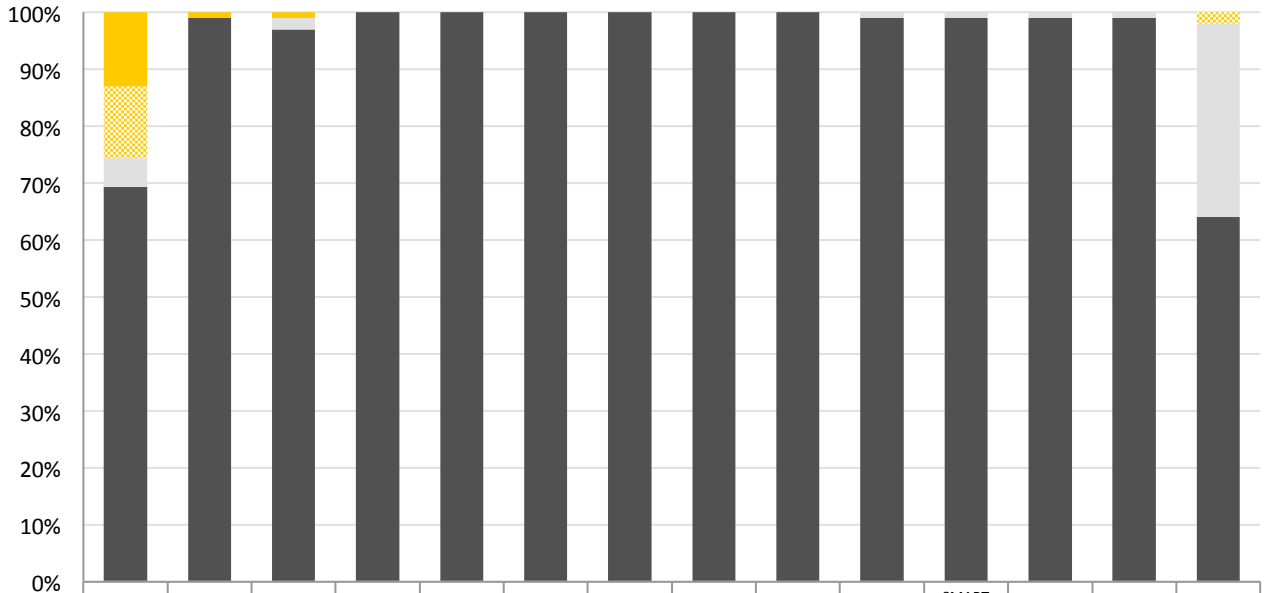
Table 9. 2015 SEAP Apprentice Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n =39)		
Female	14	36%
Male	25	64%
Choose not to report	0	0%
Respondent Race/Ethnicity (n =39)		
Hispanic or Latino	1	3%
Asian	7	18%
Black or African American	8	20%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	20	51%
Choose not to report	2	5%
Other race or ethnicity, (specify):	1	3%
Respondent Grade Level (n =39)		
9th	2	5%
10th	8	21%
11th	16	41%
12th	13	33%
Choose not to report	0	0%
Respondent Eligible for Free/Reduced-Price Lunch (n = 40)		
Yes	2	5%
No	35	90%
Choose not to report	3	5%

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

Table 10. 2015 SEAP Apprentice Respondent School Information		
Demographic Category	**Questionnaire Respondents**	
Respondent School Location (n = 87)		
Department of Defense	1	1%
Home School	1	1%
Suburban	16	18%
Rural (country)	52	60%
Urban (city)	17	20%

Apprentices reported only limited past participation in AEOP programs. When asked how many times they participated in AEOP programs, the vast majority had never participated in any but GEMS and SEAP. It is notable, however, that 32% of SEAP apprentices reported in participating in GEMS at least once, and 26% participated two or more times, suggesting that GEMS participation had a favorable influence on students' decisions to participate in SEAP.

Chart 1: Apprentice Participation in AEOP Programs (n = 87)



	GEMS	WPBDC	Camp Invention	URAP	CQL	JSHS	JSS	REAP	UNITE	HSAP	SMART College Scholarship	eCYBERMISSION	GEMS Near Peers	SEAP
Three or more times	13%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Twice	13%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
Once	5%	0%	2%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	34%
Never	69%	99%	97%	100%	100%	100%	100%	100%	100%	99%	99%	99%	98%	64%

Note: GEMS = Gains in the Education of Mathematics and Science; WPBDC = West Point Bridge Design Contest; URAP = Undergraduate Research Apprenticeship Program; CQL = College Qualified Leaders; JSHS = Junior Science and Humanities Symposium; JSS = Junior Solar Sprint; REAP = Research & Engineering Apprenticeship Program; HSAP = High School Apprenticeship Program;SMART = Science, Mathematics, and Research for Transformation.

Mentor Demographics

The 2015 mentor demographic information is summarized in Table 11. Because of the nature of the SEAP program, nearly all mentors were scientists, engineers, or mathematics professionals (83%), and all were research mentors as compared to research team members.

Table 11. 2015 SEAP Mentor Respondent Profile		
Category	**Questionnaire Respondents**	
Respondent Occupation (n = 23)		
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	1	4%
Scientist, Engineer, or Mathematics professional	19	83%
Other, (specify) †	3	13%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	1	4%
Respondent Role in SEAP (n = 24)		
Research Mentor	24	100%

†**Other = Research Architect; Product Quality Manager; Branch Chief**

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 AEOPs to increase and diversify the future pool of talent capable of contributing to the nation's scientific and technological 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

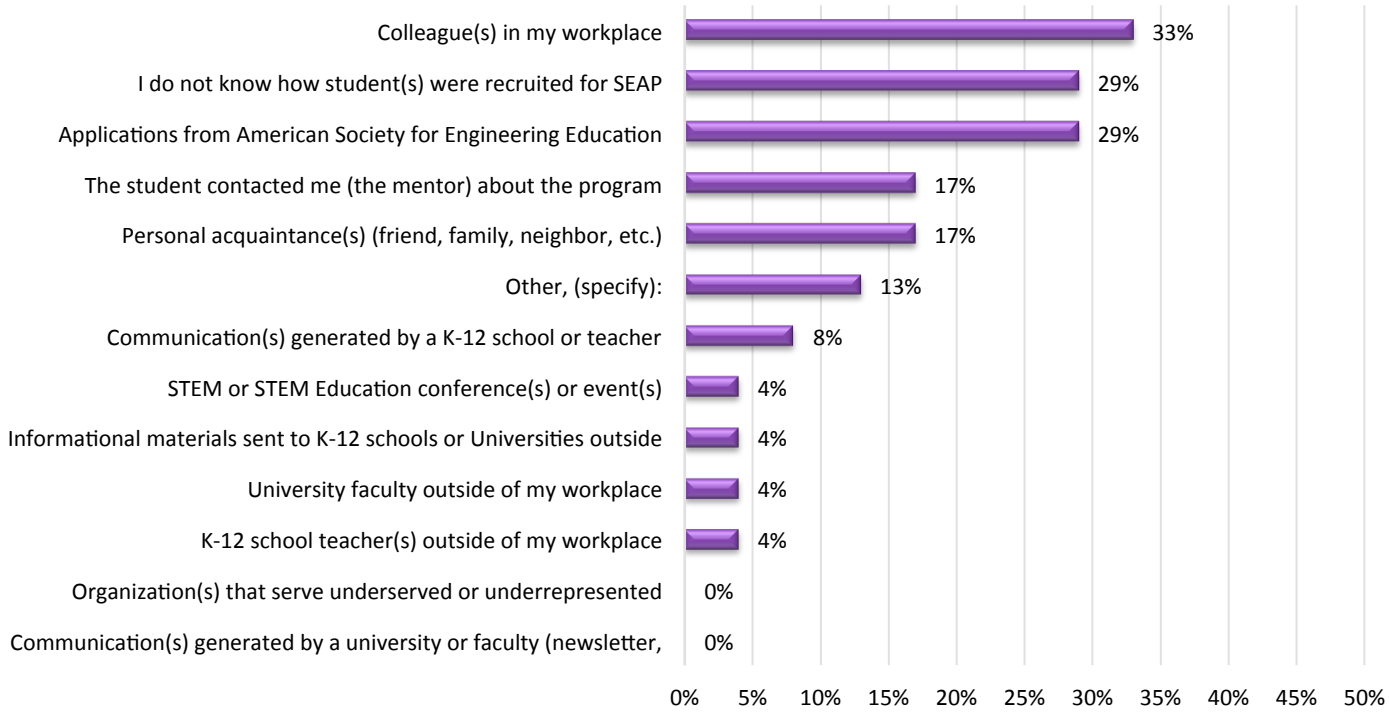
According to the annual program report submitted by ASEE, a number of strategies were used to disseminate information about the SEAP program to a diverse audience:

- Email blasts to 4,000+ teachers, guidance counselors, and principals in areas nearby participating SEAP labs.

- Mailed promotional materials (AEOP brochures, rack cards, etc.) when requested by teachers.
- Outreach Efforts included the following events:
  - National Summer Learning Association Conference
  -2015 ASEE Annual Conference
  -School Visit to Thomas Jefferson Science and Tech High School in Alexandria, VA
- Wrote 2015 Timeline for GEMS/SEAP/CQL.
- ASEE's Help-Desk team received 200+ phone calls, 500+ emails, and responded to each request within 72 hours of contact.
- Assisted with development of SEAP application developed by Virginia Tech.

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 (33%), personal acquaintances (17%), and personal contact from the student (17%). Over a quarter of mentors (29%) indicated using the applications from ASEE for recruitment while another 29% reported that they had no knowledge of how their apprentices were recruited.

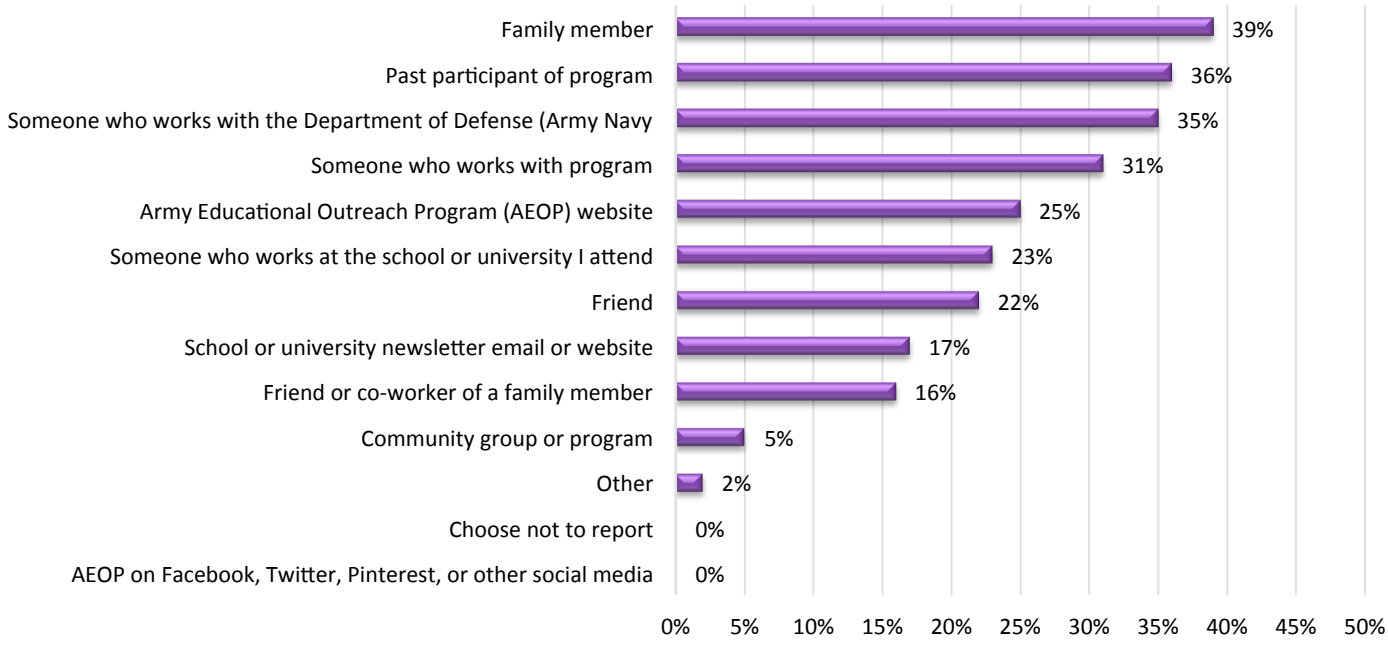
Chart 2: Mentor Reports of Recruitment Strategies (n = 24)



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 a family member (39%). A quarter of respondents indicated learning about SEAP from the AEOP website. Over a third (36%) reported being a past participant of SEAP. Other ways students reported hearing about SEAP included personal acquaintances of some form such as a someone who works at the Department of Defense (35%), someone who works with the SEAP program (31%), someone who works at the apprentice's school or university (23%), a friend (22%), or a friend or coworker of a family member (16%). These findings align with responses of mentors, indicating that most apprentices are recruited via personal connections, although the AEOP website was a source of information for many students (25%).

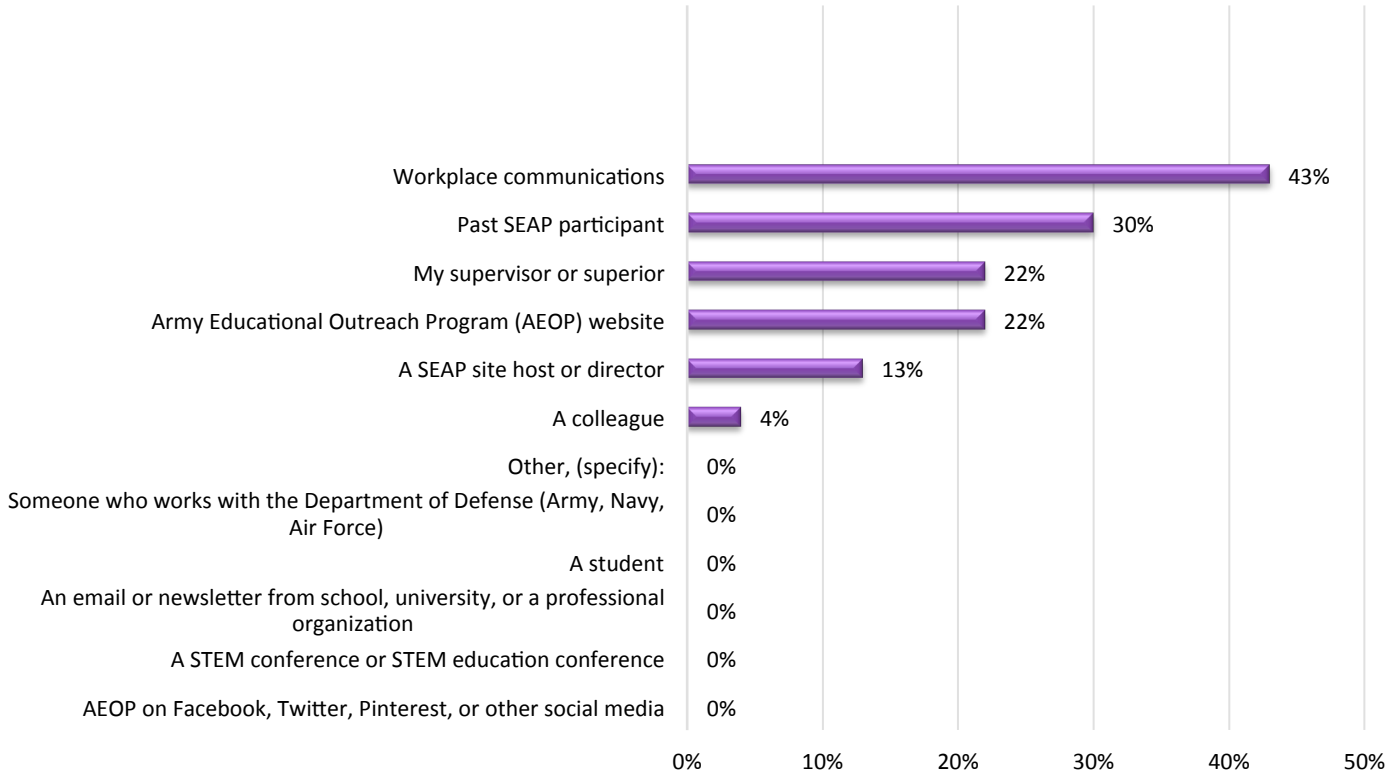
As in 2014, personal connections were the most common means of recruiting SEAP apprentices in 2015, a phenomenon which may have implications for the program's ability to attract a diverse pool of applicants. As a result, the program may want to consider alternative methods of recruitment that encourage a more diverse applicant pool. It is important that selection of apprentices are conducted competitively at host sites (i.e., conducting a selection through panel, masking names, etc.). Further, the AEOP website as a source of recruitment (how apprentices heard of SEAP) increased from 0% in FY14 to 25% in FY15 – indicating more potential participants are utilizing the AEOP website. It is recommended that the SEAP sites utilize the website as the primary means of selection of apprentices to insure the competitive application process.

Chart 3: How Apprentices Learned about SEAP (n = 48)



Mentors were also asked how they learned about SEAP (see Chart 4). Nearly three-quarters of responding mentors learned about SEAP through workplace communications (43%), a past SEAP participant (30%). A supervisor or superior was a source of information for 22% of mentor respondents, and another 22% heard about SEAP from the AEOP website, while 13% heard about the program from a SEAP site host or director. Interestingly, in 2014 no mentor respondents reported hearing about the program from the AEOP website, so the increase to 22% of respondents in 2015 may indicate that mentors are receiving more contextual information about AEOPs..

Chart 4: How Mentors Learned about SEAP (n = 24)



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. Many mentors have either never heard of, or never participated in, most of the AEOP programs. For example, 75% reported never hearing about or never participating in GEMS, while 76% had never heard about or never participated in CQL. It should be noted, however, that this level of awareness and participation represents an improvement over the mentor reports from 2014 when 98% indicated never hearing about or participating in CQL. Many mentors reported participating in SEAP multiple times, with 50% participating at least

twice in the past. These results indicate that, while mentors have not participated in other AEOPs to a large extent, that there may be a growing awareness of other AEOP programs.

Factors Motivating Apprentice Participation

The questionnaires and interviews 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 12, the opportunity to earn stipends or awards for doing STEM was a key motivator, with 67% of respondents indicating that this motivated them "very much" to participate in SEAP. Other motivators included exploring a unique work environment (35%), the SEAP mentors (27%), and the opportunity to learn in ways not possible in school (27%).

Table 12. Factors Motivating Apprentices "Very Much" to Participate in SEAP (n = 56-57)

Item	Questionnaire Respondents
Earning stipends or awards for doing STEM	67%
Exploring a unique work environment	35%
The SEAP mentor(s)	27%
Learning in ways that are not possible in school	27%
Having fun	18%
Building college application or resume?	18%
Teacher or professor encouragement	16%
An academic requirement or school grade	11%
Figuring out education or career goals	11%
Desire to expand laboratory or research skills	7%
Choose not to report	6%
Interest in STEM careers with the Army	5%
Serving the community or country	4%
Networking opportunities	2%
Opportunity to do something with friends	1%
Recommendations of past participants	1%
Interest in science technology engineering or mathematics (STEM)	1%
Seeing how school learning applies to real life	0%
Opportunity to use advanced laboratory technology	0%
Desire to learn something new or interesting	0%

The two interview participants echoed these findings. For example, when asked about their reasons for participating, apprentices answered:

Gave me something to do during this summer. I thought doing this internship would be kind of fun…And learn about engineering. (SEAP Apprentice)

I wanted to kind of explore new job options for when I get into the career field, so I could know which job options I would like and which ones I wouldn't. (SEAP Apprentice)

The SEAP Experience

Apprentices were asked to respond to items asking about the nature of their SEAP experience and how that experience compared to STEM learning opportunities in school. As can be seen in Chart 5, well over half of responding apprentices indicated that they were assigned a project by their mentor (69%). The remaining apprentices reported working with their mentor and members of a research team to design a project (10%), working with their mentor (8%), choosing from projects suggested by their mentor (6%), or designing the entire project on their own (4%). Of the responding apprentices, 2% reported that they did not have a project (which may be a survey error – as all SEAP apprentices are actively working on projects).

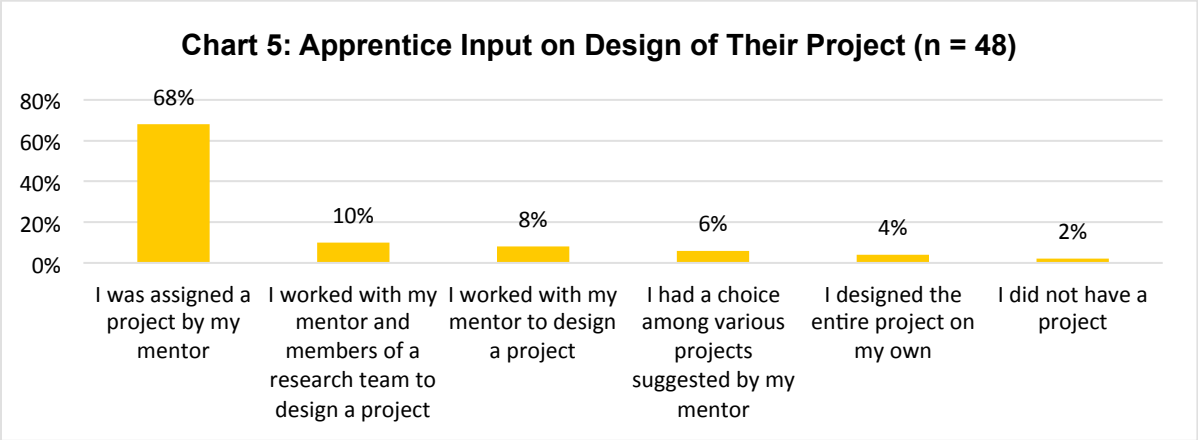
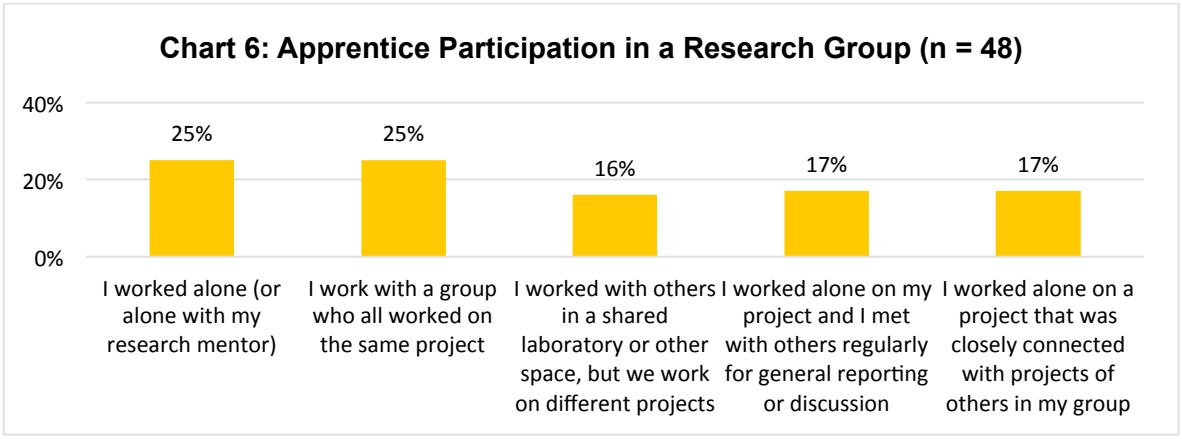
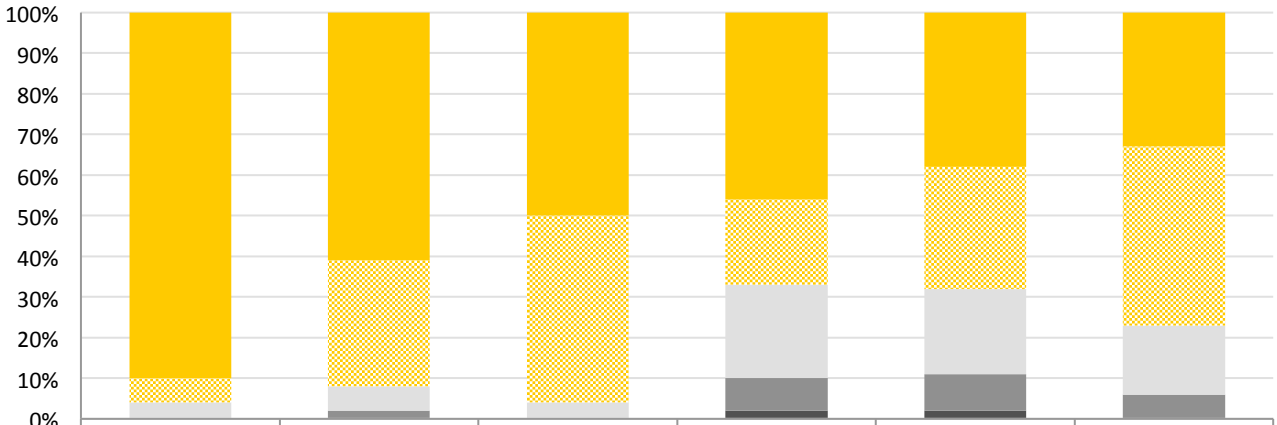


Chart 6 reports apprentice responses about their participation in research groups. A quarter of apprentices reported working alone or alone with their research mentors while another quarter worked with a group who all worked on the same project. The remaining 50% of mentors split their responses evenly between working in a shared laboratory, but on different project, working alone but meeting regularly with others for general reporting or discussion, and working alone on a project closely connected to other group members' projects



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 scientists or engineers (96%), learning about new applying STEM knowledge to real life situations (91%), learning about STEM topics new to them (96%), communicating with other students about STEM (77%), learning about different careers that use STEM (68%), and learning about new discoveries in STEM (77%) on most days or every day.

Chart 7: Nature of Apprentice Activities in SEAP (n = 48)



	Interact with scientists or engineers	Apply STEM learning to real-life situations	Learn about STEM topics that are new to you	Communicate with other students about STEM	Learn about different careers that use STEM	Learn about new discoveries in STEM
Every day	90%	61%	50%	46%	38%	33%
Most days	6%	31%	46%	21%	30%	44%
A few times	4%	6%	4%	23%	21%	17%
At least once	0%	2%	0%	8%	9%	6%
Not at all	0%	0%	0%	2%	2%	0%

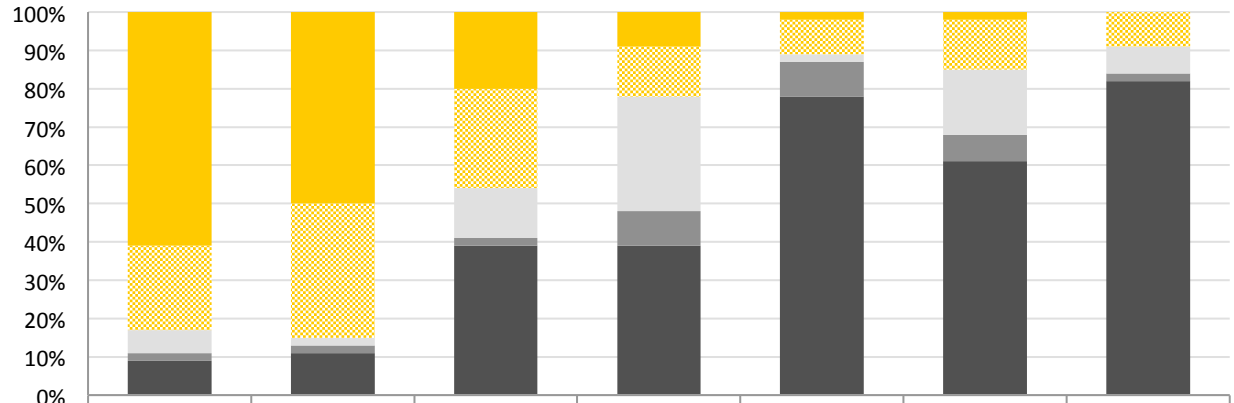
Because increasing the number of those who purse STEM careers is one goal of the SEAP program, the questionnaire also asked how many jobs/careers in STEM in general, and STEM jobs/careers in the DoD more specifically, apprentices learned about during their experience. As can be seen in Table 13, all responding apprentices reported learning about at least one STEM job/career although 8% reported learning about no DoD STEM jobs/careers. The majority of students, however, (59%) reported learning about four or more STEM jobs/careers. Similarly, 58% reported learning about four or more DoD STEM jobs/careers, with 87% reporting learning about two or more.

Table 13. Number of STEM Jobs/Careers Apprentices Learned about During SEAP (n = 48)

	STEM Jobs/Careers	DoD STEM Jobs/Careers
None	0%	8%
1	6%	4%
2	13%	8%
3	23%	21%
4	13%	23%
5 or more	46%	35%

Apprentices were also asked which resources impacted their awareness of DoD STEM careers. Participation in SEAP (81%), their mentors (85%), and invited speakers or career events (46%) were most often reported as being somewhat or very much responsible for this impact (see Chart 8). On the other hand, 82% of respondents indicated that they did not experience the It Starts Here! Magazine while 78% did not experience AEOP on social media, and 61% did not experience the AEOP brochure. It is recommended that the SEAP program consider implementing a welcome packet for apprentices that could include AEOP marketing materials (e.g. brochure, social media card).

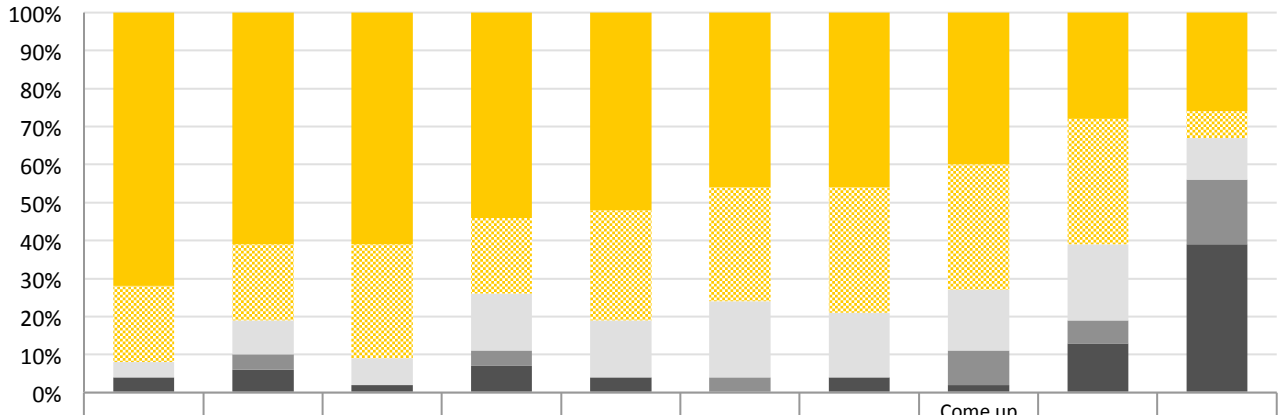
Chart 8: Impact of Resources on Apprentice Awareness of DoD STEM Careers (n = 45-46)



	Participation in SEAP	My SEAP mentor(s)	Invited speakers or "career" events during SEAP	AEOP website	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP brochure	It Starts Here! Magazine
Very Much	61%	50%	20%	9%	2%	2%	0%
Somewhat	22%	35%	26%	13%	9%	13%	9%
A little	6%	2%	13%	30%	2%	17%	7%
Not at all	2%	2%	2%	9%	9%	7%	2%
Did not experience	9%	11%	39%	39%	78%	61%	82%

Apprentices were also asked how often they engaged in various STEM practices during their SEAP experience. Apprentices reported consistently experiencing STEM practices (see Chart 9). For example, 92% of apprentices participated in hands-on STEM activities and 91% analyzed data or information on most or every day of their SEAP experiences. About three-quarters of apprentices reported opportunities every day or most days to use laboratory procedures or tools (82%), work as part of a team (74%), carry out investigations (80%), draw conclusions from investigations (79%), identify questions or problems to investigate (76%), and come up with creative explanations or solutions (73%). Mentors responses to questions regarding how often their apprentices engaged in these STEM activities were similar to apprentice responses.

Chart 9: Apprentice Engagement in STEM Practices in SEAP (n = 47-48)



	Participate in hands-on STEM activities	Use laboratory procedures and tools	Analyze data or information	Work as part of a team	Carry out an investigation	Identify questions or problems to investigate	Draw conclusions from an investigation	Come up with creative explanations or solutions	Design an investigation	Build or make a computer model
Every day	72%	61%	61%	54%	52%	46%	46%	40%	28%	26%
Most days	20%	20%	30%	20%	29%	30%	33%	33%	33%	7%
A few times	4%	9%	7%	15%	15%	20%	17%	16%	20%	11%
At least once	0%	4%	0%	4%	0%	4%	0%	9%	6%	17%
Not at all	4%	6%	2%	7%	4%	0%	4%	2%	13%	39%

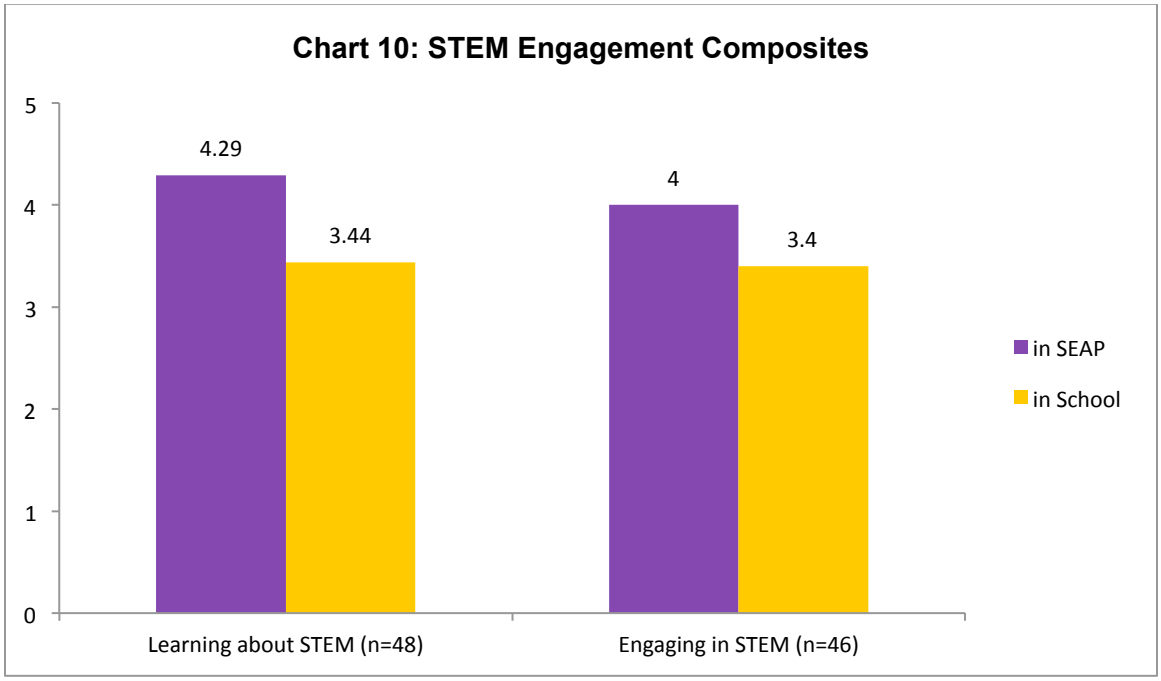
A composite score[3] was calculated for each of these two sets of items, the first titled "Learning about STEM in SEAP,"[4] and the second "Engaging in STEM Practices in SEAP."[5] Response categories were converted to a scale of 1 = "Not at all" to 5 = "Every day" and the average across all items in the scale was calculated. The composite scores were used to test 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.

[3] 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.

[4] The Cronbach's alpha reliability for these 6 items was 0.725.

[5] The Cronbach's alpha reliability for these 10 items was 0.741.

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,"[6] and "Engaging in STEM Practices in School"[7] 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 = 1.10 standard deviations for Learning about STEM; a large effect of 1.71 standard deviations for Engaging in STEM practices).[8] These data indicate that SEAP provides participants with more intensive STEM learning experiences than they would typically receive in school.



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, 71% indicated working with 1 apprentice, 24% reported working with 2 apprentices, and 5% with 3 apprentices. Therefore SEAP is meeting and exceeding the required 1:1 mentor to apprentice ratio for the program.

[6] Cronbach's alpha reliability of 0.883.

[7] Cronbach's alpha reliability of 0.894.

[8] Two-tailed independent samples t-tests: Learning about STEM, $t(47) = 6.08$, $p < 0.001$; Engaging in STEM Practices, $t(45) = 5.76$, $p = 0.002$.

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:[9]

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.

Many mentors reported using an array of strategies to help make the learning activities relevant to students (see Table 14). For example, all mentors reported becoming familiar with students' backgrounds and interests at the beginning of the program and giving students real-life problems to investigate or solve. Over three-quarters of mentors selected readings or activities for their students related to the students' backgrounds (79%) and asked students to relate real-life events or activities to topics covered in SEAP (79%). Over half of all mentors also reported helping students become aware of the roles that STEM plays in their everyday lives (71%), encouraged students to suggest new readings, activities or projects (67%), and helped students understand how STEM can help them improve their own communities (58%).

Table 14. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 24)

Item	Questionnaire Respondents
Become familiar with my student(s) background and interests at the beginning of the SEAP experience	100%
Giving students real-life problems to investigate or solve	100%
Selecting readings or activities that relate to students' backgrounds	79%
Asking students to relate real-life events or activities to topics covered in SEAP	79%
Helping students become aware of the role(s) that STEM plays in their everyday lives	71%
Encouraging students to suggest new readings, activities, or projects	67%
Helping students understand how STEM can help them improve their own community	58%

[9] 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.

Mentors reported using strategies to support the diverse needs of students as learners (see Table 15). All responding mentors reported using a variety of teaching and/or mentoring activities to meet the needs of all students. Over three-quarters of mentors reported identifying the different learning styles that students may have at the beginning of the SEAP experience (79%), treating all students the same way, regardless of their backgrounds (79%), and directing students to other individuals or programs for additional support (79%). Many mentors also provided extra readings, activities, or learning support for students who lacked essential knowledge or skills (71%).

Table 15. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 24)	
Item	**Questionnaire Respondents**
Use a variety of teaching and/or mentoring activities to meet the needs of all students	100%
Identify the different learning styles that my student (s) may have at the beginning of the SEAP experience	79%
Interact with students and other personnel the same way regardless of their background	79%
Directing students to other individuals or programs for additional support as needed	79%
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	71%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	42%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	38%

Several mentors also reported using a variety of strategies to support students' development of collaboration and interpersonal skills. The results displayed in Table 16 indicate that 92% of responding mentors had students listen to the ideas of others with an open mind, while 88% had students explain difficult ideas to others, give and receive constructive feedback with others, and work on collaborative activities or projects as a member of a team. Nearly three-quarters of mentors had students exchange ideas with others whose backgrounds or viewpoints differed from their own, and over half had students tell others about their backgrounds and interests (58%) and had students resolve conflicts and reach agreement with their team (58%).

Table 16. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 24)	
Item	**Questionnaire Respondents**
Having my student(s) listen to the ideas of others with an open mind	92%
Having my student(s) explain difficult ideas to others	88%
Having my student(s) give and receive constructive feedback with others	88%

Having students work on collaborative activities or projects as a member of a team	88%
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	74%
Having my student(s) tell other people about their backgrounds and interests	58%
Allowing my student(s) to resolve conflicts and reach agreement within their team	58%

A large majority of mentors reported using strategies used to support student engagement in authentic STEM activities (see Table 17). For example, 92% of responding mentors reported demonstrating laboratory/field techniques, procedures and tools for students; supervising students while they practiced STEM research skills; providing students with constructive feedback to improve their STEM competencies; and allowing students to work independently to improve their self-management abilities. Likewise, most mentors also encouraged students to seek support from other team members (83%), taught or assigned readings about specific STEM subject matter (79%), had students search for and use technical research to support their work (79%), and encouraged students to learn collaboratively (71%).

Table 17. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 24)	
Item	**Questionnaire Respondents**
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	92%
Supervising my student(s) while they practice STEM research skills	92%
Providing my student(s) with constructive feedback to improve their STEM competencies	92%
Allowing students to work independently to improve their self-management abilities	92%
Encouraging students to seek support from other team members	83%
Teaching (or assigning readings) about specific STEM subject matter	79%
Having my student(s) search for and review technical research to support their work	79%
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	71%

The final section of items regarding mentoring strategies focused on supporting students' STEM educational and career pathways (see Table 18). Nearly all (96%) of the responding mentors reported asking students about their educational and career interests. About three-quarters of mentors also indicated providing guidance about educational pathways that would prepare students for a STEM career (83%), helped students with resumes, applications, personal statements, and/or interview preparations (79%), discussed STEM career opportunities in private industry or academia (75%) or with the DoD or other government agencies (74%). Only 46% of mentors reported recommending AEOPs in alignment with student goals, however. Given the goal of having students graduate into other AEOP opportunities, this is an area that may merit attention in the future. Apprentices were presented with a subset of these items and asked to indicate which their mentors used with them during their SEAP experience (see Appendix B). In general, smaller percentages of apprentices than mentors reported that their mentors used these strategies.

Table 18. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 23-24)	
Item	**Questionnaire Respondents**
Asking my student(s) about their educational and/or career goals	96%
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	83%
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	79%
Discussing STEM career opportunities in private industry or academia	75%
Discussing STEM career opportunities within the DoD or other government agencies	74%
Recommending extracurricular programs that align with students' goals	67%
Helping students build a professional network in a STEM field	67%
Recommending student and professional organizations in STEM to my student(s)	50%
Recommending Army Educational Outreach Programs that align with students' goals	46%
Discussing the economic, political, ethical, and/or social context of a STEM career	46%

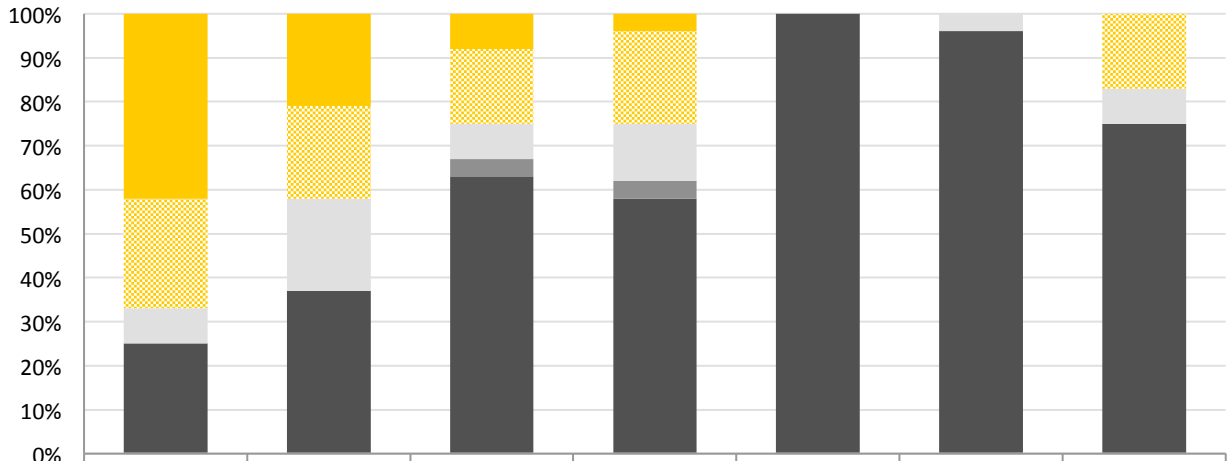
Mentors were asked which of the AEOP programs were explicitly discussed with their apprentices during SEAP. Not surprisingly, the most frequently discussed program was SEAP (81%). As can be seen in Table 19, half of mentors discussed CQL with students and about a third discussed SMART (38%) and GEMS (33%).

Table 19. Mentors Explicitly Discussing AEOPs with Apprentices (n = 21-22)	
Item	**Questionnaire Respondents**
Science & Engineering Apprenticeship Program (SEAP)	82%
College Qualified Leaders (CQL)	50%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	38%
Gains in the Education of Mathematics and Science (GEMS)	33%
I discussed AEOP with my student(s) but did not discuss any specific program	32%
Research & Engineering Apprenticeship Program (REAP)	9%
GEMS Near Peer Mentor Program	9%
High School Apprenticeship Program (HSAP)	5%
Undergraduate Research Apprenticeship Program (URAP)	5%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	5%
UNITE	0%
Junior Science & Humanities Symposium (JSHS)	0%

Various resources were used by mentors in their efforts to expose their apprentices to the different AEOPs. The findings for this question, displayed in Chart 11, indicate that participation in SEAP (42%), program administrators or site coordinators (21%), the AEOP website (4%) and invited speakers or career events (8%) were the only resources perceived as "very much" useful. Materials provided by the AEOP program tended to be less useful, with the majority of mentors indicating they did not experience these resources. For example, no mentors experienced the It Starts Here! Magazine, 96% did not experience AEOP on social media and 75% did not experience the AEOP brochure.

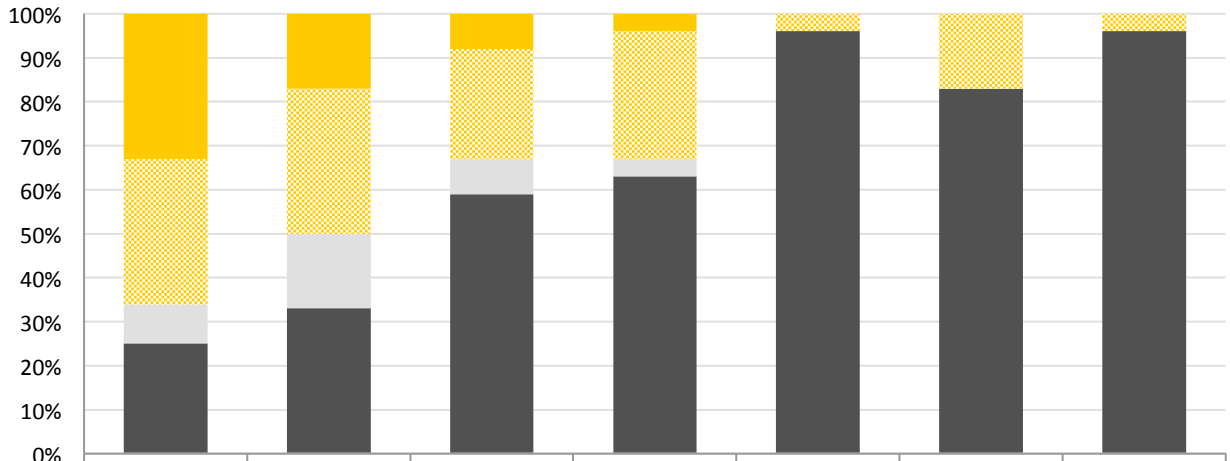
Resources were used by mentors for exposing apprentices to DoD STEM careers (see Chart 12). As with the previous item, mentors were most likely to rate participation in SEAP as useful, with 66% indicating that SEAP participation was at least somewhat useful in this area. Likewise, half of responding mentors responded that program administrators or site coordinators were useful in exposing apprentices to DoD careers. Again, most mentors indicated a lack of experience with the AEOP materials (a range of 83-96%) or the AEOP website (63%).

Chart 11: Usefulness of Resources for Exposing Apprentices to AEOPs (n = 23-24)



	Participation in SEAP	SEAP Program administrator or site coordinator	Invited speakers or "career" events	AEOP website	It Starts Here! Magazine	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP brochure
Very Much	42%	21%	8%	4%	0%	0%	0%
Somewhat	25%	21%	17%	21%	0%	0%	17%
A little	8%	21%	8%	13%	0%	4%	8%
Not at all	0%	0%	4%	4%	0%	0%	0%
Did not experience	25%	37%	63%	58%	100%	96%	75%

Chart 12: Usefulness of Resources for Exposing Apprentices to DoD STEM Careers (n = 24)

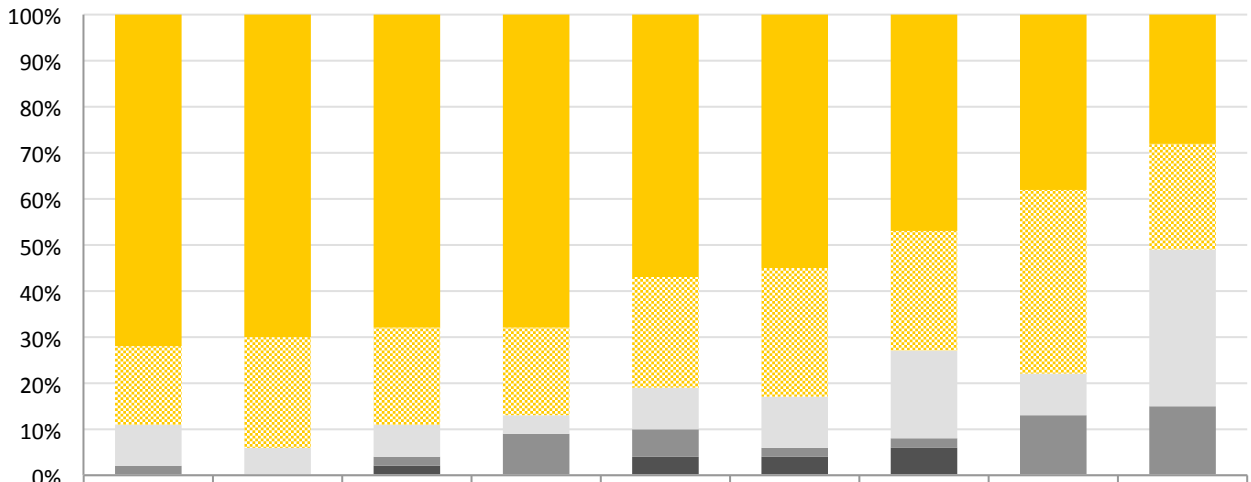


	Participation in SEAP	SEAP Program administrator or site coordinator	Invited speakers or "career" events	AEOP website	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP brochure	It Starts Here! Magazine
Very Much	33%	17%	8%	4%	0%	0%	0%
Somewhat	33%	33%	25%	29%	4%	17%	4%
A little	9%	17%	8%	4%	0%	0%	0%
Not at all	0%	0%	0%	0%	0%	0%	0%
Did not experience	25%	33%	59%	63%	96%	83%	96%

Satisfaction with SEAP

Apprentices and mentors reported their levels of satisfaction 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 teaching or mentoring provided during SEAP, 87% with stipends, 89% with the variety of STEM topics available to them, and 79% with the physical location of SEAP activities. Logistical and administrative issues were not rated as highly as these areas, with more than 10% of apprentices reporting being not at all satisfied with administrative tasks such as in-processing and network access (15%) and applying or registering for the program (13%).

Chart 13: Apprentice Satisfaction with SEAP Program Features (n = 47)



	The physical location(s) of SEAP activities	Teaching or mentoring provided during SEAP activities	The variety of STEM topics available to you in SEAP	Stipends (payment)	Research presentation process	Research abstract preparation requirements	Communicating with your SEAP host site organizers	Applying or registering for the program	Other administrative tasks (in-processing, network access, etc.)
Very Much	72%	70%	68%	68%	57%	55%	47%	38%	28%
Somewhat	17%	24%	21%	19%	24%	28%	26%	40%	23%
A little	9%	6%	7%	4%	9%	11%	19%	9%	34%
Not at all	2%	0%	2%	9%	6%	2%	2%	13%	15%
Did not experience	0%	0%	2%	0%	4%	4%	6%	0%	0%

Apprentices reported about the availability of their mentors. As can be seen in Table 20, 60% of responding apprentices indicated their mentor was always available, and another 34% indicated that their mentors were available about half or more than half of the time. Few apprentices indicated that their mentor was available less than half of the time.

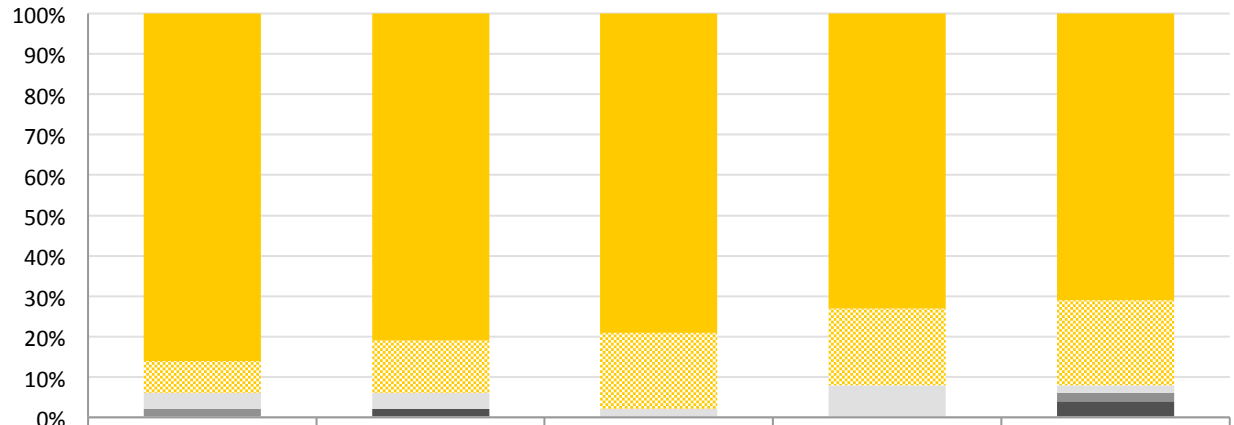
Table 20. Apprentice Reports of Availability of Mentors (n = 48)

Item	Questionnaire Respondents
The mentor was always available	60%
The mentor was available more than half of the time	19%
The mentor was available about half of the time of my project	15%
The mentor was available less than half of the time	6%

Apprentices reported 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, 85% of apprentices indicated "very much" when asked about their

relationship with their mentor, with another 8% indicating they were "somewhat" satisfied. Similarly, 94% were at least somewhat satisfied with their relationship with the group or team and the 98% with the research experience overall. Additionally, 92% reported being at least somewhat satisfied with the time they spent with their mentor and with the time spent doing meaningful research.

Chart 14: Apprentice Satisfaction with Their Experience (n = 48)



	My working relationship with my mentor	My working relationship with the group or team	The research experience overall	The amount of time I spent doing meaningful research	The amount of time I spent with my research mentor
Very Much	86%	81%	79%	73%	71%
Somewhat	8%	13%	19%	19%	21%
A little	4%	4%	2%	8%	2%
Not at all	2%	0%	0%	0%	2%
Did not experience	0%	2%	0%	0%	4%

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 38 apprentices who answered this question, 36 (95%) had something positive to say. For example:

> *I was extremely satisfied with my SEAP experience. It was a lot different than anything I have ever done before, and also one of the most rewarding things I have ever done. While in the program I was able to learn much more about STEM and many scientific procedures…I am very grateful I had the opportunity to learn so much more in such a friendly environment. One of the things that really stood out to me was how kind everyone was, not just my mentor but all the other adults in the lab. I was taught that it was okay to make a mistake, and that science is founded upon making mistakes and learning from them.* (SEAP Apprentice)

I found the program rewarding for the opportunity to partake in engineering activities. Throughout the program, I felt the entirety of the program was truly dedicated to benefit the interns and other participants. (SEAP Apprentice)

I've learned so much from this hands on experience in the labs that I feel confident entering college; participating in this program has definitely given me the upper hand. I was very engaged in the lab experiments, much more than I would have been reading about the procedures in a textbook. (SEAP Apprentice)

Five apprentices (13%) responded with positive comments, but offered some caveats as well. For example:

The SEAP program was such an amazing opportunity. I come from a creative arts background, but was interested in pursuing a career in engineering…All the students that participated in the program were really great and I love that I was a part of it. I do, however, wish that the students were able to pick their own project. I also wish that some of the mentors are reevaluated as mine wasn't that good of a mentor. It was still a great experience. (SEAP Apprentice)

I am quite satisfied with the experience gained from the internship. I was not aware that I was supposed to create my own project, and I do not think that my site mentors were aware of that either. Though I am not upset about this, as I learned a great deal about how professional research projects are carried out, etc., I would have liked to have known of the expectations well in advance. That is why I listed that there needs to be more communication between the site, participants, and AEOP. (SEAP Apprentice)

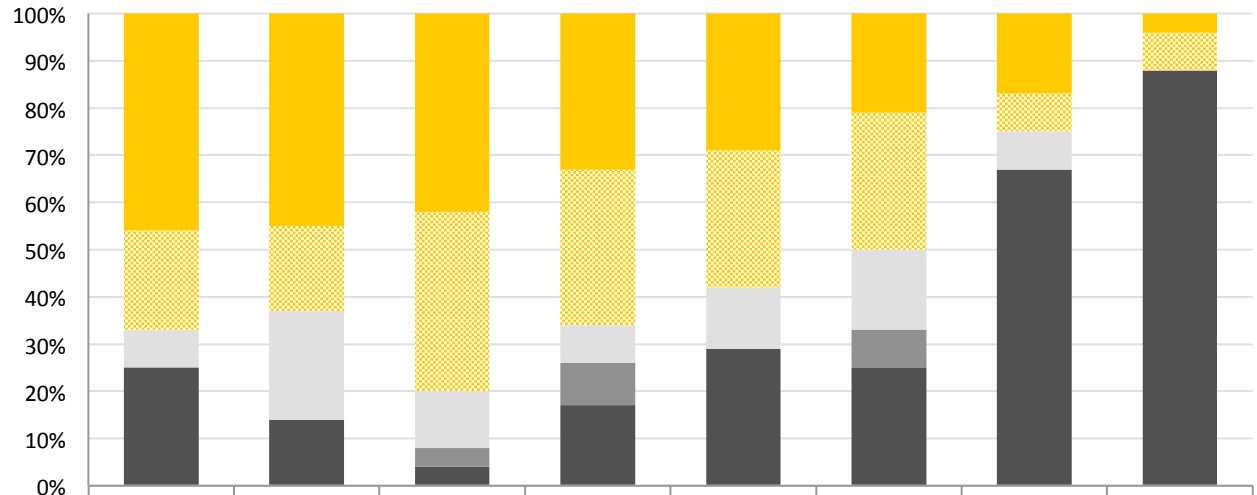
Apprentices were also asked how the SEAP program could be improved. Of the 35 apprentices who responded, 7 (20%) suggested that the stipends be higher and/or paid in a more timely fashion, 6 (17%) suggested that the application process could be improved or streamlined, and 5 (14%) indicated that in-processing could be improved. Other suggestions included evaluating mentors or providing more organization to the mentor-apprentice relationship (4 apprentices, or 11%), providing more opportunities for apprentices to interact with one another (4 apprentices, or 11%), giving apprentices more of a voice in choosing projects (4 apprentices, or 11%), and ensuring that apprentices have opportunities for laboratory or hands-on work (4 apprentices, or 11%).

The majority of mentors also reported being somewhat or very much satisfied with most program components they experienced (see Chart 15). For example 67% were at least somewhat satisfied with support for instruction or mentorship during program activities and 64% with communicating with SEAP organizers. Another 80% reported being

"Overall, this experience has prepared me for school/the real world in ways I never could have imagined."-- SEAP Apprentice

at least somewhat satisfied with the research presentation process and 66% with the research abstract preparation requirements.. Although large proportions of mentors did not experience them, most who did were at least somewhat satisfied with the participation stipends and administrative tasks, although 8% of responding mentors reported being "not at all" satisfied with administrative tasks such as in-processing and network access.

Chart 15: Mentor Satisfaction with SEAP Program Features (n = 22-24)



	Support for instruction or mentorship during program activities	Communicating with SEAP organizers	Research presentation process	Research abstract preparation requirements	Application or registration process	Other administrative tasks (in-processing, network access, etc.)	Stipends (payment)	Communicating with ASEE
Very Much	46%	45%	42%	33%	29%	21%	17%	4%
Somewhat	21%	18%	38%	33%	29%	29%	8%	8%
A little	8%	23%	12%	8%	13%	17%	8%	0%
Not at all	0%	0%	4%	9%	0%	8%	0%	0%
Did not experience	25%	14%	4%	17%	29%	25%	67%	88%

Mentors were also asked to respond to open-ended questionnaire items asking for their opinions about the program. One item asked mentors to identify the three most important ways that they have benefitted from SEAP. A total of 15 mentors responded to this question. All responding mentors noted benefits to apprentices rather than to themselves, although one respondent replied that he/she appreciated the "extra set of hands for the summer" (SEAP mentor). Although several important aspects of the program were listed, the most frequent were opportunities for apprentices to have hands-on/real-life research experiences (7 mentors, or 47%), exposure to STEM careers and the workplace (5 mentors, or 33%), the STEM knowledge apprentices gain during their experience (3 mentors, or 20%), the opportunity for students to present their work (2 mentors, or 13%), and the opportunity to interact with STEM professionals (2 mentors, or 13%).

Mentors were also asked to note three ways in which SEAP should be improved for future participants. The 11 responding mentors offered a variety of suggestions, though none was mentioned by more than three individuals. Suggestions included improving network access for students (3 mentors, or 27%), improving communication between program organizers and students (2 mentors, or 18%), and improving the application process (2 mentors, or 18%). Other suggestions (each made by one mentor) included coaching apprentices on office expectations, providing a longer time for student briefings/presentations, starting earlier in the summer, providing access to the presentation schedule, selecting only scientists and engineers to act as judges, providing feedback to mentors for sharing with students, and shortening the questionnaire.

Mentors were also asked to share their overall satisfaction with their SEAP experience. Of the 17 mentors who responded to this question, 16 provided positive comments such as:

> *I was very pleased with my student and her progress this summer. I think the program is very valuable and even more students should participate as funding for the program allows in the future.* (SEAP Mentor)

> *I am really happy with the candidates that presented themselves in the application process. The student that came to us was very excited to get started and has worked really hard to learn and gain new experiences and knowledge. I have enjoyed having this student and look forward to additional work with her this coming school year.* (SEAP Mentor)

Six of these 16 respondents also identified areas for improvement, including the need for intensive time to bring high school students up to speed on DoD/STEM research. This may be an opportunity for implementing AEOP level activities to expose participants in SEAP and other programs to DoD STEM careers and research. For example:

> *It requires a lot of time to bring a high school student up to speed on any sort of basic research. While I appreciate the value of this, I found myself struggling to be able to keep them fully engaged while also committing to my normal day-to-day work…Perhaps have a daily/weekly activity for all the students to attend could free the mentors up to accomplish some of our needed tasks without having to keep the student busy.* (SEAP Mentor)

Some participants alluded to difficult interactions with the SEAP office. These are indicative of the administrative issues within SEAP that should be addressed and may be remedied with new program leadership.

> *The students were great. I enjoyed my interactions with the SEAP office in person. Due to unprofessionalism between the SEAP office and the students on multiple occasions I was forced to go in person and request the same thing the student requested. All of these interactions were professional between me and the SEAP office but the students did not receive the same treatment or level of respect*. (SEAP Mentor)

In summary, findings from the Actionable Program Evaluation indicate that the program experienced some success in attracting participation of females to participate in SEAP. However, participation of students from race/ethnic groups historically underrepresented and underserved in many STEM fields is an area in which SEAP should target for improvement.

Once in the SEAP program, apprentices are working both independently and collaboratively on research projects. The vast majority of apprentices interact consistently with STEM professionals, have satisfying relationships with their mentors, learn about new STEM topics, apply STEM to real-life situations, analyze data and information. Findings also indicate that apprentices learned about at least one DoD or STEM job/career. The majority of mentors credit SEAP participation, program administrators/site coordinators, and invited speakers with providing this career information. There is some evidence that mentors discuss other AEOPs with apprentices, including CQL, SMART, and GEMS, although mentors' limited awareness of these programs presents an opportunity for growth.

Student apprentices are more engaged in learning about STEM and in STEM practices than they would typically are in school. Nearly all mentors supported this engagement by employing strategies to make 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 and apprentices were less satisfied with administrative aspects of the program than with other aspects, overall, participants were somewhat or very much satisfied with most of the SEAP program components they experienced.

"I love having the students around and seeing their interest in STEM grow. That is the reason I come back year after year as a mentor."-- SEAP Mentor

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.[10] STEM competencies, including foundational knowledge, skills, and abilities in STEM, as well as the confidence to apply them appropriately, are necessary for a STEM-literate citizenry. These STEM competencies are important not only for those pursuing careers in STEM, 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

Chart 16 provides an overview of apprentice reports about their gains in STEM knowledge as a result of the SEAP program. No students reported no gain in any area and a majority reported large or extreme gains in each area. For example, 96% reported large or extreme gains in their knowledge of research conducted in a STEM topic or field, 90% in their knowledge of research processes, ethics and rules for conduct in STEM, and 90% in their knowledge of how scientists and engineers work on real problems in STEM. Another 91% reported large or extreme gains in the knowledge of what everyday research work is like in STEM and 73% reported large or extreme gains in their in depth knowledge of a STEM topic. Mentors were also asked about impacts on apprentices' gains in STEM knowledge. Mentors were less likely to report extreme gains than were apprentices, however were more likely to report large gains in these areas.

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

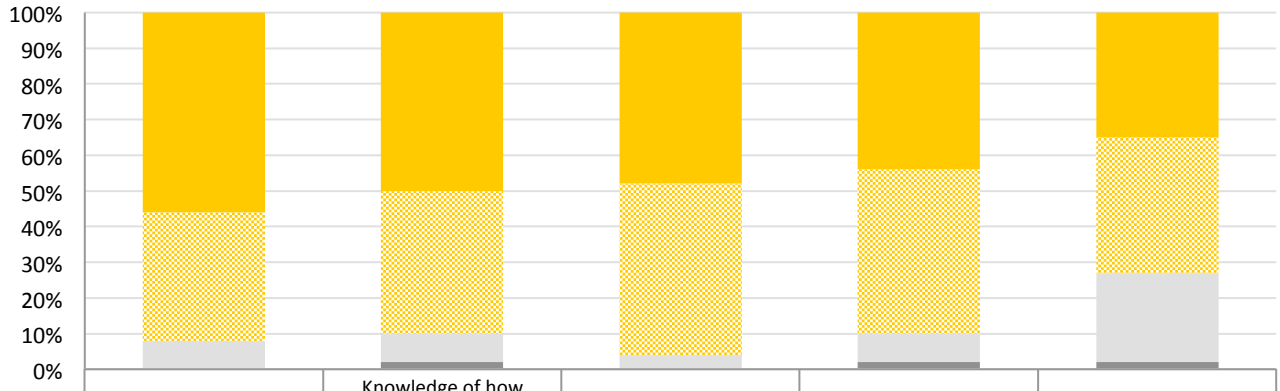
Committee on STEM Education. (2013*). Federal Science, Technology, Engineering, and Mathematics (STEM) education 5-year strategic plan: A report from the Committee on STEM Education, National Science and Technology Council.* Washington, DC: The White House, Office of Science and Technology Policy.

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.

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.

Chart 16: Apprentice Report of Impacts on STEM Knoweldge (n = 48)



	Knowledge of what everyday research work is like in STEM	Knowledge of how scientists and engineers work on real problems in STEM	Knowledge of research conducted in a STEM topic or field	Knowledge of research processes, ethics, and rules for conduct in STEM	In depth knowledge of a STEM topic(s)
Extreme gain	56%	50%	48%	44%	35%
Large gain	36%	40%	48%	46%	38%
Some gain	8%	8%	4%	8%	25%
A little gain	0%	2%	0%	2%	2%
No gain	0%	0%	0%	0%	0%

These apprentice questionnaire items were combined into a composite variable[11] 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.

Apprentices were asked about perceived impacts of SEAP participation on STEM competencies, or abilities to use STEM practices. Apprentices were presented with different sets of items depending on whether the focus of their SEAP experience was science or technology/engineering. Of the apprentices with a science-related experience, 81% reported large or extreme gains in their ability to carry out procedures for an experiment and record data accurately (see Table 21). About two-thirds reported large or extreme gains in their ability to design procedures for an experiment (65%), identify the limitations of methods and tools used for data collection (65%), and communicate about experiments and explanations in different ways (65%). Over half of responding apprentices reported large or extreme gains in areas such as supporting an explanation for an observation with data from experiments (61%), supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge (58%), and considering different interpretations of data when deciding how the data answer a question (55%).

[11] The Cronbach's alpha reliability for these 5 items was 0.892.

Table 21. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Science Practices (n = 31)	
Item	**Questionnaire Respondents**
Carrying out procedures for an experiment and recording data accurately	81%
Designing procedures for an experiment that are appropriate for the question to be answered	65%
Identifying the limitations of the methods and tools used for data collection	65%
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	65%
Supporting an explanation for an observation with data from experiments	61%
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	58%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	58%
Considering different interpretations of data when deciding how the data answer a question	55%
Organizing data in charts or graphs to find patterns and relationships	52%
Integrating information from technical or scientific texts and other media to support your explanation of an observation	48%
Asking a question that can be answered with one or more scientific experiments	45%
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	45%
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	45%
Defending an argument that conveys how an explanation best describes an observation	45%
Making a model of an object or system showing its parts and how they work	32%
Using computer models of objects or systems to test cause and effect relationships	19%

Table 22 provides 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 defining a problem that can be solved by developing a new or improved object, process, or system (82%), carrying out procedures for an experiment and recording data accurately (82%), communicating information about design experiments and solutions in different ways (77%), and using knowledge and creativity to propose a testable solution for a problem (71%). Similarly, over half of apprentices reported large or extreme gains in areas such as designing procedures for an experiment that are appropriate for the question to be answered (65%), supporting a solution for a problem with data from experiments (63%), and making a model of an object or system to show its parts and how they work (59%). In this case, mentors' reports of apprentice gains varied substantially for several items, with mentors reporting greater gains than apprentices for some items and smaller gains for others.

Table 22. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Engineering Practices (n = 17)	
Item	**Questionnaire Respondents**
Defining a problem that can be solved by developing a new or improved object, process, or system	82%
Carrying out procedures for an experiment and recording data accurately	82%
Organizing data in charts or graphs to find patterns and relationships	77%
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	77%
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	77%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	76%
Using knowledge and creativity to propose a testable solution for a problem	71%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	71%
Designing procedures for an experiment that are appropriate for the question to be answered	65%
Considering different interpretations of the data when deciding if a solution works as intended	65%
Defend an argument that conveys how a solution best meets design criteria	65%
Supporting a solution for a problem with data from experiments	63%
Making a model of an object or system to show its parts and how they work	59%
Identifying the limitations of the methods and tools used for data collection	59%
Using computer models of an object or system to investigate cause and effect relationships	59%
Integrating information from technical or scientific texts and other media to support your solution to a problem	47%

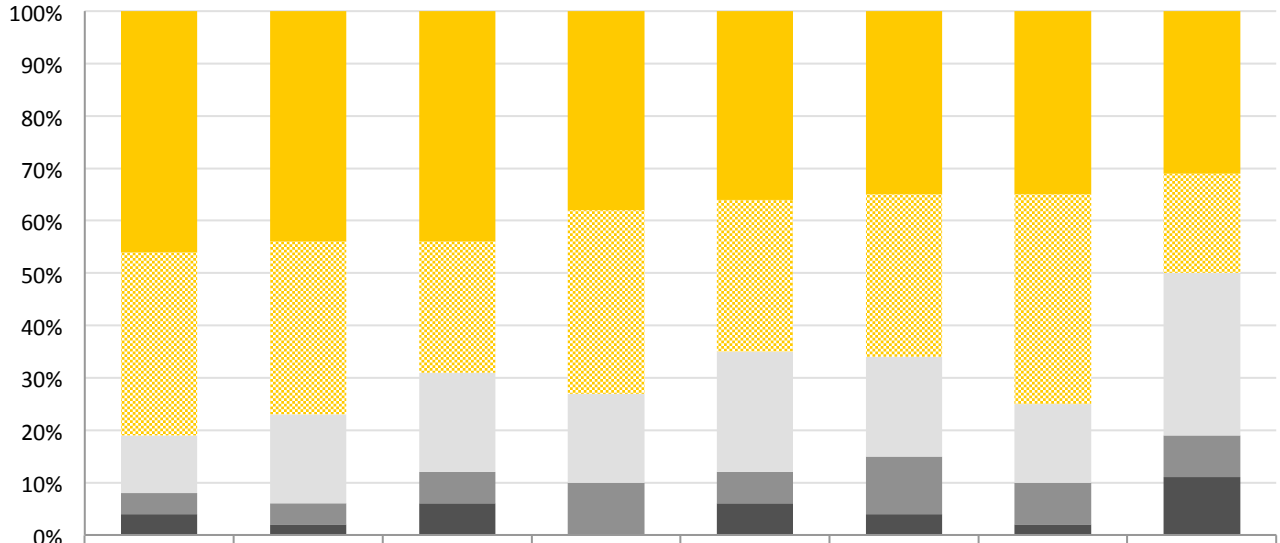
Composite scores were calculated for each set of STEM practices items[12] on the apprentice questionnaire to examine whether the SEAP program had differential impacts on subgroups of apprentices. There were no significant differences among subgroups, indicating that apprentices from different genders, races/ethnicities, and community types reported similar impacts in these areas.

Apprentices were asked about the impact of SEAP on their "21st Century Skills," skills and abilities 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 in each of these skills, including making changes when things do not go as planned (81%), learning to work independently (77%), sticking with a task until it is finished (85%), and communicating effectively with others (73%). 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

[12] The science practices composite has a Cronbach's alpha reliability of 0.961; the engineering practices composite has a Cronbach's alpha reliability of 0.891

similar gains regardless of gender, race/ethnicity, or community type.[13] In addition, mentor reports of apprentice gains in this area are generally similar to those of the apprentices.

Chart 17: Apprentice Report of Impacts on 21st Century Skills (n = 48)



	Making changes when things do not go as planned	Learning to work independently	Viewing failure as an opportunity to learn	Communicating effectively with others	Working well with people from all backgrounds	Setting goals and reflecting on performance	Sticking with a task until it is finished	Including others' perspectives when making decisions
Extreme gain	46%	44%	44%	38%	36%	35%	35%	31%
Large gain	35%	33%	25%	35%	29%	31%	40%	19%
Some gain	11%	17%	19%	17%	23%	19%	15%	31%
A little gain	4%	4%	6%	10%	6%	11%	8%	8%
No gain	4%	2%	6%	0%	6%	4%	2%	11%

STEM Identity and Confidence

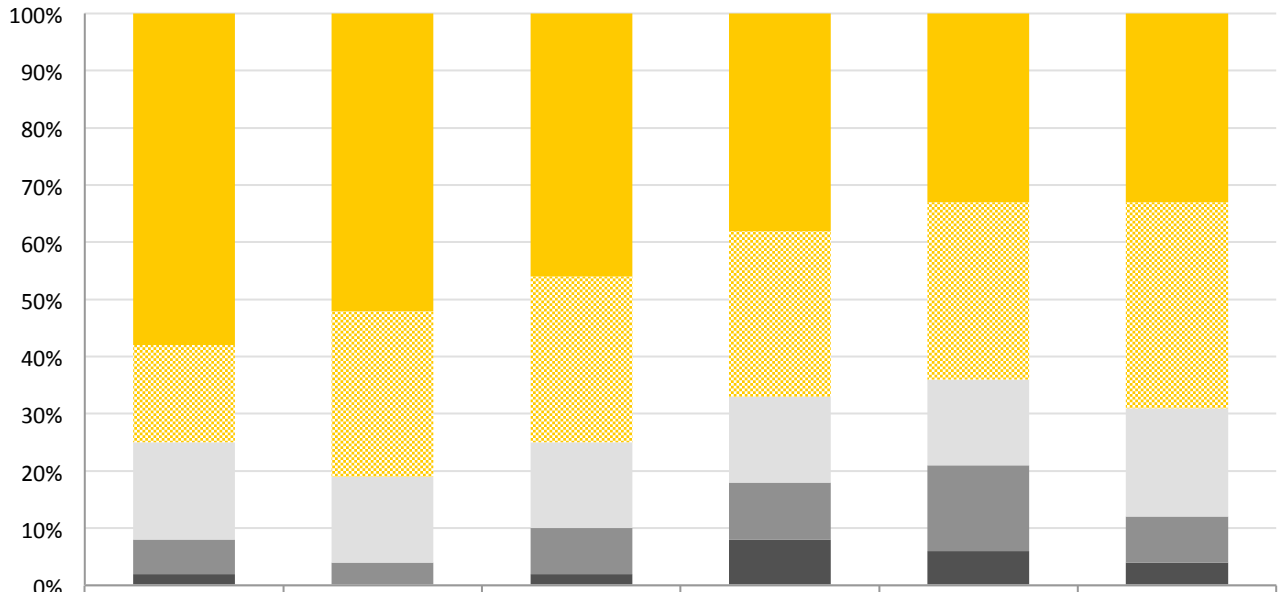
Deepening apprentices' STEM knowledge and skills are key factors in increasing the likelihood that they will pursue STEM further in their education and/or careers, however they are unlikely to do so if they do not see themselves as capable of succeeding in STEM.[14] The apprentice questionnaire included a series of items intended to measure the impact of SEAP on apprentices' STEM identities. These data are shown in Chart 18 and strongly suggest that the program has had a positive impact in this area. For example, 81% of responding apprentices reported large or extreme

[13] The 21st Century Skills composite has a Cronbach's alpha reliability of 0.941.

[14] 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.

gains in their preparedness for more challenging STEM activities while 75% reported similar gains in their confidence to try out new ideas or procedures on their own in a STEM project. Similarly, substantial proportions of apprentices reported large or extreme gains in their sense of accomplishing something in STEM (75%) and deciding on a Again, there were no differences among subgroups of apprentices on a composite variable created from these items.[15]

Chart 18: Apprentice Report of Impacts on STEM Identity (n = 48)



	Sense of accomplishing something in STEM	Feeling prepared for more challenging STEM activities	Confidence to try out new ideas or procedures on my own in a STEM project	Deciding on a path to pursue a STEM career	Interest in a new STEM topic	Patience for the slow pace of STEM research
Extreme gain	58%	52%	46%	38%	33%	33%
Large gain	17%	29%	29%	29%	31%	36%
Some gain	17%	15%	15%	15%	15%	19%
A little gain	6%	4%	8%	10%	15%	8%
No gain	2%	0%	2%	8%	6%	4%

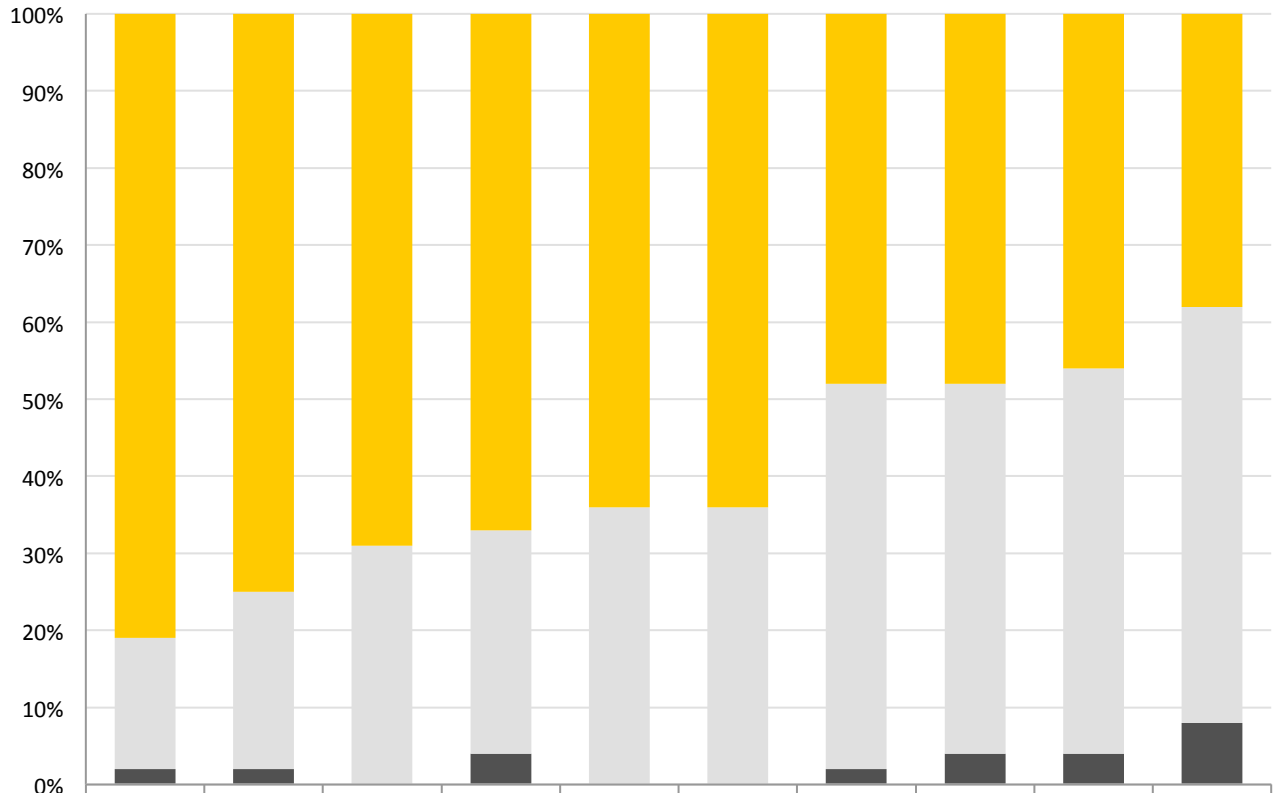
Interest and Future Engagement in STEM

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 SEAP experience, and whether their interest level in participating

[15] The Cronbach's alpha reliability for these 8 items was 0.884.

in future AEOP programs changed as a result of SEAP. 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, 81% reported being more likely to work on a STEM project or experiment in a university or professional setting; 75% 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,[16] 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 = 48)

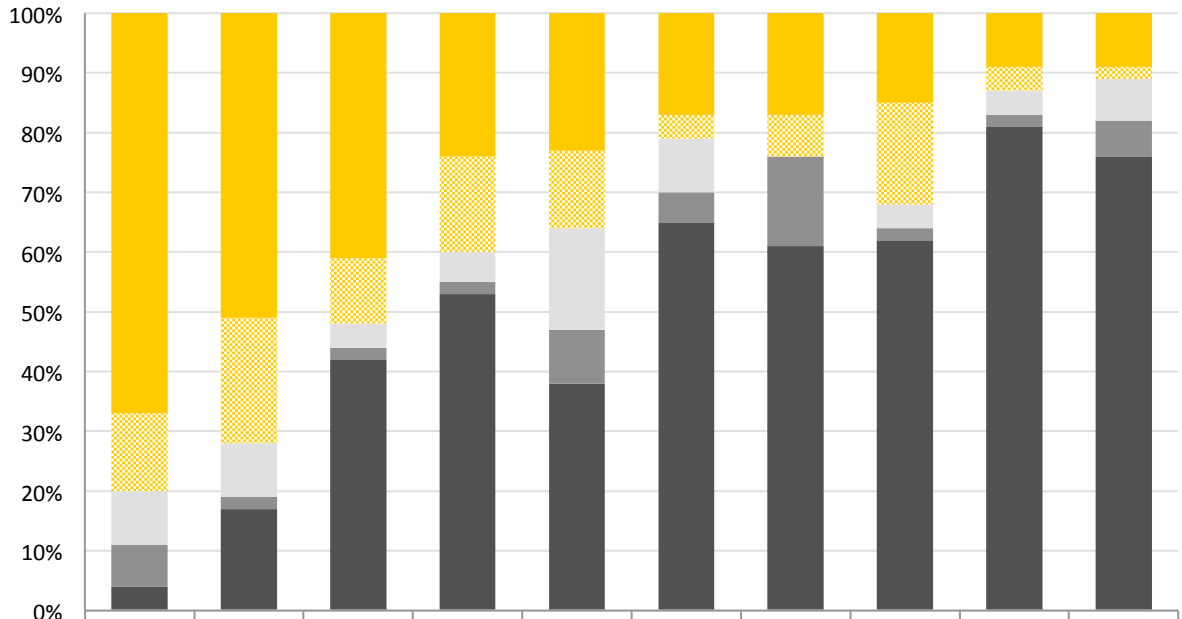


	Work on a STEM project or experiment in a university or professional setting	Mentor or teach other students about STEM	Talk with friends or family about STEM	Take an elective (not required) STEM class	Help with a community service project related to STEM	Participate in a STEM camp, club, or competition	Watch or read non-fiction STEM	Tinker (play) with a mechanical or electrical device	Work on solving mathematical or scientific puzzles	Use a computer to design or program something
More likely	81%	75%	69%	67%	64%	64%	48%	48%	46%	38%
About the same	17%	23%	31%	29%	36%	36%	50%	48%	50%	54%
Less likely	2%	2%	0%	4%	0%	0%	2%	4%	4%	8%

[16] These 10 items had a Cronbach's alpha reliability of 0.784.

Apprentices (67%) reported being "very much" interested in participating in SEAP again; 51% in CQL, and 41% in SMART (see Chart 20). Conversely, a majority of responding apprentices had never heard of HSAP, JSHS, and UNITE.

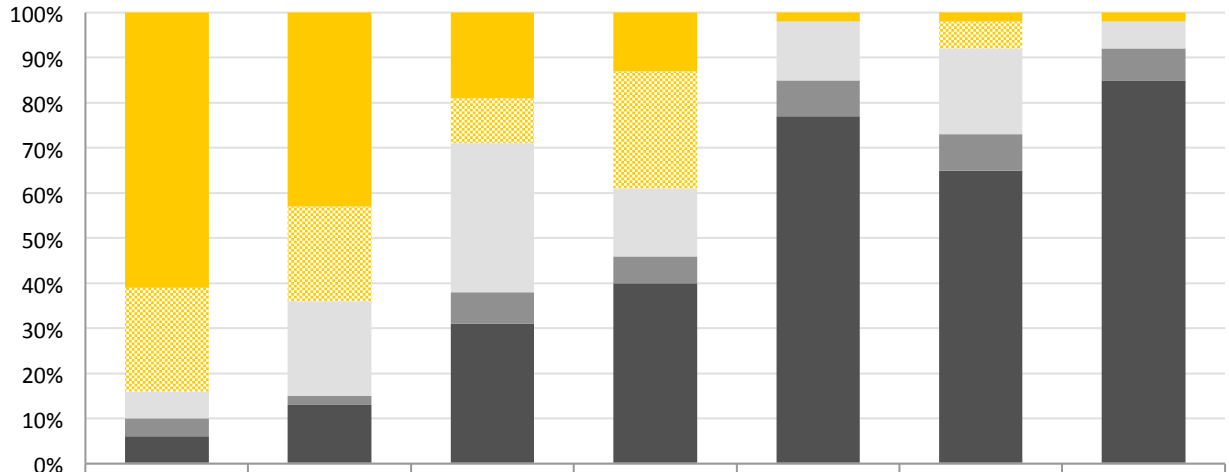
Chart 20: Apprentice Interest in Future AEOP Programs (n = 46-47)



	SEAP	CQL	SMART College Scholarship	URAP	GEMS Near Peer Mentor Program	REAP	HSAP	NDSEG Fellowship	UNITE	JSHS
Very much	67%	51%	41%	24%	23%	17%	17%	15%	9%	9%
Somewhat	13%	21%	11%	16%	13%	4%	7%	17%	4%	2%
A little	9%	9%	4%	5%	17%	9%	0%	4%	4%	7%
Not at all	7%	2%	2%	2%	9%	5%	15%	2%	2%	6%
Never Heard of Program	4%	17%	42%	53%	38%	65%	61%	62%	81%	76%

Apprentices shared insight into the resources that impacted their awareness of the various AEOPs. The responses reflected in Chart 21 indicate that simply participating in SEAP was most likely to impact apprentice awareness of other AEOPs, with apprentices 83% of apprentices indicating that this impacted their awareness "somewhat" or "very much." Mentors were also rated by a majority of apprentices (64%) as having at least some impact on their awareness of AEOP programs. On the other hand, the majority of apprentices indicated that they did not experience AEOP resources including the It Starts Here! magazine (85%) and the AEOP brochure (65%). Likewise, 77% of responding apprentices had not experienced AEOP on social media.

Chart 21: Impact of Resources on Apprentice Awareness of AEOPs (n = 47-48)

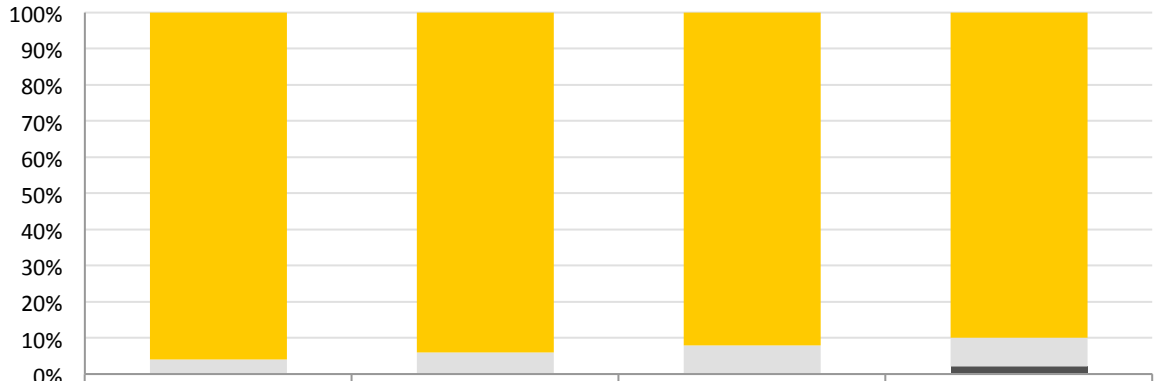


	Participation in SEAP	My SEAP mentor(s)	AEOP website	Invited speakers or "career" events during SEAP	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP brochure	It Starts Here! Magazine
Very Much	61%	43%	19%	13%	2%	2%	2%
Somewhat	23%	21%	10%	26%	0%	6%	0%
A little	6%	21%	33%	15%	13%	19%	6%
Not at all	4%	2%	7%	6%	8%	8%	7%
Did not experience	6%	13%	31%	40%	77%	65%	85%

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 vast majority of responding apprentices responded with favorable opinions (see Chart 22). All responding students agreed or strongly agreed that DoD researchers advance science and engineering fields, that DoD researchers solve real-world problems, and that DoD research is valuable to society.

Chart 22: Apprentice Opinions about DoD Researchers and Research (n = 51)



	DoD research is valuable to society	DoD researchers advance science and engineering fields	DoD researchers solve real-world problems	DoD researchers develop new, cutting edge technologies
Strongly agree or agree	96%	94%	92%	90%
Neither agree nor disagree	4%	6%	8%	8%
Strong disagree or disagree	0%	0%	0%	2%

Education and Career Aspirations

The SEAP evaluation 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 23, when asked to think back on how far they wanted to go in school before participating in SEAP, 6% indicated wanting to finish college, 38% to get a masters' degree, 19% a Ph.D., and 8% a medical-related degree. Interestingly, after SEAP, only 4% aspired to a Bachelor's degree and 31% to a master's degree, while interest in earning a Ph.D. rose to 21% and medical-related degrees to 15%. While student interest seemed to shift somewhat, particularly in terms of earning medical-related degrees, it should be noted that the vast majority of students reported education aspirations before the program that included at least some post-secondary education (94%). Overall this rate rose to 98% after participation in SEAP.

Table 23. Apprentice Education Aspirations (n = 48)		
	Before SEAP	**After SEAP**
Graduate from high school	6%	2%
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)	6%	4%
Get more education after college	6%	6%
Get a master's degree	38%	31%
Get a Ph.D.	19%	21%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	8%	15%
Get a combined M.D. / Ph.D.	13%	17%
Get another professional degree (law, business, etc.)	4%	4%

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 24). Most apprentices generally expressed interest in STEM-related careers both before and after participating in SEAP, with about a third of students aspiring to engineering careers (32% before SEAP and 35% after). There was no change in the number of students who were undecided about their career aspirations before and after SEAP although there was a slight decline (6% pre-SEAP to 4% post-SEAP) in students aspiring to careers in both biological and environmental science. The rate of students aspiring to careers other than those listed rose from 4% to 11% after SEAP; all students responding in this way specified that they are interested STEM-related careers.

"I go [an] understanding of what exactly engineering is. Now I know actually what happens in engineering. I know what the daily life of an engineer looks like. And I know without a shado of a doubt now, I want to do engineering."-- SEAP Apprentice

Table 24. Apprentice Career Aspirations (n = 46-47)		
	Before SEAP	**After SEAP**
Engineering	32%	35%
Medicine (doctor, dentist, veterinarian, etc.)	19%	20%
Other, (specify):	4%	11%
Science (no specific subject)	6%	7%
Undecided	9%	9%
Physical science (physics, chemistry, astronomy, materials science)	2%	4%
Biological science	6%	4%
Environmental science	6%	4%
Earth, atmospheric or oceanic science	0%	2%
Computer science	4%	2%
Mathematics or statistics	0%	2%
Technology	2%	0%
Health (nursing, pharmacy, technician, etc.)	0%	0%
Social science (psychologist, sociologist, etc.)	4%	0%
Teaching, STEM	0%	0%
Teaching, non-STEM	0%	0%
Business	0%	0%
Law	2%	0%
Business	0%	0%
Military, police, or security	0%	0%
Skilled trade (carpenter, electrician, plumber, etc.)	0%	0%

Note: Before SEAP Other = Biomedical Engineering/Research; Criminal justice/forensics.
After SEAP Other = Biomedical Engineering/Research; Criminal justice/forensics; Epidemiology; Bioinformatics or MD/PHD Researcher/Doctor; 3-D Scanning

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 (see Table 25). All apprentices expect to use STEM at least 26% of the time in their work and a majority (56%) expect to use STEM 76-100% of the time in their work.

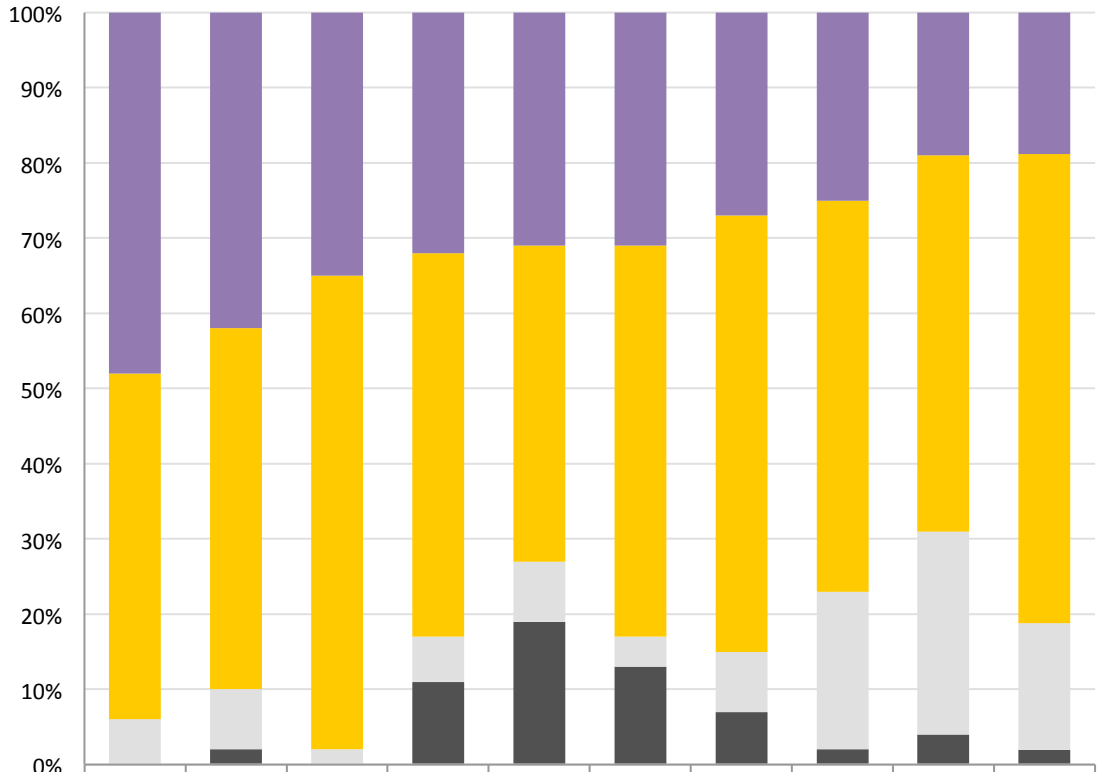
Table 25. Apprentices Expecting to use STEM in Their Work at Age 30 (n = 48)	
	Questionnaire Respondents
Not at all	0%
Less than 25% of the time	0%
26% to 50% of the time	8%
51% to 75% of the time	35%
76% to 100% of the time	56%

Overall Impact

Apprentices reported on the impacts of participating in SEAP more broadly and indicated SEAP had substantial impacts on them (see Chart 23). For example, a large majority of responding apprentices indicated that SEAP contributed or was a primary reason for them being more confident in their STEM knowledge, skills, and abilities (98%), for their greater appreciation of Army or DoD STEM research (94%), and for their interest in pursuing a career in STEM (82%). Similarly, 85% of apprentices indicated that SEAP contributed or was a primary reason for their interest in pursuing STEM activities outside of school activities. While 73% indicated that SEAP at least contributed to their awareness of other AEOPs, 19% of students reported that they were not more aware of AEOPs after SEAP. Likewise, although 83% indicated that SEAP at least contributed to an increased interest in a STEM career with the Army or DoD, 13% indicated that their interest had not increased. These items were combined into a composite variable[17] to test for differences among subgroups of students. There were no differences between minority students and non-minority students or by gender. Mentors reports about impacts on apprentices in these areas were similar to those of the apprentices.

[17] The Cronbach's alpha reliability for these 10 items was 0.830.

Chart 23: Apprentice Opinions of SEAP Impacts (n = 47-48)



	I have a greater appreciation of Army or DoD STEM research	I am more aware of Army or DoD STEM research and careers	I am more confident in my STEM knowledge, skills, and abilities	I am more interested in participating in other AEOPs	I am more aware of other AEOPs	I am more interested in pursuing a STEM career with the Army or DoD	I am more interested in participating in STEM activities outside of school requirements	I am more interested in earning a STEM degree	I am more interested in taking STEM classes in school	I am more interested in pursuing a career in STEM
Agree - SEAP was primary resason	48%	42%	35%	32%	31%	31%	27%	25%	19%	19%
Agree - SEAP contributed	46%	48%	63%	51%	42%	52%	58%	52%	50%	63%
Disagree - happened, but not because of SEAP	6%	8%	2%	6%	8%	4%	8%	21%	27%	17%
Disagree - did not happen	0%	2%	0%	11%	19%	13%	7%	2%	4%	2%

An open-ended item on the questionnaire asked apprentices to list the three most important ways they benefited from the program. The 41 apprentices who responded referred to a variety of benefits. Nearly half (44%) noted the benefit of their exposure to the research process and hands-on laboratory work, and a similar number of students (41%)

commented upon the STEM knowledge and skills they had acquired. About a quarter of responding apprentices (24%) reported that the work experience they gained was valuable. Eight apprentices (20%) valued learning about STEM career paths and 5 respondents (12%) specifically noted that they learned about the value of DoD STEM research. Apprentices also commented upon the value of relationships with mentors and other STEM professionals (20%) and 15% reported

that they had more confidence in their STEM skills after participating in SEAP. Other themes in responses were improved communication and collaboration skills (12%) and the usefulness of the experience for the college application process (5%).

Interview participants expanded upon some of these benefits. For instance:

> *[SEAP] just gave me an overall experience of what their career field would be about. What they would have to do on a daily basis and it also gave me a presentation spot where I could actually go up and give a presentation.* (SEAP Apprentice)

> *Now I know actually what happens in engineering. I know what the daily life of an engineer looks like. And I know without a shadow of a doubt now, I want to do engineering.* (SEAP apprentice)

"I have never worked so hard on any project in my entire life. This program gave me the opportunity to learn computer programming with no prior experience and apply this knowledge to real life projects…The most important thing I learned from this program is how to solve problems on my own and work without assistance from a supervisor."-- SEAP Apprentice

Summary of Findings

The FY15 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 26.

Table 26. 2015 SEAP Evaluation Findings	
Participant Profiles	
SEAP continued to serve students from historically underrepresented and underserved populations, providing evidence that the program disseminated information about SEAP to a diverse audience.	The proportion of females - a population that is historically underrepresented in engineering fields - participating in SEAP increased from 40% in FY14 to 45% in FY15.
	SEAP continued to serve students from historically underrepresented and underserved race/ethnic groups at similar rates as in FY14. Of enrolled apprentices in FY15, 14% identified as Black or African American (13% in FY14) and 2% as Hispanic or Latino (1% in FY14). Although there was a small increase in the percentage of students identifying with these groups, this remains an area for potential growth.
SEAP experienced limited success in recruiting GEMS participants to SEAP.	Although no SEAP apprentices reported past participation in programs such as JSHS and JSS, 32% reported having participated in GEMS at least once. This is a slight increase over FY14 when 30% of SEAP participants reported being alumni of GEMS, but falls short of the goal for FY15 of 40% of SEAP participants being GEMS alumni. GEMS mentors (66%) in FY15 reported discussing SEAP with GEMS participants and 37% of GEMS participants indicated interest in participating in SEAP in the future.
SEAP did not reach its targeted number of program applicants.	The program fell short of its FY15 goal of 900 applicants and received fewer applications (22% decrease) in FY15 than in FY14 (633 versus 810).
Actionable Program Evaluation	
Pre-existing relationships continue to be a factor in SEAP recruitment, however website applications played an increased role in apprentice recruitment.	As in FY14, references from workplace colleagues and applications from the ASEE or AEOP websites were the most commonly reported methods of apprentice recruitment. However, in FY15, slightly more mentors reported that website applications were a key recruitment strategy (29% in FY15 versus 24% in FY14) and fewer reported personal references as a key strategy (33% in FY15 versus 41% in FY14).
	As in FY14, apprentices in FY15 most commonly learned about SEAP from personal relationships including family members (39%) and past participants of the program (36%). The AEOP website, however, was cited by only 25% of apprentices as a method of learning about SEAP.

SEAP apprentices continue to be motivated by a variety of factors, although apprentice stipends were a key motivator for participation.	A range of factors motivated apprentices to participate in SEAP. Apprentice stipends were a major motivator with 67% of respondents reporting that stipends "very much" motivated them to participate. Other factors included exploring a unique work environment (35%), SEAP mentors (27%), and learning in ways that are not possible in school (27%).
SEAP engaged apprentices in meaningful STEM learning.	Over 90% of apprentices reported interacting with scientists or engineers, applying STEM to real life situations, and learning about STEM topics new to them on most days or every day of their apprenticeship. Likewise, over half of apprentices reported communicating with other students about STEM, learning about careers that use STEM, and learning about new discoveries in STEM on most days or every day.
	Apprentices reported engaging in a variety of STEM practices during their SEAP experience. For example, a large majority of apprentices reported participating in hands-on STEM activities every day or most days (92%), analyzing data or information (91%), and using laboratory procedures and tools (81%).
	Apprentices reported markedly greater opportunities to learn about STEM and engage in STEM practices in SEAP as compared to their typical school experiences.
	All responding mentors reported using a variety of teaching and/or mentoring activities to meet students' needs. Mentors also used a variety of other strategies to support the diverse needs of their students as learners, including identifying student learning styles (79%) and directing students to other individuals or programs for additional support (79%). Similarly, mentors used a variety of strategies to support student collaboration and interpersonal skills. These strategies included having students listen to the ideas of others with an open mind (92%), having students explain difficult ideas to others (88%), and having students work on collaborative activities or projects (88%). Mentors also supported apprentices' engagement in authentic STEM activities using a variety of strategies including demonstrating laboratory/field techniques, procedures, and tools (92%), providing students with constructive feedback (92%), had having students work independently to improve their self-management abilities (92%).
SEAP promotes apprentice awareness of DoD STEM research and careers.	Apprentices reported overwhelmingly positive opinions about DoD researchers and research. For example, apprentices reported that they believe that DoD research is valuable to society (96%) and that DoD researchers advance science and engineering fields (94%).
	Nearly all apprentices (92%) reported learning about at least one DoD STEM career during their participation in SEAP. Apprentices found participation in SEAP and their mentors to be the most impactful resources in learning about DoD STEM careers while mentors reported that participation in SEAP and the SEAP program administrator or site coordinator were the most useful resources in their efforts to expose apprentices to DoD STEM careers.

SEAP has an opportunity to improve mentor and apprentice awareness of and marketing of other AEOP opportunities.	Most apprentices reported never hearing about or never participating in most AEOP programs beyond SEAP. One exception to this was the GEMS program; over a quarter of SEAP apprentices reported participating in GEMS at least once. Similarly, responding mentors generally had little awareness of or past participation in other AEOP programs, although a quarter reported participating in GEMS at least once in the past.
The SEAP experience is valued by apprentices and mentors.	Apprentices and mentors were asked about their overall satisfaction with the SEAP program. Nearly all respondents had overall positive perceptions of the program. While 15% of apprentices reported being not at all satisfied with "other administrative tasks" associated with SEAP, this is an improvement over FY14 when 31% reported dissatisfaction with administrative aspects of the program. In responses to an open-ended item asking about their satisfaction with the SEAP program. The vast majority of apprentices (93%) reported being at least somewhat satisfied with instruction or mentorship during the program and 89% reported being at least somewhat satisfied with their working relationship with their group or team. Likewise, mentors reported being somewhat or very satisfied with program features such as communication with the SEAP site (88%), the research presentation process (83%) and research abstract requirements (82%).
Outcomes Evaluation	
SEAP apprentices reported gains in STEM knowledge and competencies.	A large majority of apprentices reported large or extreme gains in their STEM knowledge, including what everyday research work is like in STEM, how professionals work on real problems in STEM, and knowledge of a STEM topic or field, as a result of their SEAP participation.
	Apprentices reported large or extreme gains in a variety of STEM competencies as well, including carrying out procedures for an experiment and recording data accurately; designing procedures for an experiment appropriate for the question to be answered; identifying the limitations of methods and tools used for data collection; defining a problem that can be solved by developing a new or improved object, process, or system; and organizing data in charts or graphs to find patterns and relationships.
SEAP participants reported gains in 21st Century Skills.	Apprentices reported gains in their 21st century skills as a result of participating in SEAP. In particular, the majority of apprentices reported large or extreme gains in areas such as their ability to make changes when things do not go as planned, viewing failure as an opportunity to learn, learning to work independently, and communicating effectively with others.
SEAP participants reported increased confidence and identity in STEM.	Apprentices reported gains in their confidence and STEM identity, including large or extreme gains in areas such as a sense of accomplishing something in STEM, confidence to try out new ideas or procedures on their own in a STEM project, and deciding on a path to pursue a STEM career.

SEAP participants reported increased interest in future STEM engagement.	Apprentices reported that after participating in SEAP they were more likely to engage in STEM activities outside of school. A majority of apprentices indicated that they were more likely to engage in activities such as working on a STEM project or experiment in a university of professional setting, mentor or teach other students about STEM, and talk with friends and family about STEM.
SEAP participants reported aspiring to advanced degrees and STEM careers with little overall change in education or career aspirations after participating in the program.	Most apprentices indicated wishing to pursue an advanced degree both before and after SEAP, although somewhat more students expressed interest in a degree in a medical field after SEAP participation.
	Most apprentices expressed interest in STEM-related careers both before and after participating in SEAP.
SEAP participants show interest in future AEOP opportunities.	A majority of apprentices indicated being "very much" interested in participating in SEAP again (67%) and in CQL (51%). Another 41% were very interested in SMART, and about a quarter of participants expressed a high level of interest in both URAP and the GEMS Near Peer Mentor Program.

Recommendations

Evaluation findings indicate that FY15 was a successful year overall for the SEAP program. Notable successes for the year include an increase in the percentage of female participants over FY14, evidence of increased use of the ASEE and AEOP websites, and evidence of a growing AEOP pipeline with 32% of SEAP apprentices reporting that they were alumnae of GEMS, and 82% of apprentices indicating that they are familiar with CQL. Apprentices and mentors continue to report high levels of satisfaction with the program and with mentor-apprentice relationships. Both groups likewise report strong apprentice gains in STEM knowledge and competencies as a result of the SEAP experience.

While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY16 and beyond:

AEOP Priority: Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base

1. The AEOP goal of attracting students from groups historically underrepresented and underserved in STEM has been met with limited success in SEAP. Most apprentices reported learning about SEAP through personal connections, suggesting that the pool of SEAP applicants has not broadened considerably over previous years. This is borne out by enrollment statistics showing little increase in the numbers of students identifying as Black or African American and Hispanic or Latino. The lack of growth in SEAP apprentices from groups historically underrepresented and underserved groups is influenced by various factors including the recruitment and selection process and the marketing of SEAP to target groups. The program may want to consider additional/alternate means of broadening the pool of applicants and devising strategies for recruiting and selecting apprentices and mentors to ensure that SEAP includes diverse groups of highly talented participants.

For example, the IPA may choose to place a cap on the number of students accepted in the program who are related to lab personnel; once this cap is reached, mentors would then need to select students based upon their qualifications and aptitude rather than relationships.

2. The percentage of applicants who are recruited outside of existing connections with Army Labs needs to be increased. The AEOP wants to ensure the programs (including SEAP) have a fair and competivie selection process. If only 29% of mentors are using the online application to select participants, the selection process can and should be improved substantially. It is recommended that SEAP mentors utilize the online application as the primary means of selecting participants to insure the selection process is fair and competitive in the future.

AEOP Priority: Support and empower educators with unique Army research and technology resources

1. There is a continued need for SEAP to grow the number of participating mentors in the program. Even with a reduced number of apprentice applications in FY15 as compared to FY 14 (633 versus 810), there is substantial unmet need in terms of mentor capacity with only 92 students (15% of applicants) being placed. In order to expand the program beyond its current size, the program will need to actively recruit additional Army S&Es to serve as mentors. These recruiting efforts may focus on communicating the value of the AEOP pipeline to potential mentors by highlighting success stories of apprentices who proceeded through SEAP into other AEOP programs and into successful STEM careers. It may be necessary to examine the procedures and resources used to recruit SEAP mentors and identify factors that motivate and discourage Army S&Es from assuming this role.

AEOP Priority: Develop and implement a cohesive, coordinated and sustainable STEM education outreach infrastructure across the Army

1. The effectiveness of SEAP program administration continues to be a concern. Although the level of satisfaction with administrative tasks was higher in FY15 than in FY14, apprentice and mentor responses indicate that there is yet room for improvement. While apprentices and mentors were positive overall about their SEAP experiences, concern was expressed regarding in-processing procedures such as receiving computer access and communication between SEAP organizers and apprentices. Additionally, some apprentices reported finding the application process confusing and identified this as an area for potential improvement. As the Academy of Applied Science assumes the administration of SEAP, it should be mindful of these issues and leverage its past experience with administering apprenticeship programs to streamline processes and improve communication with apprentices. It is recommended that AAS implement separate SEAP/CQL applications for each lab.

2. There is continued room for improvement in marketing of other AEOPs within the SEAP program. As a starting point for SEAP there could be much more effort in promoting other AEOP programs (e.g. welcome packet with information on applicable AEOP programs). Further, to create a robust pipeline of AEOP programs in which students progress from other AEOPs into SEAP and beyond, the program may want to consider innovative ways

to work with other AEOPs to create a more seamless continuum of programs. Given the FY15 objective of encouraging more GEMS alumni to participate in SEAP, program administrators may with to work closely with the GEMS program to devise ways of disseminating SEAP information to GEMS participants and alumni. It is notable that 50% of mentors reported explicitly discussing CQL with their apprentices. At the same time, however, less than half discussed SMART (38%) and GEMS (33%), and only 9% discussed GEMS Near Peer Mentors with their apprentices. Since mentors provide much of the information apprentices receive during SEAP, efforts should be made to ensure that mentors are informed about the range of AEOPs. Other means of educating apprentices about AEOPs should be combined with mentor information, especially given the very real consideration of mentor time constraints in working with apprentices. This could include incorporating AEOP information into orientation materials and alumni communications. Given the limited use of AEOP website, print materials, and social media, the program should consider how these materials could be more effectively utilized to provide students with targeted program information.

3. The SEAP programs' participation in the overall AEOP evaluation has been less than desired. The continued low response rates for both apprentice and mentor questionnaires (50% and 21%) raise questions about the representativeness of the results. It is recommended that SEAP/AAS continue to emphasize the importance of these evaluations with individual program sites and communicating expectations for evaluation activities to take place on-site during the program. Finally, there is a need for increased Army leadership support for evaluation participation at the Army labs.

Appendices

Appendix A

FY15 SEAP Evaluation Plan

Questionnaires

Purpose:
As per the approved FY15 AEOP APP, the external evaluation of SEAP (data collected by VT and evaluated by Purdue University) 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.

From FY14 to FY15, questionnaire assessments were revised and shortened while maintaining alignment 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 (VT provided questionnaires for FY15). 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 is 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.

Telephone Interviews

Purpose:
In lieu of on-site focus groups, Virginia Tech (VT) conducted telephone interviews with SEAP apprentices.

Interviews provide the VT evaluation team with first-hand opportunities to speak with SEAP apprentices. The information gleaned from these interviews assists us in illustrating and more deeply understanding the findings of other data collected (from questionnaires). VT's interview assessment efforts focused on program successes and attempt to inform useful program changes so that SEAP can improve in the future. Two phone interviews were conducted with SEAP apprentices by VT staff (approximately 15-20 minutes each).

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

FY15 SEAP Apprentice Questionnaire Data Summaries

SEAP Participant 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)

	Freq.	%
9th	2	5%
10th	8	21%
11th	16	41%
12th	13	33%
Choose not to report	0	0%
Total	**39**	**100%**

What is your gender?

	Freq.	%
Male	14	36%
Female	25	64%
Choose not to report	0	0%
Total	**39**	**100%**

What is your race or ethnicity?	Freq.	%
Hispanic or Latino	1	3%
Asian	7	18%
Black or African American	8	20%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	20	51%
Other race or ethnicity, (specify): †	2	5%
Choose not to report	1	3%
Total	**39**	**100%**

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

Do you qualify for free or reduced lunches at school?

	Freq.	%
Yes	2	5%
No	35	90%
Choose not to report	3	5%
Total	**40**	**100%**

Which of the following best describes the school you attend?

	Freq.	%
Department of Defense	1	1%
Home School	1	1%
Suburban	16	18%
Rural (country)	52	60%
Urban (city)	17	20%
Total	**87**	**100%**

Where was the SEAP program located (choose one)?

	Freq.	%
US Army Aviation and Missile Research Development and Engineering Center – Redstone Arsenal (AMRDEC)	12	30.8%
US Army Center for Environmental Health Research at Fort Detrick (USACEHR)	2	5.1%
US Army Medical Research Institute of Chemical Defense (USAMRICD)	4	10.3%
US Army Medical Research Institute for Infectious Diseases at Fort Detrick (USAMRIID)	11	28.2%
US Army Research Laboratory – Aberdeen Proving Ground (ARL-APG)	0	0.0%
US Army Research Laboratory – Adelphi (ARL-A)	3	7.7%
Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL)	5	12.8%
Engineer Research & Development Center – Geospacial Research Laboratory (ERDC-GRL)	1	2.6%
Walter Reed Army Institute of Research (WRAIR)	1	2.6%
TOTAL	**39**	**100.0%**

How did you learn about SEAP? (Check all that apply) (n = 48)

	%	Freq.
AEOP on Facebook, Twitter, Pinterest, or other social media	0%	0
Choose not to report	0%	0
Other	2%	1
Community group or program	5%	3
Friend or co-worker of a family member	16%	7
School or university newsletter email or website	17%	8
Friend	22%	10
Someone who works at the school or university I attend	23%	11
Army Educational Outreach Program (AEOP) website	25%	12
Someone who works with program	31%	15
Someone who works with the Department of Defense (Army Navy Air Force)	35%	16
Past participant of program	36%	17
Family member	39%	19

Why did you want to participate in SEAP (check all that apply) (n=83)

	%	Freq.
Teacher or professor encouragement	1%	1
An academic requirement or school grade	1%	1
Desire to learn something new or interesting	41%	34
The program mentor(s)	16%	13
Building college application or resume	11%	9
Networking opportunities	6%	5
Interest in science, technology, engineering, or mathematics (STEM)	67%	56
Interest in STEM careers with the Army	18%	15
Having fun	4%	3
Earning stipends or awards for doing STEM	2%	2
Opportunity to do something with friends	0%	0
Opportunity to use advanced laboratory technology	18%	15
Desire to expand laboratory or research skills	35%	29
Learning in ways that are not possible in school	27%	22
Serving the community or country	5%	4
Recommendations of past participants	0%	0
Figuring out education or career goals	27%	22
Exploring a unique work environment	7%	6
Seeing how school learning applies to real life	7%	6
Other	0%	0

How often did you do each of the following in STEM classes at school?

	Not at all	At least once	A few times	Most days	Every day	Response Total	Avg.	SD
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	2.1%	4.2%	16.7%	33.3%	43.8%	**48**	**4.13**	0.98
	1	2	8	16	21			
Apply STEM learning to real-life situations	4.2%	14.6%	33.3%	27.1%	20.8%	**48**	**3.46**	1.11
	2	7	16	13	10			
Learn about new discoveries in STEM	2.1%	16.7%	45.8%	18.8%	16.7%	**48**	**3.31**	1.01
	1	8	22	9	8			
Learn about different careers that use STEM	2.1%	22.9%	39.6%	14.6%	20.8%	**48**	**3.29**	1.11
	1	11	19	7	10			
Interact with scientists or engineers	18.8%	31.3%	16.7%	14.6%	18.8%	**48**	**2.83**	1.40
	9	15	8	7	9			
Communicate with other students about STEM	4.3%	12.8%	27.7%	19.1%	36.2%	**47**	**3.70**	1.21
	2	6	13	9	17			

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

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	n	Avg.	SD
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	0.0%	0.0%	4.2%	45.8%	50.0%	**48**	**4.46**	0.58
	0	0	2	22	24			
Apply STEM learning to real-life situations	0.0%	2.1%	6.3%	31.3%	60.4%	**48**	**4.50**	0.71
	0	1	3	15	29			
Learn about new discoveries in STEM	0.0%	6.3%	16.7%	43.8%	33.3%	**48**	**4.04**	0.87
	0	3	8	21	16			
Learn about different careers that use STEM	2.1%	8.5%	21.3%	29.8%	38.3%	**47**	**3.94**	1.07
	1	4	10	14	18			
Interact with scientists or engineers	0.0%	0.0%	4.2%	6.3%	89.6%	**48**	**4.85**	0.46
	0	0	2	3	43			
Communicate with other students about STEM	2.1%	8.3%	22.9%	20.8%	45.8%	**48**	**4.00**	1.11
	1	4	11	10	22			

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

How often did you do each of the following in STEM classes at school?

	Not at all	At least once	A few times	Most days	Every day	Response Total	Avg.	SD
Use laboratory procedures and tools	4.2%	0.0%	52.1%	29.2%	14.6%	**48**	**3.50**	0.90
	2	0	25	14	7			
Participate in hands-on STEM activities	2.1%	2.1%	47.9%	25.0%	22.9%	**48**	**3.65**	0.93
	1	1	23	12	11			
Work as part of a team	2.1%	4.2%	33.3%	35.4%	25.0%	**48**	**3.77**	0.95
	1	2	16	17	12			
Identify questions or problems to investigate	2.1%	10.4%	25.0%	41.7%	20.8%	**48**	**3.69**	0.99
	1	5	12	20	10			
Design an investigation	10.6%	17.0%	42.6%	19.1%	10.6%	**47**	**3.02**	1.11
	5	8	20	9	5			
Carry out an investigation	6.3%	14.6%	41.7%	27.1%	10.4%	**48**	**3.21**	1.03
	3	7	20	13	5			
Analyze data or information	0.0%	4.2%	35.4%	31.3%	29.2%	**48**	**3.85**	0.90
	0	2	17	15	14			
Draw conclusions from an investigation	4.2%	10.4%	35.4%	35.4%	14.6%	**48**	**3.46**	1.01
	2	5	17	17	7			
Come up with creative explanations or solutions	4.2%	14.6%	29.2%	27.1%	25.0%	**48**	**3.54**	1.15
	2	7	14	13	12			
Build or make a computer model	42.6%	21.3%	17.0%	10.6%	8.5%	**47**	**2.21**	1.33
	20	10	8	5	4			

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

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	n	Avg.	SD
Use laboratory procedures and tools	6.5%	4.3%	8.7%	19.6%	60.9%	**46**	**4.24**	1.20
	3	2	4	9	28			
Participate in hands-on STEM activities	4.3%	0.0%	4.3%	19.6%	71.7%	**46**	**4.54**	0.94
	2	0	2	9	33			
Work as part of a team	6.5%	4.3%	15.2%	19.6%	54.3%	**46**	**4.11**	1.22
	3	2	7	9	25			
Identify questions or problems to investigate	0.0%	4.3%	19.6%	30.4%	45.7%	**46**	**4.17**	0.90
	0	2	9	14	21			
Design an investigation	13.0%	6.5%	19.6%	32.6%	28.3%	**46**	**3.57**	1.33
	6	3	9	15	13			
Carry out an investigation	4.3%	0.0%	15.2%	28.3%	52.2%	**46**	**4.24**	1.02
	2	0	7	13	24			
Analyze data or information	2.2%	0.0%	6.5%	30.4%	60.9%	**46**	**4.48**	0.81
	1	0	3	14	28			
Draw conclusions from an investigation	4.3%	0.0%	17.4%	32.6%	45.7%	**46**	**4.15**	1.01
	2	0	8	15	21			
Come up with creative explanations or solutions	2.2%	8.9%	15.6%	33.3%	40.0%	**45**	**4.00**	1.07
	1	4	7	15	18			
Build or make a computer model	39.1%	17.4%	10.9%	6.5%	26.1%	**46**	**2.63**	1.66
	18	8	5	3	12			

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

How much did each of the following resources help you learn about Army Educational Outreach Programs (AEOPs)?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Army Educational Outreach Program (AEOP) website	31.3%	6.3%	33.3%	10.4%	18.8%	**48**	**2.79**	1.47
	15	3	16	5	9			
AEOP on Facebook, Twitter, Pinterest or other social media	77.1%	8.3%	12.5%	0.0%	2.1%	**48**	**1.42**	0.87
	37	4	6	0	1			
AEOP brochure	64.6%	8.3%	18.8%	6.3%	2.1%	**48**	**1.73**	1.11
	31	4	9	3	1			
It Starts Here! Magazine	85.4%	6.3%	6.3%	0.0%	2.1%	**48**	**1.27**	0.76
	41	3	3	0	1			
My SEAP mentor(s)	12.8%	2.1%	21.3%	21.3%	42.6%	**47**	**3.79**	1.37
	6	1	10	10	20			
Invited speakers or "career" events during SEAP	40.4%	6.4%	14.9%	25.5%	12.8%	**47**	**2.64**	1.54
	19	3	7	12	6			
Participation in SEAP	6.3%	4.2%	6.3%	22.9%	60.4%	**48**	**4.27**	1.16
	3	2	3	11	29			

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

How much did each of the following resources help you learn about STEM careers in the Army or Department of Defense (DoD)?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	S.D.
Army Educational Outreach Program (AEOP) website	39.1%	8.7%	30.4%	13.0%	8.7%	**46**	**2.43**	1.36
	18	4	14	6	4			
AEOP on Facebook, Twitter, Pinterest or other social media	78.3%	8.7%	2.2%	8.7%	2.2%	**46**	**1.48**	1.05
	36	4	1	4	1			
AEOP brochure	60.9%	6.5%	17.4%	13.0%	2.2%	**46**	**1.89**	1.23
	28	3	8	6	1			
It Starts Here! Magazine	82.2%	2.2%	6.7%	8.9%	0.0%	**45**	**1.42**	0.97
	37	1	3	4	0			
My SEAP mentor(s)	10.9%	2.2%	2.2%	34.8%	50.0%	**46**	**4.11**	1.27
	5	1	1	16	23			
Invited speakers or "career" events during SEAP	39.1%	2.2%	13.0%	26.1%	19.6%	**46**	**2.85**	1.63
	18	1	6	12	9			
Participation in SEAP	8.7%	2.2%	6.5%	21.7%	60.9%	**46**	**4.24**	1.23
	4	1	3	10	28			

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

How SATISFIED were you with the following SEAP features?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Applying or registering for the program	0.0%	12.8%	8.5%	40.4%	38.3%	**47**	**4.04**	1.00
	0	6	4	19	18			
Other administrative tasks (in-processing, network access, etc.)	0.0%	14.9%	34.0%	23.4%	27.7%	**47**	**3.64**	1.05
	0	7	16	11	13			
Communicating with your SEAP host site organizers	6.4%	2.1%	19.1%	25.5%	46.8%	**47**	**4.04**	1.16
	3	1	9	12	22			
The physical location(s) of SEAP activities	0.0%	2.1%	8.5%	17.0%	72.3%	**47**	**4.60**	0.74
	0	1	4	8	34			
The variety of STEM topics available to you in SEAP	2.1%	2.1%	6.4%	21.3%	68.1%	**47**	**4.51**	0.88
	1	1	3	10	32			
Teaching or mentoring provided during SEAP activities	0.0%	0.0%	6.4%	23.4%	70.2%	**47**	**4.64**	0.61
	0	0	3	11	33			
Stipends (payment)	0.0%	8.5%	4.3%	19.1%	68.1%	**47**	**4.47**	0.93
	0	4	2	9	32			
Research abstract preparation requirements	4.3%	2.1%	10.6%	27.7%	55.3%	**47**	**4.28**	1.04
	2	1	5	13	26			
Research presentation process	4.3%	6.5%	8.7%	23.9%	56.5%	**46**	**4.22**	1.13
	2	3	4	11	26			

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

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

	%	Freq.
I did not have a project	2.1%	1
I was assigned a project by my mentor	68.8%	33
I worked with my mentor to design a project	8.3%	4
I had a choice among various projects suggested by my mentor	6.3%	3
I worked with my mentor and members of a research team to design a project	10.4%	5
I designed the entire project on my own	4.2%	2
Total	**100%**	**48**

How often was your mentor available to you during SEAP?

I did not have a mentor	0.0%	0
The mentor was never available	0.0%	0
The mentor was available less than half of the time	6.3%	3
The mentor was available about half of the time of my project	14.6%	7
The mentor was available more than half of the time	18.8%	9
The mentor was always available	60.4%	29
Total	**100%**	**48**

To what extent did you work as part of a group or team during SEAP?

	%	Freq.
I worked alone (or alone with my research mentor)	25.0%	12
I worked with others in a shared laboratory or other space, but we work on different projects	16.7%	8
I worked alone on my project and I met with others regularly for general reporting or discussion	16.7%	8
I worked alone on a project that was closely connected with projects of others in my group	16.7%	8
I work with a group who all worked on the same project	25.0%	12
Total	**100%**	**48**

How SATISFIED were you with each of the following:

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
My working relationship with my mentor	0.0%	2.1%	4.2%	8.3%	85.4%	**48**	**4.77**	0.63
	0	1	2	4	41			
My working relationship with the group or team	2.1%	0.0%	4.2%	12.5%	81.3%	**48**	**4.71**	0.74
	1	0	2	6	39			
The amount of time I spent doing meaningful research	0.0%	0.0%	8.3%	18.8%	72.9%	**48**	**4.65**	0.64
	0	0	4	9	35			
The amount of time I spent with my research mentor	4.2%	2.1%	2.1%	20.8%	70.8%	**48**	**4.52**	0.97
	2	1	1	10	34			
The research experience overall	0.0%	0.0%	2.1%	18.8%	79.2%	**48**	**4.77**	0.47
	0	0	1	9	38			

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

The list below includes effective teaching and mentoring strategies. From the list, please indicate which strategies that your mentor(s) used when working with you in SEAP:

	Yes - my mentor used this strategy with me	No - my mentor did not use this strategy with me	n
Helped me become aware of STEM in my everyday life	66.7%	33.3%	**48**
	32	16	
Helped me understand how I can use STEM to improve my community	68.8%	31.3%	**48**
	33	15	
Used a variety of strategies to help me learn	81.3%	18.8%	**48**
	39	9	
Gave me extra support when I needed it	87.5%	12.5%	**48**
	42	6	
Encouraged me to share ideas with others who have different backgrounds or viewpoints than I do	63.8%	36.2%	**47**
	30	17	
Allowed me to work on a team project or activity	87.2%	12.8%	**47**
	41	6	
Helped me learn or practice a variety of STEM skills	93.8%	6.3%	**48**
	45	3	
Gave me feedback to help me improve in STEM	87.5%	12.5%	**48**
	42	6	
Talked to me about the education I need for a STEM career	68.8%	31.3%	**48**
	33	15	
Recommended Army Educational Outreach Programs that match my interests	50.0%	50.0%	**48**
	24	24	
Discussed STEM careers with the DoD or government	62.5%	37.5%	**48**
	30	18	

Which of the following statements apply to your research experience (choose all that apply)?

	%	Freq.
I presented a talk or poster to other students or faculty	65.2%	30
I presented a talk or poster at a professional symposium or conference	21.7%	10
I attended a symposium or conference	34.8%	16
I wrote or co-wrote a paper that was/will be published in a research journal	13.0%	6
I wrote or co-wrote a technical paper or patent	26.1%	12
I will present a talk or poster to other students or faculty	41.3%	19
I will present a talk or poster at a professional symposium or conference	17.4%	8
I will attend a symposium or conference	10.9%	5
I will write or co-write a paper that was/will be published in a research journal	15.2%	7
I will write or co-write a technical paper or patent	6.5%	3
I won an award or scholarship based on my research	10.9%	5

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	Extreme gain	n	Avg.	SD
In depth knowledge of a STEM topic(s)	0.0%	2.1%	25.0%	37.5%	35.4%	**48**	**4.06**	0.84
	0	1	12	18	17			
Knowledge of research conducted in a STEM topic or field	0.0%	0.0%	4.2%	47.9%	47.9%	**48**	**4.44**	0.58
	0	0	2	23	23			
Knowledge of research processes, ethics, and rules for conduct in STEM	0.0%	2.1%	8.3%	45.8%	43.8%	**48**	**4.31**	0.72
	0	1	4	22	21			
Knowledge of how scientists and engineers work on real problems in STEM	0.0%	2.1%	8.3%	39.6%	50.0%	**48**	**4.38**	0.73
	0	1	4	19	24			
Knowledge of what everyday research work is like in STEM	0.0%	0.0%	8.3%	35.4%	56.3%	**48**	**4.48**	0.65
	0	0	4	17	27			

Which category best describes the focus of your SEAP experience?

	%	Freq.
Science	64.6%	31
Technology	10.4%	5
Engineering	18.8%	9
Mathematics	6.3%	3
Total	**100%**	**48**

As a result of your SEAP experience, how much did you GAIN in your ability to do each of the following?

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	6.5%	19.4%	29.0%	32.3%	12.9%	**31**	**3.26**	1.12
	2	6	9	10	4			
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	9.7%	16.1%	29.0%	29.0%	16.1%	**31**	**3.26**	1.21
	3	5	9	9	5			
Making a model of an object or system showing its parts and how they work	45.2%	6.5%	16.1%	25.8%	6.5%	**31**	**2.42**	1.46
	14	2	5	8	2			
Designing procedures for an experiment that are appropriate for the question to be answered	19.4%	6.5%	9.7%	29.0%	35.5%	**31**	**3.55**	1.52
	6	2	3	9	11			
Identifying the limitations of the methods and tools used for data collection	9.7%	9.7%	16.1%	38.7%	25.8%	**31**	**3.61**	1.26
	3	3	5	12	8			
Carrying out procedures for an experiment and recording data accurately	3.2%	6.5%	9.7%	25.8%	54.8%	**31**	**4.23**	1.09
	1	2	3	8	17			
Using computer models of objects or systems to test cause and effect relationships	51.6%	12.9%	16.1%	6.5%	12.9%	**31**	**2.16**	1.46
	16	4	5	2	4			
Organizing data in charts or graphs to find patterns and relationships	19.4%	12.9%	16.1%	19.4%	32.3%	**31**	**3.32**	1.54
	6	4	5	6	10			
Considering different interpretations of data when deciding how the data answer a question	9.7%	6.5%	29.0%	32.3%	22.6%	**31**	**3.52**	1.21
	3	2	9	10	7			
Supporting an explanation for an observation with data from experiments	9.7%	9.7%	19.4%	29.0%	32.3%	**31**	**3.65**	1.31
	3	3	6	9	10			
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	16.1%	3.2%	22.6%	29.0%	29.0%	**31**	**3.52**	1.39
	5	1	7	9	9			
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	16.1%	3.2%	35.5%	22.6%	22.6%	**31**	**3.32**	1.33
	5	1	11	7	7			
Defending an argument that conveys how an explanation best describes an observation	19.4%	9.7%	25.8%	29.0%	16.1%	**31**	**3.13**	1.36
	6	3	8	9	5			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	12.9%	6.5%	22.6%	29.0%	29.0%	**31**	**3.55**	1.34
	4	2	7	9	9			
Integrating information from technical or scientific texts and other media to support your explanation of an observation	9.7%	9.7%	32.3%	22.6%	25.8%	**31**	**3.45**	1.26
	3	3	10	7	8			
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	0.0%	16.1%	19.4%	25.8%	38.7%	**31**	**3.87**	1.12
	0	5	6	8	12			

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 your ability to do each of the following?

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	5.9%	5.9%	5.9%	47.1%	35.3%	**17**	**4.00**	1.12
	1	1	1	8	6			
Using knowledge and creativity to propose a testable solution for a problem	0.0%	5.9%	23.5%	47.1%	23.5%	**17**	**3.88**	0.86
	0	1	4	8	4			
Making a model of an object or system to show its parts and how they work	5.9%	5.9%	29.4%	29.4%	29.4%	**17**	**3.71**	1.16
	1	1	5	5	5			
Designing procedures for an experiment that are appropriate for the question to be answered	0.0%	23.5%	11.8%	41.2%	23.5%	**17**	**3.65**	1.12
	0	4	2	7	4			
Identifying the limitations of the methods and tools used for data collection	0.0%	11.8%	29.4%	35.3%	23.5%	**17**	**3.71**	0.99
	0	2	5	6	4			
Carrying out procedures for an experiment and recording data accurately	0.0%	17.6%	0.0%	41.2%	41.2%	**17**	**4.06**	1.09
	0	3	0	7	7			
Using computer models of an object or system to investigate cause and effect relationships	17.6%	11.8%	11.8%	17.6%	41.2%	**17**	**3.53**	1.59
	3	2	2	3	7			
Considering different interpretations of the data when deciding if a solution works as intended	11.8%	5.9%	17.6%	35.3%	29.4%	**17**	**3.65**	1.32
	2	1	3	6	5			
Organizing data in charts or graphs to find patterns and relationships	11.8%	5.9%	5.9%	41.2%	35.3%	**17**	**3.82**	1.33
	2	1	1	7	6			
Supporting a solution for a problem with data from experiments	12.5%	12.5%	12.5%	37.5%	25.0%	**16**	**3.50**	1.37
	2	2	2	6	4			
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	0.0%	5.9%	17.6%	47.1%	29.4%	**17**	**4.00**	0.87
	0	1	3	8	5			
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0.0%	0.0%	23.5%	52.9%	23.5%	**17**	**4.00**	0.71
	0	0	4	9	4			
Defend an argument that conveys how a solution best meets design criteria	0.0%	23.5%	11.8%	29.4%	35.3%	**17**	**3.76**	1.20
	0	4	2	5	6			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	5.9%	23.5%	0.0%	35.3%	35.3%	**17**	**3.71**	1.36
	1	4	0	6	6			
Integrating information from technical or scientific texts and other media to support your solution to a problem	17.6%	17.6%	17.6%	23.5%	23.5%	**17**	**3.18**	1.47
	3	3	3	4	4			
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	0.0%	11.8%	11.8%	29.4%	47.1%	**17**	**4.12**	1.05
	0	2	2	5	8			

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 each of the skills/abilities listed below?

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Learning to work independently	2.1%	4.2%	16.7%	33.3%	43.8%	**48**	**4.13**	0.98
	1	2	8	16	21			
Setting goals and reflecting on performance	4.2%	10.4%	18.8%	31.3%	35.4%	**48**	**3.83**	1.15
	2	5	9	15	17			
Sticking with a task until it is finished	2.1%	8.3%	14.6%	39.6%	35.4%	**48**	**3.98**	1.02
	1	4	7	19	17			
Making changes when things do not go as planned	4.2%	4.2%	10.4%	35.4%	45.8%	**48**	**4.15**	1.05
	2	2	5	17	22			
Working well with people from all backgrounds	6.3%	6.3%	22.9%	29.2%	35.4%	**48**	**3.81**	1.18
	3	3	11	14	17			
Including others' perspectives when making decisions	10.4%	8.3%	31.3%	18.8%	31.3%	**48**	**3.52**	1.30
	5	4	15	9	15			
Communicating effectively with others	0.0%	10.4%	16.7%	35.4%	37.5%	**48**	**4.00**	0.99
	0	5	8	17	18			
Viewing failure as an opportunity to learn	6.3%	6.3%	18.8%	25.0%	43.8%	**48**	**3.94**	1.21
	3	3	9	12	21			

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?

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Interest in a new STEM topic	6.3%	14.6%	14.6%	31.3%	33.3%	**48**	**3.71**	1.25
	3	7	7	15	16			
Deciding on a path to pursue a STEM career	8.3%	10.4%	14.6%	29.2%	37.5%	**48**	**3.77**	1.29
	4	5	7	14	18			
Sense of accomplishing something in STEM	2.1%	6.3%	16.7%	16.7%	58.3%	**48**	**4.23**	1.08
	1	3	8	8	28			
Feeling prepared for more challenging STEM activities	0.0%	4.2%	14.6%	29.2%	52.1%	**48**	**4.29**	0.87
	0	2	7	14	25			
Confidence to try out new ideas or procedures on my own in a STEM project	2.1%	8.3%	14.6%	29.2%	45.8%	**48**	**4.08**	1.07
	1	4	7	14	22			
Patience for the slow pace of STEM research	4.2%	8.3%	18.8%	35.4%	33.3%	**48**	**3.85**	1.11
	2	4	9	17	16			
Desire to build relationships with mentors who work in STEM	2.1%	6.3%	12.5%	35.4%	43.8%	**48**	**4.13**	1.00
	1	3	6	17	21			
Connecting a STEM topic or field to my personal values	8.3%	4.2%	16.7%	33.3%	37.5%	**48**	**3.88**	1.21
	4	2	8	16	18			

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, are you MORE or LESS likely 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	n	Avg.	SD
Watch or read non-fiction STEM	2.1%	0.0%	50.0%	33.3%	14.6%	**48**	**3.58**	0.82
	1	0	24	16	7			
Tinker (play) with a mechanical or electrical device	4.2%	0.0%	47.9%	20.8%	27.1%	**48**	**3.67**	1.02
	2	0	23	10	13			
Work on solving mathematical or scientific puzzles	4.2%	0.0%	50.0%	22.9%	22.9%	**48**	**3.60**	0.98
	2	0	24	11	11			
Use a computer to design or program something	4.2%	4.2%	54.2%	14.6%	22.9%	**48**	**3.48**	1.03
	2	2	26	7	11			
Talk with friends or family about STEM	0.0%	0.0%	31.3%	37.5%	31.3%	**48**	**4.00**	0.80
	0	0	15	18	15			
Mentor or teach other students about STEM	0.0%	2.1%	22.9%	41.7%	33.3%	**48**	**4.06**	0.81
	0	1	11	20	16			
Help with a community service project related to STEM	0.0%	0.0%	35.4%	35.4%	29.2%	**48**	**3.94**	0.81
	0	0	17	17	14			
Participate in a STEM camp, club, or competition	0.0%	0.0%	35.4%	29.2%	35.4%	**48**	**4.00**	0.85
	0	0	17	14	17			
Take an elective (not required) STEM class	4.2%	0.0%	29.2%	29.2%	37.5%	**48**	**3.96**	1.03
	2	0	14	14	18			
Work on a STEM project or experiment in a university or professional setting	0.0%	2.1%	16.7%	33.3%	47.9%	**48**	**4.27**	0.82
	0	1	8	16	23			

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

Before you participated in SEAP, how far did you want to go in school?

	%	Freq.
Graduate from high school	6.3%	3
Go to a trade or vocational school	0.0%	0
Go to college for a little while	0.0%	0
Finish college (get a Bachelor's degree)	6.3%	3
Get more education after college	6.3%	3
Get a master's degree	37.5%	18
Get a Ph.D.	18.8%	9
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	8.3%	4
Get a combined M.D. / Ph.D.	12.5%	6
Get another professional degree (law, business, etc.)	4.2%	2
Total	**100%**	**48**

After you have participated in SEAP, how far do you want to go in school?

	%	Freq.
Graduate from high school	2.1%	1
Go to a trade or vocational school	0.0%	0
Go to college for a little while	0.0%	0
Finish college (get a Bachelor's degree)	4.2%	2
Get more education after college	6.3%	3
Get a master's degree	31.3%	15
Get a Ph.D.	20.8%	10
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	14.6%	7
Get a combined M.D. / Ph.D.	16.7%	8
Get another professional degree (law, business, etc.)	4.2%	2
Total	**100%**	**48**

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

	%	Freq.
not at all	0.0%	0
up to 25% of the time	0.0%	0
up to 50% of the time	8.3%	4
up to 75% of the time	35.4%	17
up to 100% of the time	56.3%	27
Total	**100%**	48

Before you participated in SEAP, what kind of work did you want to do when you are 30? (select one)

	%	Freq.
Undecided	8.5%	4
Science (no specific subject)	6.4%	3
Physical science (physics, chemistry, astronomy, materials science)	2.1%	1
Biological science	6.4%	3
Earth, atmospheric or oceanic science	0.0%	0
Environmental science	6.4%	3
Computer science	4.3%	2
Technology	2.1%	1
Engineering	31.9%	15
Mathematics or statistics	0.0%	0
Medicine (doctor, dentist, veterinarian, etc.)	19.1%	9
Health (nursing, pharmacy, technician, etc.)	0.0%	0
Social science (psychologist, sociologist, etc.)	4.3%	2
Teaching, STEM	0.0%	0
Teaching, non-STEM	0.0%	0
Business	0.0%	0
Law	2.1%	1
Military, police, or security	0.0%	0
Art (writing, dancing, painting, etc.)	2.1%	1
Skilled trade (carpenter, electrician, plumber, etc.)	0.0%	0
Other, (specify):	4.3%	2
Total	**100%**	**47**

Note: Before SEAP Other = Biomedical Engineering/Research; Criminal justice/forensics.
After SEAP Other = Biomedical Engineering/Research; Criminal justice/forensics; Epidemiology; Bioinformatics or MD/PHD Researcher/Doctor; 3-D Scanning

After you participated in SEAP, what kind of work do you want to do when you are 30? (select one)

	%	Freq.
Undecided	8.7%	4
Science (no specific subject)	6.5%	3
Physical science (physics, chemistry, astronomy, materials science)	4.3%	2
Biological science	4.3%	2
Earth, atmospheric or oceanic science	2.2%	1
Environmental science	4.3%	2
Computer science	2.2%	1
Technology	0.0%	0
Engineering	34.8%	16
Mathematics or statistics	2.2%	1
Medicine (doctor, dentist, veterinarian, etc.)	19.6%	9
Health (nursing, pharmacy, technician, etc.)	0.0%	0
Social science (psychologist, sociologist, etc.)	0.0%	0
Teaching, STEM	0.0%	0
Teaching, non-STEM	0.0%	0
Business	0.0%	0
Law	0.0%	0
Military, police, or security	0.0%	0
Art (writing, dancing, painting, etc.)	0.0%	0
Skilled trade (carpenter, electrician, plumber, etc.)	0.0%	0
Other, (specify):	10.9%	5
Total	100%	46

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

	I've never heard of this program	Not at all	A little	Somewhat	Very much	n	Avg.	SD
UNITE	80.4%	2.2%	4.3%	4.3%	8.7%	**46**	**1.59**	1.29
	37	1	2	2	4			
Junior Science & Humanities Symposium (JSHS)	76.1%	6.5%	6.5%	2.2%	8.7%	**46**	**1.61**	1.26
	35	3	3	1	4			
Science & Engineering Apprenticeship Program (SEAP)	4.3%	6.5%	8.7%	13.0%	67.4%	**46**	**4.33**	1.16
	2	3	4	6	31			
Research & Engineering Apprenticeship Program (REAP)	65.2%	4.3%	8.7%	4.3%	17.4%	**46**	**2.04**	1.59
	30	2	4	2	8			
High School Apprenticeship Program (HSAP)	60.9%	15.2%	0.0%	6.5%	17.4%	**46**	**2.04**	1.58
	28	7	0	3	8			
College Qualified Leaders (CQL)	17.0%	2.1%	8.5%	21.3%	51.1%	**47**	**3.87**	1.50
	8	1	4	10	24			
GEMS Near Peer Mentor Program	38.3%	8.5%	17.0%	12.8%	23.4%	**47**	**2.74**	1.63
	18	4	8	6	11			
Undergraduate Research Apprenticeship Program (URAP)	53.3%	2.2%	4.4%	15.6%	24.4%	**45**	**2.56**	1.78
	24	1	2	7	11			
Science Mathematics, and Research for Transformation (SMART) College Scholarship	41.3%	2.2%	4.3%	10.9%	41.3%	**46**	**3.09**	1.87
	19	1	2	5	19			
National Defense Science & Engineering Graduate (NDSEG) Fellowship	61.7%	2.1%	4.3%	17.0%	14.9%	**47**	**2.21**	1.64
	29	1	2	8	7			

Note. Response scale: 0 = "I've never heard of this program," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much."

How many jobs/careers in STEM did you learn about during SEAP?

	%	Freq.
None	0.0%	0
1	6.3%	3
2	12.5%	6
3	22.9%	11
4	12.5%	6
5 or more	45.8%	22
Total	**100%**	48

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

	%	Freq.
None	8.3%	4
1	4.2%	2
2	8.3%	4
3	20.8%	10
4	22.9%	11
5 or more	35.4%	17
Total	**100%**	**48**

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

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Response Total	Avg.	SD
DoD researchers advance science and engineering fields	0.0%	0.0%	6.3%	41.7%	52.1%	**48**	**4.46**	0.62
	0	0	3	20	25			
DoD researchers develop new, cutting edge technologies	0.0%	2.1%	8.3%	39.6%	50.0%	**48**	**4.38**	0.73
	0	1	4	19	24			
DoD researchers solve real-world problems	0.0%	0.0%	8.3%	35.4%	56.3%	**48**	**4.48**	0.65
	0	0	4	17	27			
DoD research is valuable to society	0.0%	0.0%	4.2%	31.3%	64.6%	**48**	**4.60**	0.57
	0	0	2	15	31			

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 the SEAP program?

	Disagree - This did not happen	Disagree - This happened but not because of SEAP	Agree - SEAP contributed	Agree - SEAP was primary reason	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	0.0%	2.1%	62.5%	35.4%	**48**	**3.33**	0.52
	0	1	30	17			
I am more interested in participating in STEM activities outside of school requirements	6.3%	8.3%	58.3%	27.1%	**48**	**3.06**	0.78
	3	4	28	13			
I am more aware of other AEOPs	18.8%	8.3%	41.7%	31.3%	**48**	**2.85**	1.07
	9	4	20	15			
I am more interested in participating in other AEOPs	10.6%	6.4%	51.1%	31.9%	**47**	**3.04**	0.91
	5	3	24	15			
I am more interested in taking STEM classes in school	4.2%	27.1%	50.0%	18.8%	**48**	**2.83**	0.78
	2	13	24	9			
I am more interested in earning a STEM degree	2.1%	20.8%	52.1%	25.0%	**48**	**3.00**	0.74
	1	10	25	12			
I am more interested in pursuing a career in STEM	2.1%	16.7%	62.5%	18.8%	**48**	**2.98**	0.67
	1	8	30	9			
I am more aware of Army or DoD STEM research and careers	2.1%	8.3%	47.9%	41.7%	**48**	**3.29**	0.71
	1	4	23	20			
I have a greater appreciation of Army or DoD STEM research	0.0%	6.3%	45.8%	47.9%	**48**	**3.42**	0.61
	0	3	22	23			
I am more interested in pursuing a STEM career with the Army or DoD	12.5%	4.2%	52.1%	31.3%	**48**	**3.02**	0.93
	6	2	25	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

FY15 SEAP Mentor Questionnaire Data Summaries

SEAP Mentor Data Summary

How many SEAP students did you work with this year?

# of Students	%	Freq.
1	71%	15
2	24%	5
3	5%	1
Total	**100%**	**21**

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

	%	Freq.
No organization	0.0%	0
School or district (K-12)	0.0%	0
State educational agency	0.0%	0
Institution of higher education (vocational school, junior college, college, or university)	0.0%	0
Private Industry	0.0%	0
Department of Defense or other government agency	100.0%	24
Non-profit	0.0%	0
Other, (specify)	0.0%	0
Total	**100%**	**24**

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

	%	Freq.
Physical science (physics, chemistry, astronomy, materials science, etc.)	17.4%	4
Biological science	26.1%	6
Earth, atmospheric, or oceanic science	0.0%	0
Environmental science	17.4%	4
Computer science	0.0%	0
Technology	0.0%	0
Engineering	30.4%	7
Mathematics or statistics	0.0%	0
Medical, health, or behavioral science	0.0%	0
Social Science (psychology, sociology, anthropology)	0.0%	0
Other, (specify):	8.7%	2
Total	**100%**	**23**

At which of the following SEAP sites did you participate? (Select ONE)

	%	Freq.
ALABAMA – U.S. Army Aviation & Missile Research, Development & Engineering Center (AMRDEC) - Redstone, AL	37.5%	9
ILLINOIS – U.S. Army Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL) - Champaign, IL	20.8%	5
MARYLAND – U.S. Army Research Laboratory (ARL) - Aberdeen Proving Ground, MD	0.0%	0
MARYLAND - U.S. Army Research Laboratory – Adelphi, MD	0.0%	0
MARYLAND – U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) – Aberdeen Proving Ground/Edgewood, MD	0.0%	0
MARYLAND – U.S. Army Center for Environmental Health Research (USACEHR) – Fort Detrick, MD	0.0%	0
MARYLAND – U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) – Fort Detrick, MD	33.3%	8
MARYLAND – U.S. Army Medical Research and Materiel Command – Walter Reed Army Institute of Research (WRAIR) – Silver Spring, MD	0.0%	0
MISSISSIPPI – U.S. Army Engineer Research & Development Center (ERDC) – Vicksburg, MS	0.0%	0
VIRGINIA – U.S. Army Engineer Research & Development Center – Geospatial Research Laboratory (ERDC-GRL) – Alexandria, VA	8.3%	2
Total	**100%**	**24**

Which of the following BEST describes your role during SEAP?

	%	Freq.
Research Mentor	100.0%	24
Research Team Member but not a Principal Investigator (PI)	0.0%	0
Other, (specify):	0.0%	0
Total	**100%**	**24**

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

	%	Freq.
Army Educational Outreach Program (AEOP) website	21.7%	5
AEOP on Facebook, Twitter, Pinterest, or other social media	0.0%	0
A STEM conference or STEM education conference	0.0%	0
An email or newsletter from school, university, or a professional organization	0.0%	0
Past SEAP participant	30.4%	7
A student	0.0%	0
A colleague	4.3%	1
My supervisor or superior	21.7%	5
A SEAP site host or director	13.0%	3
Workplace communications	43.5%	10
Someone who works with the Department of Defense (Army, Navy, Air Force)	0.0%	0
Other, (specify):	0.0%	0
Total	**100%**	**31**

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	I've never heard of this program	n
Camp Invention	68.4%	0.0%	0.0%	0.0%	31.6%	**19**
	13	0	0	0	6	
eCYBERMISSION	68.4%	0.0%	5.3%	0.0%	26.3%	**19**
	13	0	1	0	5	
Junior Solar Sprint (JSS)	68.4%	0.0%	0.0%	0.0%	31.6%	**19**
	13	0	0	0	6	
West Point Bridge Design Contest (WPBDC)	63.2%	0.0%	0.0%	0.0%	36.8%	**19**
	12	0	0	0	7	
Junior Science & Humanities Symposium (JSHS)	57.9%	10.5%	0.0%	0.0%	31.6%	**19**
	11	2	0	0	6	
Gains in the Education of Mathematics and Science (GEMS)	65.0%	10.0%	0.0%	15.0%	10.0%	**20**
	13	2	0	3	2	
GEMS Near Peers	73.7%	0.0%	5.3%	5.3%	15.8%	**19**
	14	0	1	1	3	
UNITE	61.1%	0.0%	0.0%	0.0%	38.9%	**18**
	11	0	0	0	7	
Science & Engineering Apprenticeship Program (SEAP)	16.7%	29.2%	25.0%	25.0%	4.2%	**24**
	4	7	6	6	1	
Research & Engineering Apprenticeship Program (REAP)	63.2%	0.0%	0.0%	0.0%	36.8%	**19**
	12	0	0	0	7	
High School Apprenticeship Program (HSAP)	52.6%	5.3%	5.3%	0.0%	36.8%	**19**
	10	1	1	0	7	
College Qualified Leaders (CQL)	61.9%	9.5%	0.0%	14.3%	14.3%	**21**
	13	2	0	3	3	
Undergraduate Research Apprenticeship Program (URAP)	63.2%	0.0%	0.0%	0.0%	36.8%	**19**
	12	0	0	0	7	
Science Mathematics, and Research for Transformation (SMART) College Scholarship	61.1%	5.6%	16.7%	0.0%	16.7%	**18**
	11	1	3	0	3	
National Defense Science & Engineering Graduate (NDSEG) Fellowship	63.2%	0.0%	0.0%	5.3%	31.6%	**19**
	12	0	0	1	6	

Note. Response scale: 0 = "I've never heard of this program," 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)

	%	Freq.
Applications from American Society for Engineering Education (ASEE) or the AEOP	29.2%	7
Personal acquaintance(s) (friend, family, neighbor, etc.)	16.7%	4
Colleague(s) in my workplace	33.3%	8
K-12 school teacher(s) outside of my workplace	4.2%	1
University faculty outside of my workplace	4.2%	1
Informational materials sent to K-12 schools or Universities outside of my workplace	4.2%	1
Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)	8.3%	2
Communication(s) generated by a university or faculty (newsletter, email blast, website)	0.0%	0
STEM or STEM Education conference(s) or event(s)	4.2%	1
Organization(s) that serve underserved or underrepresented populations	0.0%	0
The student contacted me (the mentor) about the program	16.7%	4
I do not know how student(s) were recruited for SEAP	29.2%	7
Other, (specify):	12.5%	3
Total	**100%**	**39**

How SATISFIED were you with the following SEAP features?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Application or registration process	29.2%	0.0%	12.5%	29.2%	29.2%	**24**	**3.29**	1.63
	7	0	3	7	7			
Other administrative tasks (in-processing, network access, etc.)	25.0%	8.3%	16.7%	29.2%	20.8%	**24**	**3.13**	1.51
	6	2	4	7	5			
Communicating with American Society for Engineering Education (ASEE)	87.5%	0.0%	0.0%	8.3%	4.2%	**24**	**1.42**	1.14
	21	0	0	2	1			
Communicating with SEAP organizers	13.6%	0.0%	22.7%	18.2%	45.5%	**22**	**3.82**	1.40
	3	0	5	4	10			
Support for instruction or mentorship during program activities	25.0%	0.0%	8.3%	20.8%	45.8%	**24**	**3.63**	1.66
	6	0	2	5	11			
Stipends (payment)	66.7%	0.0%	8.3%	8.3%	16.7%	**24**	**2.08**	1.64
	16	0	2	2	4			
Research abstract preparation requirements	16.7%	8.3%	8.3%	33.3%	33.3%	**24**	**3.58**	1.47
	4	2	2	8	8			
Research presentation process	4.2%	4.2%	12.5%	37.5%	41.7%	**24**	**4.08**	1.06
	1	1	3	9	10			

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
Become familiar with my student(s) background and interests at the beginning of the SEAP experience	100.0% 24	0.0% 0	**24**
Giving students real-life problems to investigate or solve	100.0% 24	0.0% 0	**24**
Selecting readings or activities that relate to students' backgrounds	79.2% 19	20.8% 5	**24**
Encouraging students to suggest new readings, activities, or projects	66.7% 16	33.3% 8	**24**
Helping students become aware of the role(s) that STEM plays in their everyday lives	70.8% 17	29.2% 7	**24**
Helping students understand how STEM can help them improve their own community	58.3% 14	41.7% 10	**24**
Asking students to relate real-life events or activities to topics covered in SEAP	79.2% 19	20.8% 5	**24**

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
Identify the different learning styles that my student (s) may have at the beginning of the SEAP experience	79.2% 19	20.8% 5	**24**
Interact with students and other personnel the same way regardless of their background	79.2% 19	20.8% 5	**24**
Use a variety of teaching and/or mentoring activities to meet the needs of all students	100.0% 24	0.0% 0	**24**
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	41.7% 10	58.3% 14	**24**
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	70.8% 17	29.2% 7	**24**
Directing students to other individuals or programs for additional support as needed	79.2% 19	20.8% 5	**24**
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	37.5% 9	62.5% 15	**24**

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
Having my student(s) tell other people about their backgrounds and interests	58.3% 14	41.7% 10	**24**
Having my student(s) explain difficult ideas to others	87.5% 21	12.5% 3	**24**
Having my student(s) listen to the ideas of others with an open mind	91.7% 22	8.3% 2	**24**
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	73.9% 17	26.1% 6	**23**
Having my student(s) give and receive constructive feedback with others	87.5% 21	12.5% 3	**24**
Having students work on collaborative activities or projects as a member of a team	87.5% 21	12.5% 3	**24**
Allowing my student(s) to resolve conflicts and reach agreement within their team	58.3% 14	41.7% 10	**24**

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
Teaching (or assigning readings) about specific STEM subject matter	79.2% 19	20.8% 5	24
Having my student(s) search for and review technical research to support their work	79.2% 19	20.8% 5	24
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	91.7% 22	8.3% 2	24
Supervising my student(s) while they practice STEM research skills	91.7% 22	8.3% 2	24
Providing my student(s) with constructive feedback to improve their STEM competencies	91.7% 22	8.3% 2	24
Allowing students to work independently to improve their self-management abilities	91.7% 22	8.3% 2	24
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	70.8% 17	29.2% 7	24
Encouraging students to seek support from other team members	83.3% 20	16.7% 4	24

This list 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 this list, 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
Asking my student(s) about their educational and/or career goals	95.8% 23	4.2% 1	**24**
Recommending extracurricular programs that align with students' goals	66.7% 16	33.3% 8	**24**
Recommending Army Educational Outreach Programs that align with students' goals	45.8% 11	54.2% 13	**24**
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	83.3% 20	16.7% 4	**24**
Discussing STEM career opportunities within the DoD or other government agencies	73.9% 17	26.1% 6	**23**
Discussing STEM career opportunities in private industry or academia	75.0% 18	25.0% 6	**24**
Discussing the economic, political, ethical, and/or social context of a STEM career	45.8% 11	54.2% 13	**24**
Recommending student and professional organizations in STEM to my student(s)	50.0% 12	50.0% 12	**24**
Helping students build a professional network in a STEM field	66.7% 16	33.3% 8	**24**
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	79.2% 19	20.8% 5	**24**

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	n	Avg.	SD
Army Educational Outreach Program (AEOP) website	58.3%	4.2%	12.5%	20.8%	4.2%	**24**	**2.08**	1.41
	14	1	3	5	1			
AEOP on Facebook, Twitter, Pinterest or other social media	95.8%	0.0%	4.2%	0.0%	0.0%	**24**	**1.08**	0.41
	23	0	1	0	0			
AEOP brochure	75.0%	0.0%	8.3%	16.7%	0.0%	**24**	**1.67**	1.20
	18	0	2	4	0			
It Starts Here! Magazine	100.0%	0.0%	0.0%	0.0%	0.0%	**23**	**1.00**	0.00
	23	0	0	0	0			
SEAP Program administrator or site coordinator	37.5%	0.0%	20.8%	20.8%	20.8%	**24**	**2.88**	1.62
	9	0	5	5	5			
Invited speakers or "career" events	62.5%	4.2%	8.3%	16.7%	8.3%	**24**	**2.04**	1.49
	15	1	2	4	2			
Participation in SEAP	25.0%	0.0%	8.3%	25.0%	41.7%	**24**	**3.58**	1.64
	6	0	2	6	10			

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

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	n	Avg.	SD
Army Educational Outreach Program (AEOP) website	62.5% 15	0.0% 0	4.2% 1	29.2% 7	4.2% 1	**24**	**2.13**	1.51
AEOP on Facebook, Twitter, Pinterest or other social media	95.8% 23	0.0% 0	0.0% 0	4.2% 1	0.0% 0	**24**	**1.13**	0.61
AEOP brochure	83.3% 20	0.0% 0	0.0% 0	16.7% 4	0.0% 0	**24**	**1.50**	1.14
It Starts Here! Magazine	95.8% 23	0.0% 0	0.0% 0	4.2% 1	0.0% 0	**24**	**1.13**	0.61
SEAP Program administrator or site coordinator	33.3% 8	0.0% 0	16.7% 4	33.3% 8	16.7% 4	**24**	**3.00**	1.56
Invited speakers or "career" events	58.3% 14	0.0% 0	8.3% 2	25.0% 6	8.3% 2	**24**	**2.25**	1.57
Participation in SEAP	25.0% 6	0.0% 0	8.3% 2	33.3% 8	33.3% 8	**24**	**3.50**	1.59

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? (check ALL that apply)

	Yes - I discussed this program with my student(s)	No - I did not discuss this program with my student(s)	n
Gains in the Education of Mathematics and Science (GEMS)	33.3% 7	66.7% 14	**21**
UNITE	0.0% 0	100.0% 22	**22**
Junior Science & Humanities Symposium (JSHS)	0.0% 0	100.0% 22	**22**
Science & Engineering Apprenticeship Program (SEAP)	81.8% 18	18.2% 4	**22**
Research & Engineering Apprenticeship Program (REAP)	9.1% 2	90.9% 20	**22**
High School Apprenticeship Program (HSAP)	4.5% 1	95.5% 21	**22**
College Qualified Leaders (CQL)	50.0% 11	50.0% 11	**22**
GEMS Near Peer Mentor Program	9.1% 2	90.9% 20	**22**
Undergraduate Research Apprenticeship Program (URAP)	4.5% 1	95.5% 21	**22**
Science Mathematics, and Research for Transformation (SMART) College Scholarship	38.1% 8	61.9% 13	**21**
National Defense Science & Engineering Graduate (NDSEG) Fellowship	4.5% 1	95.5% 21	**22**
I discussed AEOP with my student(s) but did not discuss any specific program	31.8% 7	68.2% 15	**22**

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

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n	Avg.	SD
DoD researchers advance science and engineering fields	4.2%	0.0%	4.2%	54.2%	37.5%	**24**	**4.21**	0.88
	1	0	1	13	9			
DoD researchers develop new, cutting edge technologies	4.2%	4.2%	4.2%	50.0%	37.5%	**24**	**4.13**	0.99
	1	1	1	12	9			
DoD researchers solve real-world problems	4.2%	0.0%	8.3%	33.3%	54.2%	**24**	**4.33**	0.96
	1	0	2	8	13			
DoD research is valuable to society	4.2%	0.0%	8.3%	33.3%	54.2%	**24**	**4.33**	0.96
	1	0	2	8	13			

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

	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Learn new science, technology, engineering, or mathematics (STEM) topics	0.0%	0.0%	13.0%	43.5%	43.5%	**23**	**4.30**	0.70
	0	0	3	10	10			
Apply STEM knowledge to real-life situations	0.0%	13.0%	26.1%	30.4%	30.4%	**23**	**3.78**	1.04
	0	3	6	7	7			
Learn about new discoveries in STEM	4.3%	17.4%	30.4%	30.4%	17.4%	**23**	**3.39**	1.12
	1	4	7	7	4			
Learn about different careers that use STEM	4.3%	17.4%	26.1%	34.8%	17.4%	**23**	**3.43**	1.12
	1	4	6	8	4			
Interact with scientists or engineers	0.0%	0.0%	13.0%	17.4%	69.6%	**23**	**4.57**	0.73
	0	0	3	4	16			
Communicate with other students about STEM	4.5%	0.0%	18.2%	45.5%	31.8%	**22**	**4.00**	0.98
	1	0	4	10	7			
Use laboratory or field techniques, procedures, and tools	4.3%	0.0%	8.7%	30.4%	56.5%	**23**	**4.35**	0.98
	1	0	2	7	13			
Participate in hands-on STEM activities	0.0%	0.0%	8.7%	30.4%	60.9%	**23**	**4.52**	0.67
	0	0	2	7	14			
Work as part of a team	4.3%	4.3%	13.0%	34.8%	43.5%	**23**	**4.09**	1.08
	1	1	3	8	10			
Identify questions or problems to investigate	0.0%	0.0%	13.0%	47.8%	39.1%	**23**	**4.26**	0.69
	0	0	3	11	9			
Design an investigation	8.7%	8.7%	26.1%	30.4%	26.1%	**23**	**3.57**	1.24
	2	2	6	7	6			
Carry out an investigation	0.0%	8.7%	26.1%	26.1%	39.1%	**23**	**3.96**	1.02
	0	2	6	6	9			
Analyze data or information	0.0%	0.0%	21.7%	39.1%	39.1%	**23**	**4.17**	0.78
	0	0	5	9	9			
Draw conclusions from an investigation	0.0%	0.0%	30.4%	34.8%	34.8%	**23**	**4.04**	0.82
	0	0	7	8	8			
Come up with creative explanations or solutions	0.0%	8.7%	30.4%	34.8%	26.1%	**23**	**3.78**	0.95
	0	2	7	8	6			
Build or make a computer model	56.5%	13.0%	8.7%	13.0%	8.7%	**23**	**2.04**	1.43
	13	3	2	3	2			

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
In depth knowledge of a STEM topic(s)	0.0% 0	8.3% 2	12.5% 3	70.8% 17	8.3% 2	**24**	**3.79**	0.72
Knowledge of research conducted in a STEM topic or field	0.0% 0	4.2% 1	12.5% 3	75.0% 18	8.3% 2	**24**	**3.88**	0.61
Knowledge of research processes, ethics, and rules for conduct in STEM	0.0% 0	4.2% 1	20.8% 5	58.3% 14	16.7% 4	**24**	**3.88**	0.74
Knowledge of how professionals work on real problems in STEM	0.0% 0	4.2% 1	12.5% 3	75.0% 18	8.3% 2	**24**	**3.88**	0.61
Knowledge of what everyday research work is like in STEM	0.0% 0	4.3% 1	17.4% 4	65.2% 15	13.0% 3	**23**	**3.87**	0.69

Which category best describes the focus of your student(s) SEAP activities?

	%	Freq.
Science	54.2%	13
Technology	8.3%	2
Engineering	37.5%	9
Mathematics	0.0%	0
Total	100%	24

AS A RESULT OF THEIR SEAP EXPERIENCE, how much did your student(s) GAIN in their abilities to do each of the following?

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	0.0%	0.0%	53.8%	46.2%	0.0%	**13**	**3.46**	0.52
	0	0	7	6	0			
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	0.0%	0.0%	46.2%	53.8%	0.0%	**13**	**3.54**	0.52
	0	0	6	7	0			
Making a model of an object or system showing its parts and how they work	7.7%	7.7%	46.2%	38.5%	0.0%	**13**	**3.15**	0.90
	1	1	6	5	0			
Designing procedures for an experiment that are appropriate for the question to be answered	0.0%	0.0%	38.5%	53.8%	7.7%	**13**	**3.69**	0.63
	0	0	5	7	1			
Identifying the limitations of the methods and tools used for data collection	0.0%	7.7%	46.2%	30.8%	15.4%	**13**	**3.54**	0.88
	0	1	6	4	2			
Carrying out procedures for an experiment and recording data accurately	0.0%	0.0%	33.3%	41.7%	25.0%	**12**	**3.92**	0.79
	0	0	4	5	3			
Using computer models of objects or systems to test cause and effect relationships	15.4%	0.0%	53.8%	30.8%	0.0%	**13**	**3.00**	1.00
	2	0	7	4	0			
Organizing data in charts or graphs to find patterns and relationships	15.4%	7.7%	23.1%	46.2%	7.7%	**13**	**3.23**	1.24
	2	1	3	6	1			
Considering different interpretations of data when deciding how the data answer a question	0.0%	7.7%	46.2%	38.5%	7.7%	**13**	**3.46**	0.78
	0	1	6	5	1			
Supporting an explanation for an observation with data from experiments	0.0%	0.0%	66.7%	25.0%	8.3%	**12**	**3.42**	0.67
	0	0	8	3	1			
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	0.0%	7.7%	46.2%	38.5%	7.7%	**13**	**3.46**	0.78
	0	1	6	5	1			
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	0.0%	7.7%	46.2%	38.5%	7.7%	**13**	**3.46**	0.78
	0	1	6	5	1			
Defending an argument that conveys how an explanation best describes an observation	0.0%	23.1%	46.2%	30.8%	0.0%	**13**	**3.08**	0.76
	0	3	6	4	0			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0.0%	15.4%	38.5%	38.5%	7.7%	**13**	**3.38**	0.87
	0	2	5	5	1			
Integrating information from technical or scientific texts and other media to support your explanation of an observation	0.0%	15.4%	46.2%	30.8%	7.7%	**13**	**3.31**	0.85
	0	2	6	4	1			
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	0.0%	0.0%	46.2%	30.8%	23.1%	**13**	**3.77**	0.83
	0	0	6	4	3			

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

AS A RESULT OF THEIR SEAP EXPERIENCE, how much did your student(s) GAIN in their ability to do each of the following?

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	0.0%	0.0%	30.0%	50.0%	20.0%	**10**	**3.90**	0.74
	0	0	3	5	2			
Using knowledge and creativity to propose a testable solution for a problem	0.0%	0.0%	33.3%	44.4%	22.2%	**9**	**3.89**	0.78
	0	0	3	4	2			
Making a model of an object or system to show its parts and how they work	10.0%	0.0%	30.0%	40.0%	20.0%	**10**	**3.60**	1.17
	1	0	3	4	2			
Designing procedures for an experiment that are appropriate for the question to be answered	0.0%	0.0%	30.0%	50.0%	20.0%	**10**	**3.90**	0.74
	0	0	3	5	2			
Identifying the limitations of the methods and tools used for data collection	0.0%	0.0%	30.0%	50.0%	20.0%	**10**	**3.90**	0.74
	0	0	3	5	2			
Carrying out procedures for an experiment and recording data accurately	10.0%	0.0%	10.0%	40.0%	40.0%	**10**	**4.00**	1.25
	1	0	1	4	4			
Using computer models of an object or system to investigate cause and effect relationships	20.0%	20.0%	10.0%	40.0%	10.0%	**10**	**3.00**	1.41
	2	2	1	4	1			
Considering different interpretations of the data when deciding if a solution works as intended	0.0%	10.0%	30.0%	40.0%	20.0%	**10**	**3.70**	0.95
	0	1	3	4	2			
Organizing data in charts or graphs to find patterns and relationships	20.0%	0.0%	30.0%	40.0%	10.0%	**10**	**3.20**	1.32
	2	0	3	4	1			
Supporting a solution for a problem with data from experiments	10.0%	0.0%	10.0%	60.0%	20.0%	**10**	**3.80**	1.14
	1	0	1	6	2			
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	0.0%	10.0%	10.0%	50.0%	30.0%	**10**	**4.00**	0.94
	0	1	1	5	3			
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0.0%	0.0%	40.0%	50.0%	10.0%	**10**	**3.70**	0.67
	0	0	4	5	1			
Defend an argument that conveys how a solution best meets design criteria	0.0%	10.0%	30.0%	40.0%	20.0%	**10**	**3.70**	0.95
	0	1	3	4	2			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0.0%	0.0%	60.0%	30.0%	10.0%	**10**	**3.50**	0.71
	0	0	6	3	1			
Integrating information from technical or scientific texts and other media to support your solution to a problem	0.0%	0.0%	30.0%	60.0%	10.0%	**10**	**3.80**	0.63
	0	0	3	6	1			
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	0.0%	10.0%	40.0%	30.0%	20.0%	**10**	**3.60**	0.97
	0	1	4	3	2			

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 skills/abilities listed below?

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Learning to work independently	0.0%	0.0%	26.1%	56.5%	17.4%	**23**	**3.91**	0.67
	0	0	6	13	4			
Setting goals and reflecting on performance	0.0%	8.7%	30.4%	43.5%	17.4%	**23**	**3.70**	0.88
	0	2	7	10	4			
Sticking with a task until it is finished	0.0%	8.7%	17.4%	52.2%	21.7%	**23**	**3.87**	0.87
	0	2	4	12	5			
Making changes when things do not go as planned	0.0%	13.0%	8.7%	47.8%	30.4%	**23**	**3.96**	0.98
	0	3	2	11	7			
Including others' perspectives when making decisions	4.5%	4.5%	27.3%	40.9%	22.7%	**22**	**3.73**	1.03
	1	1	6	9	5			
Communicating effectively with others	0.0%	4.3%	26.1%	52.2%	17.4%	**23**	**3.83**	0.78
	0	1	6	12	4			
Confidence with new ideas or procedures in a STEM project	0.0%	0.0%	30.4%	56.5%	13.0%	**23**	**3.83**	0.65
	0	0	7	13	3			
Patience for the slow pace of research	0.0%	0.0%	26.1%	56.5%	17.4%	**23**	**3.91**	0.67
	0	0	6	13	4			
Desire to build relationships with professionals in a field	0.0%	8.7%	30.4%	52.2%	8.7%	**23**	**3.61**	0.78
	0	2	7	12	2			
Connecting a topic or field with their personal values	4.5%	9.1%	31.8%	36.4%	18.2%	**22**	**3.55**	1.06
	1	2	7	8	4			

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?

	Disagree - This did not happen	Disagree - This happened but not because of SEAP	Agree - SEAP contributed	Agree - SEAP was primary reason	n	Avg.	SD
More confident in STEM knowledge, skills, and abilities	0.0% 0	0.0% 0	91.3% 21	8.7% 2	**23**	**3.09**	0.29
More interested in participating in STEM activities outside of school requirements	8.7% 2	0.0% 0	78.3% 18	13.0% 3	**23**	**2.96**	0.71
More aware of other AEOPs	4.3% 1	8.7% 2	73.9% 17	13.0% 3	**23**	**2.96**	0.64
More interested in participating in other AEOPs	4.3% 1	13.0% 3	69.6% 16	13.0% 3	**23**	**2.91**	0.67
More interested in taking STEM classes in school	4.3% 1	17.4% 4	73.9% 17	4.3% 1	**23**	**2.78**	0.60
More interested in earning a STEM degree	4.3% 1	13.0% 3	73.9% 17	8.7% 2	**23**	**2.87**	0.63
More interested in pursuing a career in STEM	4.3% 1	8.7% 2	78.3% 18	8.7% 2	**23**	**2.91**	0.60
More aware of DoD STEM research and careers	4.3% 1	0.0% 0	69.6% 16	26.1% 6	**23**	**3.17**	0.65
Greater appreciation of DoD STEM research	4.3% 1	4.3% 1	60.9% 14	30.4% 7	**23**	**3.17**	0.72
More interested in pursuing a STEM career with the DoD	13.6% 3	9.1% 2	68.2% 15	9.1% 2	**22**	**2.73**	0.83

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

FY15 SEAP Apprentice Interview Protocol

2015 Science & Engineering Apprenticeship Program (SEAP) Evaluation Study
Student Focus Group or Phone Interview Protocol

Facilitator: My name is [evaluator] and I'd like to thank you for meeting with us today! We are really excited to learn more about your experiences in SEAP. In case you have not been in an evaluation interview before, I'd like to give you some ground rules that I like to use in interviews. They seem to help the interview move forward and make everyone a little more comfortable:

- What is shared in the interview stays in the interview.
- It is important for us to hear the positive and negative sides of all issues.
- This is voluntary - you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for note-taking purposes only. Audio will be destroyed.
- Do you have any questions before we begin?

Key Questions

1. **Why did you choose to participate in SEAP this year?**
    - How did you hear about SEAP?
    - Who did you hear about it from?

The Army Educational Outreach Program (AEOP) is a primary sponsor of SEAP. We do these interviews to help the AEOP create reports and defend funding for the program. They need specific information to defend the money for the program.

2. **We need to understand more about how SEAP is teaching students about STEM career opportunities in the Army and Department of Defense.**
    - During SEAP, did you learn anything about STEM careers in the Army or Department of Defense?
    - How did you learn about them (e.g., field trips, invited speakers, other activities, etc.)?
    - Are you interested in pursuing a career in STEM with the Army or Department of Defense?
3. **The AEOP sponsors a wide range of national STEM outreach programs other than SEAP. You are definitely eligible to participate in some of these programs and we need to know if you learned about them during SEAP.**
    - During SEAP, did you learn about any of the outreach programs that the AEOP sponsors? (JSHS, UNITE, SEAP, CQL, SMART, etc.)
    - How did you learn about them?
    - Do you think that you will try to participate in any of those programs?

4. **Were you happy that you chose to participate in SEAP this year?**
    - What, specifically do you think you got out of participating in SEAP?
    - Were there any other benefits of participating in SEAP?

5. Do you have any suggestions for improving SEAP for other students in the future?

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

Appendix E

FY15 SEAP Apprentice Questionnaire

Contact Information		
Please verify the following information:		
*First Name:		
*Last Name:		
*Email Address:		
All fields with an asterisk (*) are required.		

*1. Do you agree to participate in this survey? (required)(*Required)	
Select one.	
○ Yes, I agree to participate in this survey	(Go to question number 2.)
○ No, I do not wish to participate in this survey	Go to end of chapter

9. How often did you do each of the following in STEM classes at school?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	○	○	○	○	○
Apply STEM learning to real-life situations	○	○	○	○	○
Learn about new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○

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

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	○	○	○	○	○
Apply STEM learning to real-life situations	○	○	○	○	○
Learn about new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○

11. How often did you do each of the following in STEM classes at school?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Use laboratory procedures and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

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

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Use laboratory procedures and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

13. How much did each of the following resources help you learn about Army Educational Outreach Programs (AEOPs)?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My SEAP mentor(s)	○	○	○	○	○
Invited speakers or “career” events during SEAP	○	○	○	○	○
Participation in SEAP	○	○	○	○	○

14. How much did each of the following resources help you learn about STEM careers in the Army or Department of Defense (DoD)?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My SEAP mentor(s)	○	○	○	○	○
Invited speakers or “career” events during SEAP	○	○	○	○	○
Participation in SEAP	○	○	○	○	○

15. How SATISFIED were you with the following SEAP features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Applying or registering for the program	○	○	○	○	○
Other administrative tasks (in-processing, network access, etc.)	○	○	○	○	○
Communicating with your SEAP host site organizers	○	○	○	○	○
The physical location(s) of SEAP activities	○	○	○	○	○
The variety of STEM topics available to you in SEAP	○	○	○	○	○
Teaching or mentoring provided during SEAP activities	○	○	○	○	○
Stipends (payment)	○	○	○	○	○
Research abstract preparation requirements	○	○	○	○	○
Research presentation process	○	○	○	○	○

16. How much input did you have in selecting your SEAP research project?

Select one.

- ○ 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

17. How often was your mentor available to you during SEAP?

Select one.

- ○ 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

18. To what extent did you work as part of a group or team during SEAP?

Select one.

- ○ 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

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

Select one per row.

	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	○	○	○	○	○

20. The list below includes effective teaching and mentoring strategies. From the list, please indicate which strategies that your mentor(s) used when working with you in SEAP:

Select one per row.

	Yes - my mentor used this strategy with me	*No - my mentor did not use this strategy with me*
Helped me become aware of STEM in my everyday life	○	○
Helped me understand how I can use STEM to improve my community	○	○
Used a variety of strategies to help me learn	○	○
Gave me extra support when I needed it	○	○
Encouraged me to share ideas with others who have different backgrounds or viewpoints than I do	○	○
Allowed me to work on a team project or activity	○	○
Helped me learn or practice a variety of STEM skills	○	○
Gave me feedback to help me improve in STEM	○	○
Talked to me about the education I need for a STEM career	○	○
Recommended Army Educational Outreach Programs that match my interests	○	○
Discussed STEM careers with the DoD or government	○	○

21. Which of the following statements apply to your research experience in SEAP? (Choose ALL that apply)

Select 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

22. As a result of your SEAP experience, how much did you GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
In depth knowledge of a STEM topic(s)	○	○	○	○	○
Knowledge of research conducted in a STEM topic or field	○	○	○	○	○
Knowledge of research processes, ethics, and rules for conduct in STEM	○	○	○	○	○
Knowledge of how scientists and engineers work on real problems in STEM	○	○	○	○	○
Knowledge of what everyday research work is like in STEM	○	○	○	○	○

23. Which category best describes the focus of your student(s) SEAP activities?		
Select one.		
○	Science	(Go to question number 24.)
○	Technology	(Go to question number 25.)
○	Engineering	(Go to question number 25.)
○	Mathematics	(Go to question number 25.)

24. As a result of your SEAP experience, how much did you GAIN in your ability to do each of the following?

Select one per row.

If answered, go to question number 26.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Asking a question that can be answered with one or more scientific experiments	○	○	○	○	○
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	○	○	○	○	○
Making a model of an object or system showing its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of objects or systems to test cause and effect relationships	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Considering different interpretations of data when deciding how the data answer a question	○	○	○	○	○
Supporting an explanation for an observation with data from experiments	○	○	○	○	○
Supporting an 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	○	○	○	○	○
Defending an argument that conveys how an explanation	○	○	○	○	○

best describes an observation					
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your explanation of an observation	○	○	○	○	○
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	○	○	○	○	○

25. As a result of your SEAP experience, how much did you GAIN in your ability to do each of the following?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Defining a problem that can be solved by developing a new or improved object, process, or system	○	○	○	○	○
Using knowledge and creativity to propose a testable solution for a problem	○	○	○	○	○
Making a model of an object or system to show its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of an object or system to investigate cause and effect relationships	○	○	○	○	○
Considering different interpretations of the data when deciding if a solution works as intended	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Supporting a solution for a problem with data from experiments	○	○	○	○	○
Supporting a 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	○	○	○	○	○
Defend an argument that conveys how a solution best meets design criteria	○	○	○	○	○

Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your solution to a problem	○	○	○	○	○
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	○	○	○	○	○

26. As a result of your SEAP experience, how much did you GAIN in each of the skills/abilities listed below?

Select one per row.

	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 finished	○	○	○	○	○
Making changes when things do not go as planned	○	○	○	○	○
Working well with people from all backgrounds	○	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○	○
Communicating effectively with others	○	○	○	○	○
Viewing failure as an opportunity to learn	○	○	○	○	○

27. As a result of your SEAP experience, how much did you GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Interest in a new STEM topic	○	○	○	○	○
Deciding on a path to pursue a STEM career	○	○	○	○	○
Sense of accomplishing something in STEM	○	○	○	○	○
Feeling prepared for more challenging STEM activities	○	○	○	○	○
Confidence to try out new ideas or procedures on my own in a STEM project	○	○	○	○	○
Patience for the slow pace of STEM research	○	○	○	○	○
Desire to build relationships with mentors who work in STEM	○	○	○	○	○
Connecting a STEM topic or field to my personal values	○	○	○	○	○

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

Select one per row.

	Much less likely	*Less likely*	*About the same before and after*	*More likely*	*Much more likely*
Watch or read non-fiction STEM	○	○	○	○	○
Tinker (play) with a mechanical or electrical device	○	○	○	○	○
Work on solving mathematical or scientific puzzles	○	○	○	○	○
Use a computer to design or program something	○	○	○	○	○
Talk with friends or family about STEM	○	○	○	○	○
Mentor or teach other students about STEM	○	○	○	○	○
Help with a community service project related to STEM	○	○	○	○	○
Participate in a STEM camp, club, or competition	○	○	○	○	○
Take an elective (not required) STEM class	○	○	○	○	○
Work on a STEM project or experiment in a university or professional setting	○	○	○	○	○

29. Before you participated in SEAP, how far did you want to go in school?

Select one.

○	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.)

30. After you have participated in SEAP, how far do you want to go in school?

Select one.

○	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.)

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

Select one.

○	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

32. Before you participated in SEAP, what kind of work did you want to do when you are 30? (select one)

Select one.

○	Undecided
○	Science (no specific subject)
○	Physical science (physics, chemistry, astronomy, materials science)
○	Biological science
○	Earth, atmospheric or oceanic science
○	Environmental science
○	Computer science
○	Technology
○	Engineering
○	Mathematics or statistics
○	Medicine (doctor, dentist, veterinarian, etc.)
○	Health (nursing, pharmacy, technician, etc.)
○	Social science (psychologist, sociologist, etc.)
○	Teaching, STEM
○	Teaching, non-STEM
○	Business
○	Law
○	Military, police, or security
○	Art (writing, dancing, painting, etc.)
○	Skilled trade (carpenter
○	Other, (specify)::

33. After you participated in SEAP, what kind of work do you want to do when you are 30? (select one)

Select one.

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

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

Select one per row.

	I've never heard of this program	*Not at all*	*A little*	*Somewhat*	*Very much*
UNITE	○	○	○	○	○
Junior Science & Humanities Symposium (JSHS)	○	○	○	○	○
Science & Engineering Apprenticeship Program (SEAP)	○	○	○	○	○
Research & Engineering Apprenticeship Program (REAP)	○	○	○	○	○
High School Apprenticeship Program (HSAP)	○	○	○	○	○
College Qualified Leaders (CQL)	○	○	○	○	○
GEMS Near Peer Mentor Program	○	○	○	○	○
Undergraduate Research Apprenticeship Program (URAP)	○	○	○	○	○
Science Mathematics, and Research for Transformation (SMART) College Scholarship	○	○	○	○	○
National Defense Science & Engineering Graduate (NDSEG) Fellowship	○	○	○	○	○

35. How many jobs/careers in STEM did you learn about during SEAP?

Select one.

○	None
○	1
○	2
○	3
○	4
○	5 or more

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

Select one.

○	None
○	1
○	2
○	3
○	4
○	5 or more

37. How much do you agree or disagree with the following statements about Department of Defense (DoD) researchers and research:

Select one per row.

	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 solve real-world problems	○	○	○	○	○
DoD research is valuable to society	○	○	○	○	○

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

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of SEAP*	*Agree - SEAP contributed*	*Agree - SEAP 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 earning a STEM degree	○	○	○	○
I am more interested in pursuing a career in STEM	○	○	○	○
I am more aware of Army or DoD STEM research and careers	○	○	○	○
I have a greater appreciation of Army or DoD STEM research	○	○	○	○
I am more interested in pursuing a STEM career with the Army or DoD	○	○	○	○

39. What are the three most important ways that SEAP has helped you?

Benefit #1:	
Benefit #2:	
Benefit #3:	

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

Improvement #1:	
Improvement #2:	
Improvement #3:	

41. Please tell us about your overall satisfaction with your SEAP experience.

Appendix F

FY15 SEAP Mentor Questionnaire

Contact Information		
Please verify the following information:		
*First Name:		
*Last Name:		
*Email Address:		
All fields with an asterisk (*) are required.		

*1. Do you agree to participate in this survey? (required)(*Required)

Select one.

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

6. Which of the following BEST describes the organization you work for? (select ONE)

Select one.

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

7. Which of the following BEST describes your current occupation? (select ONE)

Select one.

○	Teacher	(Go to question number 8.)
○	Other school staff	(Go to question number 8.)
○	University educator	(Go to question number 13.)
○	Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	(Go to question number 13.)
○	Scientist, Engineer, or Mathematics professional	(Go to question number 13.)
○	Other, (specify)::	(Go to question number 13.)

8. What grade level(s) do you teach (select all that apply)?

Select all that apply.

☐	Upper elementary
☐	Middle school
☐	High school

11. Do you work at a "Title-I" school?

Select one.

○	Yes
○	No
○	I am not sure

12. Which of the following subjects do you teach? (select ALL that apply)	
Select all that apply.	
If answered, go to question number 14.	
☐	Upper elementary
☐	Physical science (physics, chemistry, astronomy, materials science, etc.)
☐	Biological science
☐	Earth, atmospheric, or oceanic science
☐	Environmental science
☐	Computer science
☐	Technology
☐	Engineering
☐	Mathematics or statistics
☐	Medical, health, or behavioral science
☐	Social Science (psychology, sociology, anthropology)
☐	Other, (specify)::

13. Which of the following best describes your primary area of research?

Select one.

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

14. At which of the following SEAP sites did you participate? (Select ONE)	
Select one.	
○	ALABAMA – U.S. Army Aviation & Missile Research, Development & Engineering Center (AMRDEC) - Redstone, AL
○	ILLINOIS – U.S. Army Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL) - Champaign, IL
○	MARYLAND – U.S. Army Research Laboratory (ARL) - Aberdeen Proving Ground, MD
○	MARYLAND - U.S. Army Research Laboratory – Adelphi, MD
○	MARYLAND – U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) – Aberdeen Proving Ground/Edgewood, MD
○	MARYLAND – U.S. Army Center for Environmental Health Research (USACEHR) – Fort Detrick, MD
○	MARYLAND – U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) – Fort Detrick, MD
○	MARYLAND – U.S. Army Medical Research and Materiel Command – Walter Reed Army Institute of Research (WRAIR) – Silver Spring, MD
○	MISSISSIPPI – U.S. Army Engineer Research & Development Center (ERDC) – Vicksburg, MS
○	VIRGINIA – U.S. Army Engineer Research & Development Center – Geospatial Research Laboratory (ERDC-GRL) – Alexandria, VA

15. Which of the following BEST describes your role during SEAP?	
Select one.	
○	Research Mentor
○	Research Team Member but not a Principal Investigator (PI)
○	Other, (specify)::

16. How many SEAP students did you work with this year?
_____ students.

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

Select all that apply.

☐	Army Educational Outreach Program (AEOP) website
☐	AEOP on Facebook, Twitter, Pinterest, or other social media
☐	A STEM conference or STEM education conference
☐	An email or newsletter from school, university, or a professional organization
☐	Past SEAP participant
☐	A student
☐	A colleague
☐	My supervisor or superior
☐	A SEAP site host or director
☐	Workplace communications
☐	Someone who works with the Department of Defense (Army, Navy, Air Force)
☐	Other, (specify)::

18. 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."

Select one per row.

	Never	*Once*	*Twice*	*Three or more times*	*I've never heard of this program*
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	○	○	○	○	○

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

Select all that apply.

☐	Applications from American Society for Engineering Education (ASEE) 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)
☐	STEM or STEM Education conference(s) or event(s)
☐	Organization(s) that serve underserved or underrepresented populations
☐	The student contacted me (the mentor) about the program
☐	I do not know how student(s) were recruited for SEAP
☐	Other, (specify)::

20. How SATISFIED were you with the following SEAP features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Application or registration process	○	○	○	○	○
Other administrative tasks (in-processing, network access, etc.)	○	○	○	○	○
Communicating with American Society for Engineering Education (ASEE)	○	○	○	○	○
Communicating with SEAP organizers	○	○	○	○	○
Support for instruction or mentorship during program activities	○	○	○	○	○
Stipends (payment)	○	○	○	○	○
Research abstract preparation requirements	○	○	○	○	○
Research presentation process	○	○	○	○	○

21. 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.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Become familiar with my student(s) background and interests at the beginning of the SEAP experience	○	○
Giving students real-life problems to investigate or solve	○	○
Selecting readings or activities that relate to students' backgrounds	○	○
Encouraging students to suggest new readings, activities, or projects	○	○
Helping students become aware of the role(s) that STEM plays in their everyday lives	○	○
Helping students understand how STEM can help them improve their own community	○	○
Asking students to relate real-life events or activities to topics covered in SEAP	○	○

22. 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.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Identify the different learning styles that my student (s) may have at the beginning of the SEAP experience	○	○
Interact with students and other personnel the same way regardless of their background	○	○
Use a variety of teaching and/or mentoring activities to meet the needs of all students	○	○
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	○	○
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	○	○
Directing students to other individuals or programs for additional support as needed	○	○
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	○	○

23. 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.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Having my student(s) tell other people about their backgrounds and interests	○	○
Having my student(s) explain difficult ideas to others	○	○
Having my student(s) listen to the ideas of others with an open mind	○	○
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	○	○
Having my student(s) give and receive constructive feedback with others	○	○
Having students work on collaborative activities or projects as a member of a team	○	○
Allowing my student(s) to resolve conflicts and reach agreement within their team	○	○

24. 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.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Teaching (or assigning readings) about specific STEM subject matter	○	○
Having my student(s) search for and review technical research to support their work	○	○
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	○	○
Supervising my student(s) while they practice STEM research skills	○	○
Providing my student(s) with constructive feedback to improve their STEM competencies	○	○
Allowing students to work independently to improve their self-management abilities	○	○
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	○	○
Encouraging students to seek support from other team members	○	○

25. This list 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 this list, please indicate which strategies you used when working with your student(s) in SEAP.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Asking my student(s) about their educational and/or career goals	○	○
Recommending extracurricular programs that align with students' goals	○	○
Recommending Army Educational Outreach Programs that align with students' goals	○	○
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	○	○
Discussing STEM career opportunities within the DoD or other government agencies	○	○
Discussing STEM career opportunities in private industry or academia	○	○
Discussing the economic, political, ethical, and/or social context of a STEM career	○	○
Recommending student and professional organizations in STEM to my student(s)	○	○
Helping students build a professional network in a STEM field	○	○
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
SEAP Program administrator or site coordinator	○	○	○	○	○
Invited speakers or “career” events	○	○	○	○	○
Participation in SEAP	○	○	○	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
SEAP Program administrator or site coordinator	○	○	○	○	○
Invited speakers or “career” events	○	○	○	○	○
Participation in SEAP	○	○	○	○	○

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

Select one per row.

	Yes - I discussed this program with my student(s)	*No - I did not discuss this program with my student(s)*
Gains in the Education of Mathematics and Science (GEMS)	○	○
UNITE	○	○
Junior Science & Humanities Symposium (JSHS)	○	○
Science & Engineering Apprenticeship Program (SEAP)	○	○
Research & Engineering Apprenticeship Program (REAP)	○	○
High School Apprenticeship Program (HSAP)	○	○
College Qualified Leaders (CQL)	○	○
GEMS Near Peer Mentor Program	○	○
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	○	○

29. How much do you agree or disagree with the following statements about Department of Defense (DoD) researchers and research:

Select one per row.

	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 solve real-world problems	○	○	○	○	○
DoD research is valuable to society	○	○	○	○	○

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

Select one per row.

	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 new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○
Use laboratory or field techniques, procedures, and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

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

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
In depth knowledge of a STEM topic(s)	○	○	○	○	○
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	○	○	○	○	○

32. Which category best describes the focus of your student(s) SEAP activities?

Select one.

○	Science	(Go to question number 33.)
○	Technology	(Go to question number 34.)
○	Engineering	(Go to question number 34.)
○	Mathematics	(Go to question number 34.)

33. AS A RESULT OF THEIR SEAP EXPERIENCE, how much did your student(s) GAIN in their abilities to do each of the following?

Select one per row.

If answered, go to question number 35.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Asking a question that can be answered with one or more scientific experiments	○	○	○	○	○
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	○	○	○	○	○
Making a model of an object or system showing its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of objects or systems to test cause and effect relationships	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Considering different interpretations of data when deciding how the data answer a question	○	○	○	○	○
Supporting an explanation for an observation with data from experiments	○	○	○	○	○
Supporting an 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	○	○	○	○	○

Defending an argument that conveys how an explanation best describes an observation	○	○	○	○	○
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your explanation of an observation	○	○	○	○	○
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	○	○	○	○	○

34. **AS A RESULT OF THEIR SEAP EXPERIENCE, how much did your student(s) GAIN in their ability to do each of the following?**

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Defining a problem that can be solved by developing a new or improved object, process, or system	○	○	○	○	○
Using knowledge and creativity to propose a testable solution for a problem	○	○	○	○	○
Making a model of an object or system to show its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of an object or system to investigate cause and effect relationships	○	○	○	○	○
Considering different interpretations of the data when deciding if a solution works as intended	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Supporting a solution for a problem with data from experiments	○	○	○	○	○
Supporting a 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	○	○	○	○	○
Defend an argument that conveys how a solution best	○	○	○	○	○

meets design criteria					
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your solution to a problem	○	○	○	○	○
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	○	○	○	○	○

35. AS A RESULT OF THE SEAP EXPERIENCE, how much did your student(s) GAIN (on average) in the skills/abilities listed below?

Select one per row.

	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 finished	○	○	○	○	○
Making changes when things do not go as planned	○	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○	○
Communicating effectively with others	○	○	○	○	○
Confidence with new ideas or procedures in a STEM project	○	○	○	○	○
Patience for the slow pace of research	○	○	○	○	○
Desire to build relationships with professionals in a field	○	○	○	○	○
Connecting a topic or field with their personal values	○	○	○	○	○

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

Select one per row.

	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 earning a STEM degree	○	○	○	○
More interested in pursuing a career in STEM	○	○	○	○
More aware of DoD STEM research and careers	○	○	○	○
Greater appreciation of DoD STEM research	○	○	○	○
More interested in pursuing a STEM career with the DoD	○	○	○	○

37. What are the three most important strengths of SEAP?

Strength #1:	
Strength #2:	
Strength #3:	

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

Improvement #1:	
Improvement #2:	
Improvement #3:	

39. Please tell us about your overall satisfaction with your SEAP experience.

Appendix G

American Society for Engineering Education (ASEE)
FY15 Evaluation Report Response

No response submitted.