Army Educational Outreach Program

Science & Engineering Apprenticeship Program

2016 Annual Program Evaluation Report

ARMY EDUCATIONAL OUTREACH PROGRAM

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Executive Summary

The Science & Engineering Apprenticeship Program (SEAP), managed by the Academy of Applied Science (AAS) in 2016, 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 2016, SEAP provided outreach to 113 apprentices and 113 adult mentors at 10 Army laboratory sites herein called SEAP sites. This represents at 19% increase in the number of student apprentices served over 2015, when 92 SEAP apprentices participated.

This report documents the evaluation of the 2016 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, site visits to three SEAP sites, three focus groups with apprentices, three focus groups with mentors, and an annual program report compiled by AAS.

2016 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	690 individual applicants
No. of Students (Apprentices)	113
Placement Rate	16%
No. of Army S&E Mentors	113
No. of Army Research Laboratories	10
No. of K-12 Schools	71
No. of K-12 Schools – Title I	11
No. of DoDEA Students	n/a
No. of DoDEA Schools	n/a

Total Cost	$379,998
Stipend Cost (paid by participating labs)	$320,157
Administrative Cost to AAS	$59,841
Cost Per Student Participant	$3,363

The response rates for the post-program apprentice and mentor surveys were 66% and 6% respectively. This represents an increase in participation for apprentices and slight decrease for mentors as compared to FY15 when 64% of mentors and 18% of apprentices responded to the survey. The margin of error for the mentor survey is than generally acceptable (6.6% at 95% confidence[1] for the apprentice survey and 36.0% at 95% confidence for the mentor survey), indicating that the samples may not be representative of their respective populations and therefore caution is needed in interpreting the results.

Summary of Findings

The FY16 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.

2016 SEAP Evaluation Findings	
Participant Profiles	
SEAP experienced another year of growth in participation of apprentices from historically underrepresented and underserved populations.	The proportion of females participating in SEAP increased again in FY16 to 55% (compared to 45% in FY15). This is substantial in that females are underrepresented in STEM disciplines overall and to a greater degree in the physical sciences and engineering specifically.
	SEAP continued to serve students from historically underrepresented and underserved race/ethnic groups and experienced growth in percentage of Black or African American apprentices to 19% (comparted to 14% in FY15) and Hispanic or Latino apprentices to 5% (compared to 2% in FY15). This is a second year of growth for SEAP in diversity of participants and should continue to be an area of focus for future 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 participants from other AEOPs to SEAP.	While over half of SEAP participants had never participated in any other AEOP, 35% had participated in GEMS and small numbers of students had participated in Camp Invention and e-Cybermission in the past. This is a slight increase from FY15 when 32% of respondents reported having participated in GEMS at least once.
SEAP apprentices expressed interest in participating in AEOPs in the future.	Most apprentices were interested in participating in SEAP again and many expressed interest in other AEOPs, such as CQL, and the GEMS Near Peer Mentor program, as well as the SMART scholarship, a workforce initiative to bring research talent into DoD labs.
SEAP increased their number of applicants, but did not reach their FY16 target.	The program fell short of its FY16 goal of 990 applicants. However there was an increase in the number of applicants from FY15 (690 compared to 633).
Actionable Program Evaluation	
Pre-existing relationships continue to be a factor in SEAP recruitment, however students reported hearing about SEAP from a variety of sources.	Mentors' most commonly identified method of student recruitment was informational materials sent to K-12 schools or universities (43%). As in FY14 and FY15, references from workplace colleagues and applications from the AAS or AEOP websites were also commonly reported methods of apprentice recruitment.
	The most often cited source of apprentice information about AEOP was family members. A school or university newsletter, email, or website and someone who works for the DoD were less commonly identified sources of information about SEAP as was the AEOP website.
SEAP apprentices continue to be motivated by a variety of factors.	A range of factors motivated apprentices to participate in SEAP. All responding apprentices identified interest in STEM as a motivator, and nearly all identified a desire to learn something new or interesting. Large proportions of apprentices also identified learning in ways that are not possible in school, the desire to expand laboratory or research skills, and figuring out education or career goals as motivators.
SEAP engaged apprentices in meaningful STEM learning.	A large majority 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, working as part of a team, and using laboratory procedures and tools every day or most days of their SEAP experience.
	Apprentices reported more intensive STEM learning opportunities in SEAP as compared to their typical school experiences.
	Responding mentors reported using a variety of teaching and/or mentoring

	activities to meet students' needs. Mentors used a variety of strategies to establish relevance of learning activities, support the diverse needs of their students as learners, to support student collaboration and interpersonal skills, support apprentices' engagement in authentic STEM activities, and to support STEM educational and career pathways. The most commonly reported mentoring strategies used (identified by 100% of responding mentors) included asking students about educational or career goals, having students search for and review technical research to support their work, providing students with constructive feedback to improve their STEM competencies, allowing students to work independently, having students work on collaborative activities or projects, and giving students real-life problems to investigate or solve.
SEAP promotes apprentice awareness of DoD STEM research and careers.	A large majority of apprentices reported positive opinions about DoD researchers and research. For example, nearly all apprentices reported that they believe that DoD research is valuable to society and that DoD researchers advance science and engineering fields.
	Nearly all apprentices 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 at least somewhat 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 AEOP programs beyond SEAP. Similarly, responding mentors generally had little awareness of or past participation in other AEOP programs. In spite of this, 89% of apprentices indicated that SEAP contributed to their awareness of other AEOPs and 85% indicated that SEAP contributed to their increased interest in participating in other AEOPs in the future.
The SEAP experience is valued by apprentices and mentors, however apprentices expressed some dissatisfaction with administrative aspects of the program.	Nearly all responding apprentices expressed overall positive perceptions of the program. Most apprentices were at least somewhat satisfied with various aspects of their research experience including their working relation with their mentor, their relationship with their group or team, and the amount of time they spent doing meaningful research. A large majority of apprentices reported being at least somewhat satisfied with SEAP features such as applying or registering for the program, the variety of STEM topics available, and communicating with SEAP host site organizers. Mentors also expressed satisfaction with features of the program they had experienced.
	Administrative aspects of the program were an area of some dissatisfaction for apprentices, as 18% of apprentices reported being not at all satisfied with "other administrative tasks" associated with SEAP including in-processing and network access. This is an increase over FY15 when 15% of students expressed dissatisfaction with these administrative features of SEAP. This theme was echoed in apprentice responses to an open-ended

	survey item in which respondents emphasized lack of computer access and late stipend payments as areas in which the program could improve. Mentors in focus groups echoed student concerns over delays in apprentice computer access.
Outcomes Evaluation	
SEAP apprentices reported gains in STEM knowledge and competencies.	Nearly all apprentices reported gains in their STEM knowledge, with large or extreme gains in areas such as knowledge of what everyday research work is like in STEM, knowledge of research conducted in a STEM topic or field, and in-depth knowledge of a STEM topic(s).
	A majority of apprentices reported gains in a variety of STEM competencies, including large or extreme gains in areas such as communicating about their experiments and explanations in different ways and supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge.
SEAP participants reported gains in 21st Century Skills.	Apprentices reported gains in their 21st century skills as a result of participating in SEAP. Large or extreme gains were reported in areas such learning to work independently, sticking with a task until it is finished, making changes when things do not go as planned, setting goals and reflecting on performance, and including others' perspectives when making decisions
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 their desire to build relationships with mentors who work in STEM, feeling prepared for more challenging STEM activities, and their sense of accomplishing something in STEM.
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 such as working on a STEM project or experiment in a university or professional setting, taking an elective (not required) STEM class, and mentoring or teaching other students about STEM.
SEAP participants reported aspiring to advanced degrees and STEM careers both before and after SEAP.	Most apprentices indicated wishing to pursue an advanced degree both before and after SEAP, although somewhat more students expressed interest in a Ph.D. or M.D./Ph.D. degree after participating in SEAP.
	Most apprentices expressed interest in STEM-related careers both before and after participating in SEAP, however the number of students interested in careers in biological science increased after SEAP participation.
SEAP participants show interest in future AEOP opportunities.	A majority of apprentices indicated being at least somewhat interested in participating in SEAP again and many expressed interest in participating in CQL and other AEOPs such as the SMART scholarship and URAP.

Responsiveness to FY15 Evaluation Recommendations

The primary purpose of the AEOP program evaluation is to serve as a vehicle to inform future programming and continuous improvement efforts with the goal of making progress toward the AEOP priortiies. In previous years the timing of the delivery of the annual program evaluation reports has precluded the ability of programs to use the data as a formative assessment tool. However, beginning with the FY16 evaluation, the goal is for programs to be able to leverage the evaluation reports as a means to target specific areas for improvement and growth.

In this report, we will highlight recommendations made in FY15 to programs and summarize efforts and outcomes reflected in the FY16 APR toward these areas.

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

Finding: SEAP demonstrated slight growth in diversity. This should be a continued focus area for FY16.

SEAP FY16 Efforts and Outcomes: In FY 16, the number of Black or African American and Hispanic or Latino groups has increased to 25%, up from 20% in FY15. AAS directed outreach to underrepresented schools within proximity to the laboratories. This outreach helped to increase the number of underrepresented populations. AAS will continue this outreach effort. In FY17, the apprentice program will work with one or more strategic partners to increase the under-represented minority population (URM).

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

Finding: SEAP should work to increase the number of mentors – and corresponding capacity to host more apprentices in FY16.

SEAP FY16 Efforts and Outcomes: SEAP mentors remained steady in FY16. AAS has had conversations with lab coordinators to talk about mentor recruitment. During the conversations, AAS was made aware of the following:

a. The Army has issued a "line of sight" directive regarding minors. No minor is allowed to move unaccompanied on a base. This means a minor must be accompanied by an adult from the time the student enters the base to the time the student exits. This is a burden on the mentor to cross the base to walk a student to the place of work and then back again at the end of the day. Many mentors are not willing to put forth this kind of effort.
b. Some lab coordinators indicated that it takes approximately 4 weeks to get a student computer access and process the necessary paperwork. Mentors do not have extra time to devote to paperwork on behalf of a student.

To address some of these concerns, in FY17, SEAP registration will be open from November 1 to February 28 (two months earlier than prior years). AAS anticipates that mentors will review applications by April 30, which will enable student notification in early May and begin the paperwork. Students could be notified in early May

and the necessary paperwork set in motion. Students could then begin their apprenticeships in June and with no time lost due to lack of computer access. The lab coordinators have agreed to the new timeline.
AAS recognized the mentors with a certificate of appreciation in FY16. The feedback from this recognition was very positive. The mentors had not received any kind of recognition prior to this time. AAS would like to continue this tradition into FY17.

In addition, AAS would like the opportunity to visit DoD labs and host a recruitment effort in the form of a "lunch and learn" or a variation of that theme. This could bring more recognition to the benefits that mentorship provides, i.e., the impact on a student's future, personal growth, and an opportunity to grow resume experience.

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

FY15 Finding: There is a need to improve the effectiveness of the administration of the SEAP program.

SEAP FY16 Efforts and Outcomes: In FY 16, AAS assumed the administration of all apprenticeship programs. First priority for AAS was to build positive working relationships with the lab coordinators; we will continue this effort in FY17. Battelle and AAS were successful in streamlining the stipend process, ensuring timely stipend payments.

AAS implemented weekly communication with consistent AEOP messaging to students, director/mentors and lab coordinators. AAS also centralized distribution of AEOP materials to students, directors/mentors and lab coordinators. New program flyers were created and distributed in FY16 and AAS will work with Widmeyer to create a consolidated flyer that describes all apprenticeships.

Finding: There is a need to market other AEOPs within the SEAP program.

SEAP FY16 Efforts and Outcomes: In FY16, AAS had ongoing communication throughout the summer to all students, mentors and lab coordinators. As part of the communication, AAS highlighted AEOP programs and the benefits offered. In addition, AAS networked with GEMS to see if additional marketing of SEAP (and all apprenticeships) would be possible by NSTA. They offered to present the apprenticeship marketing materials at NSTA events, once the promotion poster was developed. Brochures were also distributed by lab coordinators to all participants regarding AEOP opportunities as part of a lab welcome packet.

Finding: There is a need to increase SEAP participation in the AEOP evaluation.

SEAP FY16 Efforts and Outcomes: Onsite evaluations were conducted at three labs in FY16 which resulted in some good data. Students were contacted weekly regarding the survey mid-way through the apprenticeship in an effort to encourage completion. The feedback observed regarding the evaluation was that it was too long and took too much time to complete. A shorter, more concise program evaluation may result in greater completion rates. An incentive may encourage evaluation completion, as well, such as a gift card for

completion.It would be beneficial to require year end reporting later in the year so that the program evaluation link could remain open until early September.

FY 16 Recommendations

Evaluation findings indicate that FY16 was a successful year overall for the SEAP program. Notable successes for the year include high levels of mentor and apprentice satisfaction with program features; evidence of strong apprentice gains in STEM knowledge, skills, and competencies; and apprentice interest in participating in AEOPs in the future. Apprentices and mentors continue to report high levels of satisfaction with mentor-apprentice relationships, and both groups likewise report strong apprentice gains in 21st Century skills. 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

The AEOP goal of attracting students from groups historically underrepresented and underserved in STEM continues to be met with limited success in SEAP. Many apprentices reported learning about SEAP through personal connections, suggesting that marketing efforts may have limited effectiveness. Since 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 it is recommended that AAS review these processes and identify ways to ensure that SEAP information reaches these students and that the apprentice selection process is not unduly influenced by personal connections. The AAS may also wish to consider mentors suggestions that targeting funding specifically to provide outreach and logistical support (for example bus passes) for students from underserved or under-represented groups may support these students' participation in SEAP. In sum, the program should consider additional/alternate means of broadening the pool of applicants and consider devising strategies for recruiting and selecting apprentices to ensure that SEAP includes diverse groups of highly talented participants.

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. There is a substantial unmet need in terms of mentor capacity with only 113 students (16% of applicants) being placed out of 690 applicants. Program expansion will require active recruitment of additional Army S&Es to serve as mentors. Mentor suggestions to this end include providing more outreach to Army S&Es about the program and providing overhead hour pay to mentors. The AAS may wish to investigate the procedures and resources used to recruit SEAP mentors and identify factors that motivate and discourage Army S&Es from assuming this role.

2. Apprentices and mentors reported that students lacked computer access for long periods of time during their apprenticeships. This lack of access to technology may interfere with apprentices' work and learning experiences

and is likely to limit their involvement in research activities. The AAS should work with SEAP site coordinators to identify ways to expedite computer access for students.

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

1. Some features of SEAP program administration continues to be a concern. Student dissatisfaction with timeliness of stipend payments continues to be an issue as do the computer access issues referenced above. The AAS should be mindful of these issues and leverage its past experience with administering apprenticeship programs to streamline processes. It is recommended that AAS work with SEAP site coordinators to identify ways to expedite computer access for students and ensure timeliness of stipend payments.

2. Marketing of SEAP and dissemination of information about AEOPs is an area with continued room for growth within the SEAP program. Although apprentices identify mentors as a key source of information about AEOPs, few mentors or apprentices reported being familiar with most AEOPs for which students currently are or will soon be eligible. This suggests that the program may benefit from targeting AEOP information to mentors as well as apprentices. In order to meet the AEOP objective of creating a robust pipeline of AEOP programs in which students progress from other AEOPs into SEAP and from SEAP into CQL and other programs, the program may want to consider innovative ways to work with other AEOPs to create a more seamless continuum of programs. In particular, SEAP administrators may wish to target GEMS alumni to participate in SEAP, devising ways to disseminate SEAP information to GEMS participants and alumni. Given the limited apprentice awareness of resources such as the 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 program's participation in the overall AEOP evaluation continues to be lower than desired. The continued low response rates for both apprentice and mentor questionnaires (36% and 6% in FY16) continue to be a challenge which may be attributed to the schedule for apprenticeships compared to the annual AEOP reporting schedule. It is notable that FY16 participation rates represent a substantial decrease from FY15 rates when response rates were 50% for apprentices and 21% for mentors. 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. The evaluation team will work with AAS to administer the survey to more apprentices and earlier in their experience if necessary.

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 FY16, SEAP was managed by the Academy of Applied Science (AAS). The evaluation study was performed by Purdue University in cooperation with Battelle, the Lead Organization (LO) in the AEOP CA consortium.

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 FY16. 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 2016, 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 12 Army research laboratories receiving applications (compared to 9 in 2015). The number of enrolled participants grew in 2016 to 113 (compared to 92 in FY15) and there was an increase in the number of applicants from 2015 to 2016 (1,198 in 2015 vs. 1,499 in 2016).

Table 1. 2016 SEAP Site Applicant and Enrollment Numbers			
2016 SEAP Site	**No. of Applicants**	**No. of Enrolled Participants**	**Placement Rate**
ALABAMA – U.S. Army Aviation & Missile Research, Development & Engineering Center (AMRDEC) - Redstone, AL	106	15	14%
ILLINOIS – U.S. Army Engineer Research & Development Center – Construction Engineering Research Laboratory (ERDC-CERL) - Champaign, IL	37	4	11%
ILLINOIS – Edgewood Chemical Biological Center (ECBC-RI) – Rock Island, IL	41	9	22%
MARYLAND – U.S. Army Research Laboratory (ARL) - Aberdeen Proving Ground, MD	178	6	3%
MARYLAND – U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) – Aberdeen Proving Ground/Edgewood, MD	183	18	10%
MARYLAND – Edgewood Chemical Biological Center (ECBC-APG) – Gunpowder, MD	172	14	8%
MARYLAND – U.S. Army Research Laboratory (ARL) – Adelphi, MD	101	11	11%
MARYLAND – U.S. Army Center for Environmental Health Research (USACEHR) – Fort Detrick, MD	159	0	0%
MARYLAND – U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) – Fort Detrick, MD	118	15	13%
MARYLAND – U.S. Army Medical Research and Materiel Command – Walter Reed Army Institute of Research (WRAIR) – Silver Spring, MD	270	15	6%
MISSISSIPPI – U.S. Army Engineer Research & Development Center (ERDC) – Vicksburg, MS*	28	1	4%
VIRGINIA – U.S. Army Engineer Research & Development Center – Geospatial Research Laboratory (ERDC-GRL) – Alexandria, VA	106	5	5%
TOTAL	1,499 (690 individuals)	113	7% (16% actual)

Table 2. 2016 SEAP Student Participant Profile		
Demographic Category		
Participant Gender (n = 113)		
Female	62	55%
Male	50	44%
Not Reported	1	1%
Respondent Race/Ethnicity (n = 113)		
Asian	23	20%
Black or African American	22	19%
Hispanic or Latino	6	5%
Native American or Alaska Native	0	0%
White	53	47%
Other race or ethnicity	4	4%
Choose not to report	4	4%
School Setting (n = 113)		
Urban	18	15%
Suburban	80	71%
Rural	12	10%
Frontier or Tribal School	0	0%
DoDDS/DoDEA School	0	0%
Home school	3	3%
Not Reported	0	0%
Free/Reduced Lunch Status (n = 113)		
Yes	9	9%
No	100	88%
Choose Not to Report	4	4%

The total cost of the 2016 SEAP program was $379,998. This cost includes administrative costs of $59,841 and $320,157 for participant stipends. The average cost per participant was $3,363. Table 3 summarizes these and other 2016 SEAP program costs.

Table 3. 2016 SEAP Program Costs	
2016 SEAP - Cost Per Participant	
Total Student Participants	113
Total Program Cost	$379,998
Cost Per Participant	$2,708.18
2016 SEAP - Cost Breakdown Per Participant	
Average Administrative Cost to AAS	$245.69
Average Participant Stipend	$2,461.49
Cost Per Participant	$3,363

Evidence-Based Program Change

In FY16 all apprenticeship programs began being administerd by the Academy of Applied Science and combined into an overall apprenticeship portfolio. Objectives and activities for the apprenticeship programs were developed and implemented collectively for all programs and included the following:

1. Expand apprenticeship opportunities for underserved populations in cooperation with HBCUs/MSIs and other affinity groups, and in cooperation with recruitment objectives of LPCs by disseminating program information to a broader and a more diverse audience. (Supports Priority 1)

- *Collaborate with HBCUs/MSIs and affinity groups on targeted marketing and recruitment in local communities by recruiting current directors/mentor and LPCs to assist in outreach to URM population.*
- *Increase participation from schools with high percentages of free/reduced lunch*
- *Increase number of mentors across all sites to expand program by improving mentor training, creating a peer recruitment effort and offering expanded incentives.*
- *Recruit, identify and heighten awareness of apprenticeship opportunities by working with one or more strategic partners to market/outreach to organizations and schools with high percentage of URM.*

Activities:

- RFPs were sent to over 200 HBCUs/MCIs. University host sites for HBCU/MSIs increased by 90% in 2016 (compared to 2015)
- Published apprenticeship opportunities to high schools and universities located near Army labs and universities using direct mail and email campaigns.
- Developed and distributed new flyers & welcoming narrative to attract participants to the AEOP website and AEOP program information, to over 500 high schools, PTAs and after school programs targeting more diverse population, specifically to those close to host universities and DoD laboratories.
- University host directors assisted with distribution of college level program information by posting at universities.

2. **Expand cross-marketing and outreach of apprenticeship programs to include other AEOP programs to mentors and LPCs.(Supports Priority 1 & 3)**

- *Develop and disseminate materials widely through print, social media and virtual presentations*

Activities:

- All directors/mentors, students and lab coordinators received AEOP brochures, AEOP notebooks, flash drives and lab coats to promote all AEOP programs.
- Apprenticeship announcements to over 500 high schools, PTAs and after school programs targeting more diverse population, specifically to those close to host universities and DoD laboratories, also included information about all AEOP programs.
- Directors/mentors, students and lab coordinators received weekly communications addressing the entire AEOP portfolio, program evaluation assistance, abstract tip submissions, AEOP Newsletter, Social Media guidelines and the 2016 Guide to STEM Careers.

- New social media campaign was developed, including an AAS Instagram account and hashtag campaign to engage participants. #AEOPapprentice Executed AEOP's Social Media Guidelines using relevant hashtags, i.e. #edchat, #science, #womeninSTEM, #USAEOP, etc.
- Cross marketing by sharing posts about all AEOP programs.
- Provided photos and newsworthy items to Widmeyer throughout the summer.

3. Encourage apprentices to continue pursuit of AEOP STEM/Army STEM careers (Supports Priority 1)

- *Create opportunities for Army researchers to engage with students, as guest speakers and to visit host university sites, and opportunities for apprentices in university based programs to visit Army sites*
- *Create standardized information on Army STEM career opportunities; distribute to all apprentices*
- *Work with LPCs to obtain success stories and best practices which showcase STEM careers*

Activities:

- Students gain first hand exposure to Army STEM careers through direct engagement with Army scientists and engineers in DoD laboratories.
- Initiated discussions with a university to develop a "meet and greet" for participants of all AEOP programs (at same university), to include an Army speaker. Will expand on this to include REAP, HSAP/URAP, JSHS, UNITE.
- Implemented a scavenger hunt to expose students to DoD STEM careers.
- Developed communications campaign to distribute weekly notices including the new Guide to STEM Careers and AEOP Newsletter, which also showcases Army STEM Career info.
- Coordinated with Widmeyer to develop stories and publicize via AEOP.

4. Encourage more students already in the AEOP pipeline to continue with an apprenticeship program (Supports Priority 1 & 3)

- *Use incentive, such as stipends, to retain and attract former AEOP participants*
- *Coordinate with the LO and LPCs to develop and implement marketing/ outreach campaigns to target students in the AEOP pipeline*
- *Improve website & CVENT Interface*

Activities:

- Developed and distributed (US Mail and email) new flyers to over 500 high schools, PTAs and after school programs targeting more diverse population and those close to university host sites and DoD labs.
- Directors assisted with distribution of college level program information by posting at universities.
- Reviewed and updated websites and Cvent to publicize opportunities to students. Reviewed AEOP website pages to ensure accuracy of application deadlines
- Apprenticeship announcement flyers were sent to over 3,000 alumni… GEMS, UNITE, JSS, SEAP, HSAP, REAP, JSHS. Application announcement also requested family and/or friend referral.
- Conducted email outreach campaign to target AEOP alumni and publicize apprenticeship opportunities.
- ALL AEOP program alumni

57% students participated in an AEOP in prior years. SEAP: 74 CQL: 182 REAP: 34

5. Increase participant's knowledge of other AEOP programs and STEM careers (Supports Priority 1)

- Encourage peer-to-peer information sessions
- Provide virtual supplemental materials (such as marketing brochures and career testimonials)
- Present information to laboratory coordinators in other programs.

Activities:

- New program flyers were created and distributed to 500 high schools, 3,000 alumni and 80 after school programs located near high schools and DoD laboratories. Email also included a link to the AEOP website outlining other AEOP opportunities.
- Welcome packets were distributed to participants which included: Lab coats, flash drives, notebooks, pens/pencils, AEOP brochures and all AEOP program opportunities.
- Weekly communication to participants highlighted all AEOP programs and AEOP STEM Career Guide, AEOP Newsletter, AEOP social media info about other AEOP opportunities.

6. Improve the overall participant and mentor apprenticeship experience. (Supports Priority 1 & 3)

- Identify process improvements and best practices as a result of the consolidation effort.
- Improve communications and information exchange between IPAs via virtual seminars or other
- Establish effective incentive and bridging strategies (such as "exit interviews" and next step mentoring) for participants as they move throughout the pipeline. Next steps are being introduced through mentor and apprenticeship exit letters.

Activities:

- The consolidation of marketing efforts for all apprenticeship programs resulted in greater awareness of all AEOP opportunities.
- Centralized supply distribution.
- Created new media release form.
- Centralized application process for all apprenticeship applicants through the use of Cvent.
- Increased mentor recognition with certificates and/or letters of appreciation.
- Worked extensively with lab coordinators to foster better working relationship. Surveyed lab coordinators to improve stipend payment process. Established system to track monthly stipend payments.
- Surveyed each lab coordinator regarding needed program improvements/changes. Prompt response to requests established better communication and trust between the IPA and lab coordinators through weekly email correspondence and telephone contact.
- Announced new AEOP Travel Award to all participants.

FY16 Evaluation At-A-Glance

Purdue University, in collaboration with AAS, 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 • AAS providing oversight of site programming • Operations conducted by ten Army labs • 113 students participating in SEAP apprenticeships • 113 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 AAS 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 students' STEM competencies?
  - Increase students' positive attitudes toward STEM?
  - Increase students' interest in future STEM learning?
  - Increase students' awareness of and interest in other AEOP opportunities?
  - Increase students' awareness of and interest in Army/DoD STEM careers?

The assessment strategy for SEAP included apprentice and mentor questionnaires, three focus groups with apprentices, and three focus groups with mentors. Tables 4-7 outline the information collected in apprentice and mentor questionnaires and focus groups, as well as the program report that is relevant to this evaluation report.

Table 4. 2016 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 5. 2016 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 6. 2016 Apprentice Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in SEAP, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of SEAP, motivating factors for participation, involvement in other science programs in addition to SEAP, satisfaction with and suggestions for improving SEAP, benefits to participants
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities:** Extent to which apprentices were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers: Extent to which apprentices were exposed to STEM and Army/DoD STEM jobs

Table 7. 2016 Mentor Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, occupation, organization, role in SEAP, past participation in SEAP, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of SEAP, benefits to participants, suggestions for improving SEAP programs
AEOP Priorities 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Efforts to expose students to AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Efforts to expose students to STEM and Army/DoD STEM jobs
	Mentor Capacity: Local Educators – Strategies used to increase diversity/support diversity in SEAP

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. The apprentice focus group protocol is provided in Appendix B and the mentor focus group protocol is in Appendix C. Apprentice and mentor questionnaire instruments are located in Appendix D and Appendix E, respectively. Major trends in data and analyses are reported herein.

Study Sample

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 apprentice response rate increased as compared to FY15 when 50% of apprentices responded, however the mentor response rates is lower than in FY15 when 21% of mentors responded to the questionnaire.

Three focus groups were conducted with apprentice participants and three focus groups were conducted with mentors at three SEAP sites. Sixteen apprentices participated in the three apprentice focus groups. Of theses, five were male and 11 were female. Nine apprentice participants were White, two were Asian, one was Black or African American, and three were other racial groups/ethnicities. Three apprentices were rising 11th graders, eight were rising 12th graders, and four were high school graduates. Ten mentors participated in the three mentor focus groups. Seven of the participating mentors were female and three were males, eight were White, and two were Black or African American. Focus groups were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of apprentice questionnaire data. They add to the overall narrative of SEAP's efforts and impact, and highlight areas for future exploration in programming and evaluation.

Table 8. 2016 SEAP Questionnaire Participation				
Participant Group	**Respondents (Sample)**	**Total Participants (Population)**	**Participation Rate**	**Margin of Error @ 95% Confidence[2]**
Apprentices	75	113	66%	±6.6%
Mentors	7	113	6%	±36.0%

Respondent Profiles

Apprentice Demographics

SEAP participant demographic information for questionnaire respondents is summarized in Tables 9 and 10. More females (60%) than males (39%) completed the FY16 questionnaire. While 60% of responding apprentice participants identified themselves as White and 22% as Asian, only 5% of responding apprentices identified with the Black or African American racial/ethnic category and 8% as Hispanic or Latino. Most responding apprentices were 11th and 12th grade students (46% and 30% respectively). Another 16% were 10th grade students. Only one respondent reported qualifying for free or reduced-price lunch (FRL)—a common indicator of low-income status.

Table 9. 2016 SEAP Apprentice Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n =72)		
Female	43	60%
Male	28	39%
Choose not to report	1	3%
Respondent Race/Ethnicity (n =72)		
Hispanic or Latino	4	6%
Asian	15	21%
Black or African American	10	14%
Native American or Alaska Native	2	3%
Native Hawaiian or Other Pacific Islander	0	0%
White	40	56%
Choose not to report	0	0%
Other race or ethnicity	1	1%

[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.

Respondent Grade Level (n =72)		
9th	0	0%
10th	1	1%
11th	12	17%
12th	59	82%
Respondent Eligible for Free/Reduced-Price Lunch (n = 63)		
Yes	2	3%
No	59	94%
Choose not to report	2	3%

Table 10. 2016 SEAP Apprentice Respondent School Information		
Demographic Category	**Questionnaire Respondents**	
Respondent School Location (n = 65)		
Department of Defense	0	0%
Home School	3	5%
Suburban	49	75%
Rural (country)	8	12%
Urban (city)	5	8%

Apprentices reported only limited past participation in AEOP programs (see Table 11). When asked how many times they participated in AEOP programs, the most frequently reported program was GEMS, with 35% of respondents reporting they had participated in the past (compared to 31% in FY15), followed by SEAP (11% had participated in the past). This suggests that GEMS participation may influence students' decisions to participate in SEAP. Over half (54%) of SEAP apprentices had never participated in any other AEOP although 23% had participated in another STEM program.

Table 11. Apprentice Past Participation in AEOPs (n=65)

	Response Percent	Response Total
Camp Invention	7.69 %	5
eCYBERMISSION	1.54 %	1
Junior Solar Sprint (JSS)	1.54 %	1
Gains in the Education of Mathematics and Science (GEMS)	35.38 %	23
UNITE	0.00 %	0
Junior Science & Humanities Symposium (JSHS)	0.00 %	0
Science & Engineering Apprenticeship Program (SEAP)	10.77 %	7
Research & Engineering Apprenticeship Program (REAP)	0.00 %	0
High School Apprenticeship Program (HSAP)	0.00 %	0
College Qualified Leaders (CQL)	0.00 %	0
Undergraduate Research Apprenticeship Program (URAP)	0.00 %	0
Science Mathematics & Research for Transformation (SMART) College Scholarship	0.00 %	0
I've never participated in any AEOP programs	53.85 %	35
Other STEM Program	23.08 %	15

Mentor Demographics

The 2016 mentor respondent demographic information is summarized in Table 12. Most responding mentors were scientists, engineers, or mathematics professionals (57%) and all identified themselves as research mentors (86%) or simply as “mentor” (14%).

Table 12. 2016 SEAP Mentor Profile		
Demographic Category	**Questionnaire Respondents**	
Survey Respondent Gender (n = 7)		
Female	3	43%
Male	4	57%
Choose not to report	0	0%
Race/Ethnicity (n=7)		
Hispanic or Latino	0	0%
Asian	0	0%
Black or African American	1	14%
Native American or Alaskan Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	6	86%
Other	0	0%
Choose not to report	0	0%
Occupation (n=7)		
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	0	0%
Scientist, Engineer, or Mathematics professional	4	57%
Other, (specify) †	3	43%
Role in SEAP (n=7)		
Research Mentor	6	86%
Other, (specify) ‡	1	14%

† Other = Lead Developer, Analyst, Quality Assurance (engineer-related)

‡ Other = Mentor

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. 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. 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 AAS, a number of strategies were used to disseminate information about the SEAP program to a diverse audience:

- Published apprenticeship opportunities to high schools and universities located near Army labs and universities using direct mail and email campaigns.
- Developed and distributed new flyers & welcoming narrative to attract participants to the AEOP website and AEOP program information, to over 500 high schools, PTAs and after school programs targeting more diverse population, specifically to those close to host universities and DoD laboratories.
- University host directors assisted with distribution of college level program information by posting at universities.
- All directors/mentors, students and lab coordinators received AEOP brochures, AEOP notebooks, flash drives and lab coats to promote all AEOP programs.
- Apprenticeship announcements to over 500 high schools, PTAs and after school programs targeting more diverse population, specifically to those close to host universities and DoD laboratories, also included information about all AEOP programs.
- Directors/mentors, students and lab coordinators received weekly communications addressing the entire AEOP portfolio, program evaluation assistance, abstract tip submissions, AEOP Newsletter, Social Media guidelines and the 2016 Guide to STEM Careers.
- New social media campaign was developed, including an AAS Instagram account and hashtag campaign to engage participants. #AEOPapprentice Executed AEOP's Social Media Guidelines using relevant hashtags, i.e. #edchat, #science, #womeninSTEM, #USAEOP, etc.
- Cross marketing by sharing posts about all AEOP programs.
- Provided photos and newsworthy items to Widmeyer throughout the summer.

In order to understand what marketing methods are most effective, the questionnaire asked apprentices to select all of the ways they heard about AEOP. Table 13 displays their responses. The most frequently mentioned source of information about AEOP was a family member (48%), followed by a school or university newsletter, email, or website

(30%) and someone who works for the DoD (30%). Other sources of information include a past participant of the program (27%), someone who works at the school or university the apprentice attends (26%), the AEOP website (26%), and a friend (20%).

Table 13. How Apprentices Learned about AEOP (n=66)

	Response Percent	Response Total
Army Educational Outreach Program (AEOP) Website	25.76 %	17
AEOP on Facebook, Twitter, Instagram, or other social media	1.52 %	1
School or university newsletter, email, or website	30.30 %	20
Past participant of program	27.27 %	18
Friend	19.70 %	13
Family Member	48.48 %	32
Someone who works at the school or university I attend	25.67 %	17
Someone who works with the program	18.18 %	12
Someone who works with the Department of Defense (Army, Navy, Air Force, etc.)	30.30 %	20
Community group or program	6.06 %	4
Choose Not to Report	0.00 %	0

The mentor questionnaire also included an item asking how apprentices were recruited. Mentor responses are provided in Table 14 which indicates that over a quarter of mentors (29%) were unaware how their apprentices were recruited. The most common methods of recruitment were informational materials sent to K-12 schools or universities outside of my workplace (43%), applications from the AAS or the AEOP (14%), personal acquaintances (14%), and workplace colleague (14%).

Table 14. Mentor Reports of Strategies Used to Recruit Apprentices (n=7)

	Response Percent	Response Total
Applications from Academy for Applied Science (AAS) or the AEOP	14.29 %	1
Personal acquaintance(s) (friend, family, neighbor, etc.)	14.29 %	1
Colleague(s) in my workplace	14.29 %	1
K-12 school teacher(s) outside of my workplace	0.00 %	0
University faculty outside of my workplace	0.00 %	0
Informational materials sent to K-12 schools or Universities outside of my workplace	42.86 %	3
Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)	0.00 %	0
Communication(s) generated by a university or faculty (newsletter, email blast, website)	0.00 %	0
STEM or STEM Education conference(s) or event(s)	0.00 %	0
Organization(s) that serve underserved or underrepresented populations	0.00 %	0
The student contacted me (the mentor) about the program	0.00 %	0
I do not know how student(s) were recruited for SEAP	28.57 %	2
Other, (specify):	0.00 %	0

To examine whether mentors are expanding their participation in AEOP programs, the questionnaire asked mentors how many times they had participated in each of the AEOP programs. Many mentors reported either never having heard of, or never having participated in, most of the AEOP programs. For example, over half of mentors (57%) had never heard of Camp Invention, Junior Solar Sprint (JSS), Junior Science and Humanities Symposium (JSHS), Gains in the Education of Math and Science (GEMS), and Undergraduate Research Apprenticeship Program (URAP). Most mentors (71%) reported having participated in SEAP once before and one mentor had participated twice or more in SEAP. One mentor reported having participated in College Qualified Leaders (CQL) once and one mentor reported having participated in GEMS once.

Factors Motivating Apprentice Participation

The questionnaires and focus groups included questions to explore what motivated apprentices to participate in SEAP. As can be seen in Table 15, apprentices were motivated by a variety of factors. Frequently identified motivators include interest in STEM (100% of respondents), the desire to learn something new or interesting (92%), learning in ways that

are not possible in school (88%), the desire to expand laboratory or research skills (82%), the opportunity to use advanced laboratory technology (79%), and figuring out career or education goals (76%).

Table 15. Factors Motivating Apprentices to Participate in SEAP (n=66)

	Response Percent	Response Total
Teacher or professor encouragement	22.72 %	15
An academic requirement or school grade	10.61 %	7
Desire to learn something new or interesting	92.42%	61
The mentor(s)	43.94 %	29
Building college application or résumé	64.64 %	42
Networking opportunities	46.97 %	31
Interest in science, technology, engineering, or mathematics (STEM)	100.00 %	66
Interest in STEM careers with the Army	54.55%	36
Having fun	51.52%	34
Earning stipends or awards for doing STEM	48.48 %	32
Opportunity to do something with friends	10.61 %	7
Opportunity to use advanced laboratory technology	78.79 %	52
Desire to expand laboratory or research skills	81.82 %	54
Learning in ways that are not possible in school	87.88%	58
Serving the community or country	60.61 %	40
Exploring a unique work environment	74.24 %	49
Figuring out education or career goals	75.76 %	50
Seeing how school learning applies to real life	66.67 %	44
Recommendations of past participants	24.24 %	16
Choose Not to Report	0.00 %	0

Apprentices participating in focus groups were also asked about their reasons for participating in SEAP. These apprentices emphasized the value of lab experience and career information in their comments. For example,

> *I wanted to get some research experience before I go off to college. I thought being a part of a military lab would be a good experience where I could get a lot of lab-based skills under my belt.* (SEAP Apprentice)

> *I chose to participate in [SEAP] because I really want to find out what I want to do.* (SEAP Apprentice)

> *I wanted a lot more hands-on experience than what I could get at high school.* (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 Table 16, over half of responding apprentices indicated that they were assigned a project by their mentor (53%). The remaining apprentices reported working with their mentor and members of a research team to design a project (22%), worked with their mentor to design a project (15%), or chose from projects suggested by their mentor (8%).

Table 16. Apprentice Input on Design of Their Project (n=72)

	Response Percent	Response Total
I did not have a project	1.39 %	1
I was assigned a project by my mentor	52.78 %	38
I worked with my mentor to design a project	15.28 %	11
I had a choice among various projects suggested by my mentor	8.33 %	6
I worked with my mentor and members of a research team to design a project	22.22 %	16
I designed the entire project on my own	0.00 %	0

Mentors participating in a focus group at one site spoke to apprentice input on and satisfaction with their projects and indicated that they felt it would be helpful to match student interests to mentor interests during the selection process. As two mentors said,

> *They're all good students. They are all looking towards STEM. They're all excited about STEM. It's hard to differentiate who you think would be a good fit in your lab without already accepting them.* (SEAP Mentor)

> *You don't want to disappoint them, and you don't want to be disappointed either. I feel bad if I can tell they're not enjoying it.* (SEAP Mentor)

Apprentices echoed mentors' comments in responses to an open-ended survey item asking about program improvements. Twelve responses indicated that students felt that student interests should be matched to mentors' and suggested that students be able to choose or create their own projects. As one apprentice said,

> *[SEAP] gives students a lot of great experience. It would be even better if they would have that experience with someone in their desired field.* (SEAP Apprentice)

Table 17 displays apprentice responses about their participation in research groups. Apprentices most frequently reported that they worked with a group who all worked on the same project (31% of responses). Nearly a quarter (24%) of apprentices reported working with others in a shared laboratory or other space, but working on different projects. The remaining apprentices worked alone on projects and met with others regularly for general reporting or discussion (217%), worked alone on a project that was closely connected with the projects of others in their group (15%), or worked alone or with only their research mentor (14%).

Table 17. Apprentice Participation in Research Groups (n=72)

	Response Percent	Response Total
I worked alone (or alone with my research mentor)	13.89 %	10
I worked with others in a shared laboratory or other space, but we work on different projects	23.61 %	17
I worked alone on my project and I met with others regularly for general reporting or discussion	16.67 %	12
I worked alone on a project that was closely connected with projects of others in my group	15.28 %	11
I work with a group who all worked on the same project	30.56 %	22

Apprentices were also asked about the types of activities they engaged in during their experience. As can be seen in Table 18, the majority of respondents indicated engaging in activities such as interacting with scientists or engineers (88%), learning about new STEM topics (84%), applying STEM learning to real-life situations (83%), and communicating with other students about STEM (62%) on most days or every day of their SEAP experience.

Table 18. Nature of Apprentice Activities in SEAP (n=69-70)

	Not at all	At least once	A few times	Most days	Every day	Response Total
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	0.0%	7.1%	8.6%	31.4%	52.9%	
	0	5	6	22	37	**70**
Apply STEM learning to real-life situations	0.0%	7.2%	10.1%	18.8%	63.8%	
	0	5	7	13	44	**69**
Learn about new discoveries in STEM	2.9%	10.0%	22.9%	28.6%	35.7%	
	2	7	16	20	25	**70**
Learn about different careers that use STEM	1.4%	8.6%	28.6%	28.6%	32.9%	
	1	6	20	20	23	**70**
Interact with scientists or engineers	0.0%	2.9%	10.0%	8.6%	78.6%	
	0	2	7	6	55	**70**
Communicate with other students about STEM	4.3%	11.4%	22.9%	18.6%	42.9%	
	3	8	16	13	30	**70**

"I am more confident in where my future leads and that I will be able to find a job that I enjoy. I would not have traded this experience for anything else.""--SEAP Apprentice

Because increasing the number of those who pursue 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 (see Tables 19 and 20). All responding apprentices reported learning about at least one STEM job/career during their SEAP experience while all but two apprentices reported learning about at least one DoD STEM job/career. Over three-quarters of apprentices (78%) reported learning about four or more STEM jobs/careers and 69% of apprentices learned about four or more DoD STEM jobs/careers.

Table 19. Number of STEM Jobs/Careers Apprentices Learned About During SEAP (n = 70)

	Response Percent	Response Total
None	0.00 %	0
1	2.86 %	2
2	5.71 %	4
3	14.29 %	10
4	8.57 %	6
5 or more	68.57 %	48

Table 20. Number of DoD STEM Jobs/Careers Apprentices Learned About During SEAP (n=71)

	Response Percent	Response Total
None	2.82 %	2
1	7.04 %	5
2	5.63 %	4
3	15.49 %	11
4	8.45 %	6
5 or more	60.56 %	43

Apprentices were also asked to indicate which resources impacted their awareness of Army or DoD STEM careers (see Table 21). Participation in SEAP (95%) and mentors (87%) were most often reported as being somewhat or very much responsible for this impact. On the other hand, 75% of respondents indicated that they did not experience the It Starts Here! Magazine while 71% did not experience AEOP on social media, and 64% did not experience the AEOP brochure. These results suggest that existing AEOP resources such as the AEOP brochure and social media presence are being underutilized.

Table 21. Impact of Resources on Apprentice Awareness of Army or DoD STEM Careers (n=70)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Army Educational Outreach Program (AEOP) website	25.7%	5.7%	34.3%	21.4%	12.9%	
	18	4	24	15	9	**70**
AEOP on Facebook, Twitter, Pinterest or other social media	71.4%	11.4%	8.6%	7.1%	1.4%	
	50	8	6	5	1	**70**
AEOP brochure	64.3%	14.3%	8.6%	8.6%	4.3%	
	45	10	6	6	3	**70**
It Starts Here! Magazine	75.4%	13.0%	5.8%	4.3%	1.4%	
	52	9	4	3	1	**69**
My SEAP mentor(s)	4.3%	1.4%	7.1%	17.1%	70.0%	
	3	1	5	12	49	**70**
Invited speakers or "career" events during SEAP	31.9%	5.8%	5.8%	27.5%	29.0%	
	22	4	4	19	20	**69**
Participation in SEAP	1.4%	1.4%	2.9%	25.7%	68.6%	
	1	1	2	18	48	**70**

Apprentices were also asked how often they engaged in various STEM practices during their SEAP experience (see Table 22). Apprentices reported consistently engaging in many STEM practices most days or every day. For example, 82% of students identified questions or problems to investigate, and 79% of apprentices participated in hands-on STEM activities and 76% worked as part of a team on most days or every day of their SEAP experience. Likewise, 70% of apprentices carried out investigations and 69% of students used laboratory procedures and tools on most days or every day of their SEAP experiences. Activities apprentices were less likely to engage in on a regular basis included building or making a computer model (39% reported not having done this) and designing an investigation (14% reported not having done this). Mentors responses to questions regarding how often their apprentices engaged in these STEM activities were similar to apprentice responses in many STEM activities, however mentors' reports of the frequency with which apprentices engaged in some activities such as designing an investigation (14%) and carrying out investigations (29%) were substantially lower than apprentice reports. This discrepancy may be attributable to the small sample size of mentor respondents whose apprentices may have engaged in activities that are not representative of the overall population of apprentices.

Table 22. Apprentice Engagement in STEM Activities (n=70)

	Not at all	At least once	A few times	Most days	Every day	Response Total
Use laboratory procedures and tools	7.1%	7.1%	17.1%	20.0%	48.6%	
	5	5	12	14	34	**70**
Participate in hands-on STEM activities	5.7%	5.7%	10.0%	18.6%	60.0%	
	4	4	7	13	42	**70**
Work as part of a team	1.4%	4.3%	18.6%	20.0%	55.7%	
	1	3	13	14	39	**70**
Identify questions or problems to investigate	1.4%	4.3%	12.9%	40.0%	41.4%	
	1	3	9	28	29	**70**
Design an investigation	14.3%	10.0%	32.9%	24.3%	18.6%	
	10	7	23	17	13	**70**
Carry out an investigation	5.7%	7.1%	17.1%	25.7%	44.3%	
	4	5	12	18	31	**70**
Analyze data or information	2.9%	7.1%	14.3%	24.3%	51.4%	
	2	5	10	17	36	**70**
Draw conclusions from an investigation	2.9%	11.6%	20.3%	24.6%	40.6%	
	2	8	14	17	28	**69**
Come up with creative explanations or solutions	2.9%	10.0%	31.4%	25.7%	30.0%	
	2	7	22	18	21	**70**
Build or make a computer model	38.6%	12.9%	14.3%	20.0%	14.3%	
	27	9	10	14	10	**70**

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

Apprentices were asked how often they engaged in the same activities in school. 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 1, scores were significantly higher on the "in SEAP" versions of both composites than on the in school versions (a large effect of d = 1.72 standard deviations for Learning about STEM; a large effect of 1.18 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.

"[SEAP offers] a lot of value figuring out what research is actually like and what science is actually like outside the classroom. I participated in research in the lab when I was in high school, so it's nice to be on the other end of it now."-- SEAP Mentor

[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.

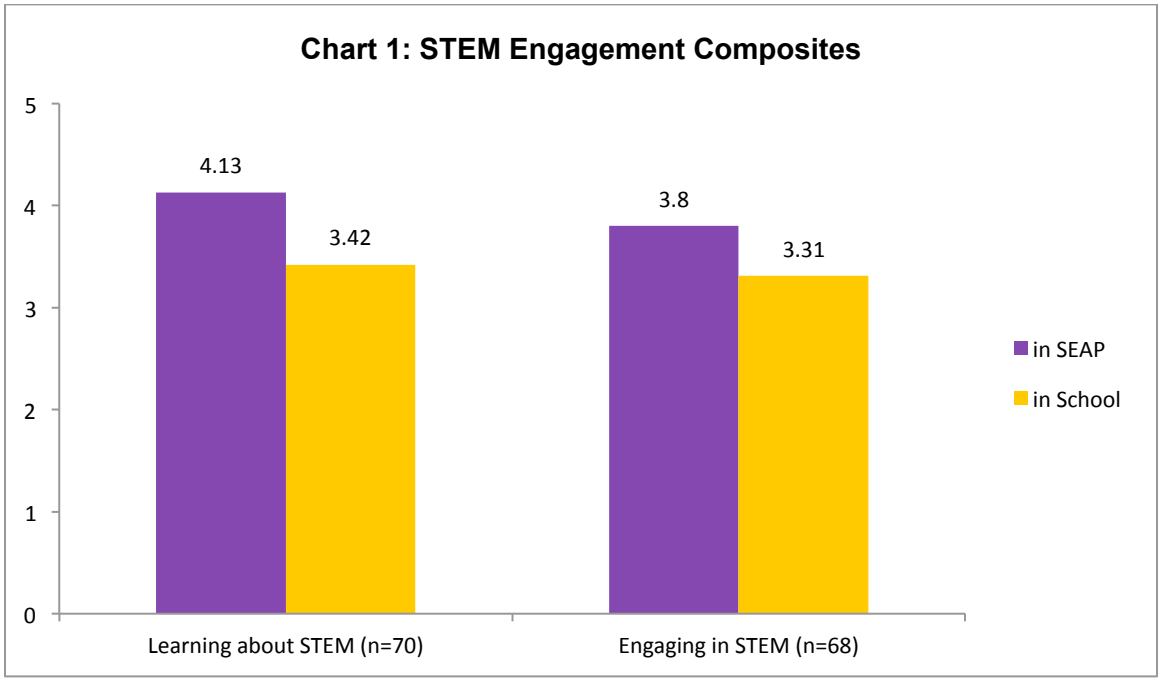
[4] The Cronbach's alpha reliability for these items was 0.858.

[5] The Cronbach's alpha reliability for these items was 0.845.

[6] Cronbach's alpha reliability for these items was 0.851.

[7] Cronbach's alpha reliability for these items was .910.

[8] Two-tailed dependent samples t-tests: Learning about STEM, $t(69) = 6.72$, $p < 0.001$; Engaging in STEM Practices, $t(67) = 4.82$, $p < 0.001$.



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 apprentices' 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, 57% indicated working with one apprentice and 43% indicated that they worked with two apprentices.

Mentors were asked whether or not they used a number of strategies when working with their apprentices (note: the questionnaires used the term "students"; consequently, the data in this section are reported using that term as well). These strategies comprised five main areas of effective mentoring:[9]

1. Establishing the relevance of learning activities;

[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.

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.

Mentors reported using an array of strategies to help make the learning activities relevant to students (see Table 23). 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. Most responding mentors also encouraged students to suggest new readings, activities or projects (71%), and helped students understand how STEM can help them improve their own communities (71%).

Table 23. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 7)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Become familiar with my student(s) background and interests at the beginning of the SEAP experience	100.0%	0.0%	
	7	0	**7**
Giving students real-life problems to investigate or solve	100.0%	0.0%	
	7	0	**7**
Selecting readings or activities that relate to students' backgrounds	42.9%	57.1%	
	3	4	**7**
Encouraging students to suggest new readings, activities, or projects	71.4%	28.6%	
	5	2	**7**
Helping students become aware of the role(s) that STEM plays in their everyday lives	57.1%	42.9%	
	4	3	**7**
Helping students understand how STEM can help them improve their own community	71.4%	28.6%	
	5	2	**7**
Asking students to relate real-life events or activities to topics covered in SEAP	42.9%	57.1%	
	3	4	**7**

Mentors also reported using strategies to support the diverse needs of students as learners (see Table 24). All responding mentors reported using a variety of teaching and/or mentoring activities to meet the needs of all students. Most mentors also directed students to other programs or individuals for support (86%), identified the different learning styles their student(s) may have (71%), and interacted with students and other personnel the same way regardless of their background (71%).

Table 24. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 7)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Identify the different learning styles that my student (s) may have at the beginning of the SEAP experience	71.4%	28.6%	
	5	2	**7**
Interact with students and other personnel the same way regardless of their background	71.4%	28.6%	
	5	2	**7**
Use a variety of teaching and/or mentoring activities to meet the needs of all students	100.0%	0.0%	
	7	0	**7**
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	57.1%	42.9%	
	4	3	**7**
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	57.1%	42.9%	
	4	3	**7**
Directing students to other individuals or programs for additional support as needed	85.7%	14.3%	
	6	1	**7**
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	28.6%	71.4%	
	2	5	**7**

Mentors reported using a variety of strategies to support students' development of collaboration and interpersonal skills as well. The results displayed in Table 25 indicate that all responding mentors had students work on collaborative activities or projects as a member of a team while 86% had students listen to the ideas of others with an open mind, 71% allowed students to resolve conflicts and reach agreement within their team, and 71% had students exchange ideas with others whose backgrounds or viewpoints differed from their own.

Table 25. Mentors Using Strategies to Support Students' Development of Collaboration and Interpersonal Skills (n=7)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Having my student(s) tell other people about their backgrounds and interests	71.4%	28.6%	
	5	2	**7**
Having my student(s) explain difficult ideas to others	57.1%	42.9%	
	4	3	**7**
Having my student(s) listen to the ideas of others with an open mind	85.7%	14.3%	
	6	1	**7**
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	71.4%	28.6%	
	5	2	**7**
Having my student(s) give and receive constructive feedback with others	85.7%	14.3%	
	6	1	**7**
Having students work on collaborative activities or projects as a member of a team	100.0%	0.0%	
	7	0	**7**
Allowing my student(s) to resolve conflicts and reach agreement within their team	71.4%	28.6%	
	5	2	**7**

Most responding mentors reported using strategies used to support student engagement in authentic STEM activities (see Table 26). For example, all responding mentors reported having students search for and review technical research to support their work, allowing students to work independently to improve their self-management abilities, encouring students to seek support from other team members, encouraging students to learn collaboratively, and providing students with constructive feedback to improve their STEM competencies.

Table 26. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 7)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Teaching (or assigning readings) about specific STEM subject	85.7%	14.3%	

matter	6	1	**7**
Having my student(s) search for and review technical research to support their work	100.0%	0.0%	
	7	0	**7**
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	71.4%	28.6%	
	5	2	**7**
Supervising my student(s) while they practice STEM research skills	85.7%	14.3%	
	6	1	**7**
Providing my student(s) with constructive feedback to improve their STEM competencies	100.0%	0.0%	
	7	0	**7**
Allowing students to work independently to improve their self-management abilities	100.0%	0.0%	
	7	0	**7**
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	100.0%	0.0%	
	7	0	**7**
Encouraging students to seek support from other team members	100.0%	0.0%	
	7	0	**7**

The final section of items regarding mentoring strategies focused on mentors' support of students' STEM educational and career pathways (see Table 27). All of the responding mentors reported asking students about their educational and career interests.Oover half of mentors reported that they provided guidance about educational pathways that would prepare students for a STEM career (57%), discussed STEM career opportunities in the DoD or other government agencies (57%), and helped students build a professional network in a STEM field (57%). Only 29% of mentors reported recommending AEOPs in alignment with student goals, however. Given the goal of having students move progressively from SEAP into other AEOP opportunities, this is an area for potential growth. Apprentices were presented with a subset of these items and asked to indicate which strategies their mentors used with them during their SEAP experience. In general, similar percentages of apprentices than mentors reported that their mentors used these strategies.

Table 27. Mentors Using Strategies to Support STEM Educational and Career Pathways (n= 7)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Asking my student(s) about their educational and/or career goals	100.0%	0.0%	
	7	0	**7**
Recommending extracurricular programs that align with students' goals	42.9%	57.1%	
	3	4	**7**
Recommending Army Educational Outreach Programs that align with students' goals	28.6%	71.4%	
	2	5	**7**
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	57.1%	42.9%	
	4	3	**7**
Discussing STEM career opportunities within the DoD or other government agencies	57.1%	42.9%	
	4	3	**7**
Discussing STEM career opportunities in private industry or academia	42.9%	57.1%	
	3	4	**7**
Discussing the economic, political, ethical, and/or social context of a STEM career	42.9%	57.1%	
	3	4	**7**
Recommending student and professional organizations in STEM to my student(s)	42.9%	57.1%	
	3	4	**7**
Helping students build a professional network in a STEM field	57.1%	42.9%	
	4	3	**7**
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	28.6%	71.4%	
	2	5	**7**

Mentors were asked which of the AEOP programs they explicitly discussed with their apprentices during SEAP (see Table 28). Not surprisingly, the most frequently discussed program was SEAP, with 86% of mentors reporting that they

discussed the program with their apprentices. Few mentors discussed other AEOPs with apprentices, although two (29%) discussed the SMART scholarship and one mentor reported discussing GEMS, CQL, and GEMS Near Peer Mentors.

Table 28. Mentors Explicitly Discussing AEOPs with Apprentices (n = 6-7)

	Yes - I discussed this program	No - I did not discuss this program	Response Total
Gains in the Education of Mathematics and Science (GEMS)	16.7% 1	83.3% 5	**6**
UNITE	0.0% 0	100.0% 7	**7**
Junior Science & Humanities Symposium (JSHS)	0.0% 0	100.0% 7	**7**
Science & Engineering Apprenticeship Program (SEAP)	85.7% 6	14.3% 1	**7**
Research & Engineering Apprenticeship Program (REAP)	0.0% 0	100.0% 7	**7**
High School Apprenticeship Program (HSAP)	0.0% 0	100.0% 7	**7**
College Qualified Leaders (CQL)	16.7% 1	83.3% 5	**6**
GEMS Near Peer Mentor Program	14.3% 1	85.7% 6	**7**
Undergraduate Research Apprenticeship Program (URAP)	0.0% 0	100.0% 7	**7**
Science Mathematics, and Research for Transformation (SMART) College Scholarship	28.6% 2	71.4% 5	**7**
National Defense Science & Engineering Graduate (NDSEG) Fellowship	0.0% 0	100.0% 7	**7**
I discussed AEOP with my student(s) but did not discuss any specific program	14.3% 1	85.7% 6	**7**

Mentors also responded to an item in which they indicated the usefulness of various resources in exposing their apprentices to AEOPs (see Table 29). Few mentors reported that any resources were "very much" useful, although 43% of respondents found the SEAP program administrator or site coordinator somewhat useful, and 50% of mentors reported that participation in SEAP was at least somewhat useful in exposing students to AEOPs. Most mentors had not experienced AEOP resources such as the AEOP website, AEOP on social media, the AEOP brochure, and the It Starts Here! magazine.

Table 29. Usefulness of Resources in Mentor Efforts to Expose Students to AEOPs during SEAP (n=6-7)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Army Educational Outreach Program (AEOP) website	85.7%	0.0%	14.3%	0.0%	0.0%	
	6	0	1	0	0	**7**
AEOP on Facebook, Twitter, Pinterest or other social media	100.0%	0.0%	0.0%	0.0%	0.0%	
	7	0	0	0	0	**7**
AEOP brochure	85.7%	0.0%	14.3%	0.0%	0.0%	
	6	0	1	0	0	**7**
It Starts Here! Magazine	100.0%	0.0%	0.0%	0.0%	0.0%	
	7	0	0	0	0	**7**
SEAP Program administrator or site coordinator	57.1%	0.0%	0.0%	42.9%	0.0%	
	4	0	0	3	0	**7**
Invited speakers or "career" events	85.7%	0.0%	0.0%	0.0%	14.3%	
	6	0	0	0	1	**7**
Participation in SEAP	33.3%	0.0%	16.7%	16.7%	33.3%	
	2	0	1	1	2	**6**

Likewise, mentors were asked to rate the usefulness of resources for exposing apprentices to DoD STEM careers (see Table 30). As with the previous item, mentors were most likely to rate participation in SEAP as useful, with 72% indicating that SEAP participation was at least somewhat useful in this area. Likewise, 29% responding mentors responded that program administrators or site coordinators were at least somewhat useful in exposing apprentices to DoD careers. Again, most mentors indicated a lack of experience with the AEOP materials and social media presence (a range of 86-100%) or the AEOP website (100%).

Table 30. Usefulness of Resources in Mentor Efforts to Expose Students to AEOPs (n=6-7)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Army Educational Outreach Program (AEOP) website	100.0%	0.0%	0.0%	0.0%	0.0%	
	6	0	0	0	0	**6**
AEOP on Facebook, Twitter, Pinterest or other social media	100.0%	0.0%	0.0%	0.0%	0.0%	
	7	0	0	0	0	**7**
AEOP brochure	85.7%	0.0%	14.3%	0.0%	0.0%	
	6	0	1	0	0	**7**
It Starts Here! Magazine	100.0%	0.0%	0.0%	0.0%	0.0%	
	7	0	0	0	0	**7**
SEAP Program administrator or site coordinator	57.1%	0.0%	14.3%	14.3%	14.3%	
	4	0	1	1	1	**7**
Invited speakers or "career" events	71.4%	0.0%	0.0%	0.0%	28.6%	
	5	0	0	0	2	**7**
Participation in SEAP	14.3%	0.0%	14.3%	28.6%	42.9%	
	1	0	1	2	3	**7**

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 Table 31, a majority of responding apprentices were somewhat or very much satisfied with most of the listed program features. For example, 96% of apprentices were at least somewhat satisfied with the teaching or mentoring provided during SEAP activities, 93% were at least somewhat satisfied with the physical location of SEAP activities, 89% were at least somewhat satisfied with applying or registering for the program, 88% were at least somewhat satisfied with the variety of STEM topics provided, and 82% were at least somewhat satisfied with the research presentation process. Some apprentices expressed dissatisfaction with some program features, however. The largest area of dissatisfaction was with administrative tasks such as in-processing, network access, etc. with 18% of participants indicating that they were "not at all" satisfied. Smaller numbers of students expressed dissatisfaction with features such as the research abstract preparation requirements (6%) and the research presentation process (4%).

Table 31. Student Satisfaction with SEAP Features (n= 72)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Applying or registering for the program	0.0%	2.8%	8.3%	43.1%	45.8%	
	0	2	6	31	33	**72**
Other administrative tasks (in-processing, network access, etc.)	1.4%	18.1%	30.6%	25.0%	25.0%	
	1	13	22	18	18	**72**
Communicating with your SEAP host site organizers	6.9%	2.8%	9.7%	38.9%	41.7%	
	5	2	7	28	30	**72**
The physical location(s) of SEAP activities	0.0%	0.0%	6.9%	29.2%	63.9%	
	0	0	5	21	46	**72**
The variety of STEM topics available to you in SEAP	0.0%	1.4%	11.1%	25.0%	62.5%	
	0	1	8	18	45	**72**
Teaching or mentoring provided during SEAP activities	0.0%	1.4%	2.8%	19.4%	76.4%	
	0	1	2	14	55	**72**
Stipends (payment)	0.0%	2.8%	11.1%	22.2%	63.9%	
	0	2	8	16	46	**72**
Research abstract preparation requirements	4.2%	5.6%	9.7%	38.9%	41.7%	
	3	4	7	28	30	**72**
Research presentation process	4.2%	4.2%	9.7%	38.9%	43.1%	
	3	3	7	28	31	**72**

Apprentices were also ask to report the availability of their mentors. As can be seen in Table 32, 46% of responding apprentices indicated their mentor was always available, and another 49% indicated that their mentors were available about half or more than half of the time. two apprentices indicated that their mentor was available less than half of the time and two reported that their mentor was never available.

Table 32. Student Reports of Mentor Availability during SEAP (n=72)

	Response Percent	Response Total
I did not have a mentor	0.00 %	0
The mentor was never available	2.78 %	2
The mentor was available less than half of the time	2.78 %	2
The mentor was available about half of the time of my project	11.11 %	8
The mentor was available more than half of the time	37.50 %	27
The mentor was always available	45.83 %	33

Students were also asked to indicate their satisfaction with their research experience overall (See Table 33). Responses indicate a high level of satisfaction with most aspects of the research experience. For example, 95% of apprentices were somewhat or very much satisfied with their working relationship with their mentor, 85% were somewhat or very much satisfied with the amount of time they spent doing meaningful research, and 98% were at least somewhat satisfied with the research experience overall. Only one student reported dissatisfaction with the amount of time spent doing meaningful research and one student expressed dissatisfaction with the research experience overall.

Table 33. Apprentice Satisfaction with Research Experience (n=72)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
My working relationship with my mentor	1.4%	0.0%	2.8%	16.7%	79.2%	
	1	0	2	12	57	**72**
My working relationship with the group or team	2.8%	0.0%	9.7%	13.9%	73.6%	
	2	0	7	10	53	**72**
The amount of time I spent doing meaningful research	0.0%	2.8%	12.5%	25.0%	59.7%	
	0	2	9	18	43	**72**
The amount of time I spent with my research mentor	1.4%	0.0%	5.6%	26.4%	66.7%	
	1	0	4	19	48	**72**
The research experience overall	0.0%	1.4%	2.8%	15.5%	80.3%	
	0	1	2	11	57	**71**

An open-ended item on the questionnaire asked apprentices about their overall satisfaction with their SEAP experience. The responses were overwhelmingly positive. All of the 33 apprentices who answered this question had something positive to say. For example:

> *I have had a great experience over this past summer being able to work with engineers and scientists from all different backgrounds, and being able to experience what they do from day to day. I am more confident in where my future leads and that I will be able to find a job that I enjoy.* (SEAP Apprentice)

> *Overall I am very thankful for my mentor and the opportunity to participate in the SEAP program. My mentor has gone above and beyond to make sure my experience was great. I have learned so many valuable things in and out of the lab. I can not say enough about the program*. (SEAP Apprentice)

> *SEAP this summer has been absolutely amazing! Not only did I gain useful research experience that colleges will be glad I have, but I also formed friendships with many people here. I got to ask scientists about their backgrounds and how they got interested in their STEM careers…SEAP definitely solidified my desire to become an engineer…Thanks so much AEOP!* (SEAP Apprentice)

Eleven apprentices (33%) responded with some positive comments, but offered some caveats as well. Five of these caveats focused on issues with computer access issues. For example:

> *While I loved my personal experience with my mentor and working in a government lab, I was unimpressed and frustrated with the lack of structure and inefficient nature of the program. For most students (including myself), the process of getting computer access was unnecessarily complicated. It took nearly four weeks to be granted computer access through my CAC card, which means about half of my time was spent without access to email, documents, data sheets, etc.*(SEAP Apprentice)

> *I enjoyed my project and felt that I helped contribute to my team. My team was supportive. Things were very slow at the beginning trying to access to the computers and my entire project was online*. (SEAP Apprentice)

Four apprentices' caveats focused on pay (two apprentices noted that they had difficulty receiving pay and two that they would have liked a larger stipend). As one mentor said,

> *As of this time, no form of payment has been received by any student in my program. It has been nearly three weeks since we were supposed to be paid for the first four weeks of the program.* (SEAP Apprentice)

Two respondents included as a caveat the desire for more opportunities to interact with other SEAP participants. Other caveats, each mentioned by one apprentice, included matching apprentice research interests with mentors', a lack of guidelines for the research paper and presentation, lack of lab time, and dissatisfaction with an apprentice's mentor.

Apprentices were also asked to provide three ways in which the SEAP program could be improved. The 36 apprentices who responded made a variety of suggestions. The most often mentioned improvement was to expedite computer access and other in-processing activities (mentioned 16 times). Another 14 responses suggested providing more interactions with other students, and 12 responses focused on matching student interests with mentors' interests or research projects. Six responses focused on ensuring that stipends are paid on time. Other improvements suggested included providing more time with mentors (4 responses), holding career information sessions (4 responses), revising or clarifying the requirements for the presentation and paper (4 responses), and providing more lab time (3 responses). Six responses indicated that no improvements are necessary for the SEAP program.

Mentors were also asked to indicate their satisfaction with features of the SEAP program (see Table 34). Many responding mentors reported not having experienced features such as communicating with SEAP organizers (86%), the application or registration process (71%), and the research presentation process (57%). Although many mentors reported not experiencing features, 29% were very satisfied with the application process and 29% were very satisfied with support for instruction or mentorship during activities. Another 29% were somewhat or very much satisfied with other administrative tasks, and 43% with the research abstract preparation requirements and research presentation process. Some responding mentors expressed dissatisfaction with some features, including support for instruction or mentorship during program activities (2 mentors or 29%), and other administrative tasks (1 mentor or 14%).

Table 34. Mentor Satisfaction with SEAP Features (n=7)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Application or registration process	71.4%	0.0%	0.0%	0.0%	28.6%	
	5	0	0	0	2	**7**
Other administrative tasks (in-processing, network access, etc.)	57.1%	14.3%	0.0%	14.3%	14.3%	
	4	1	0	1	1	**7**
Communicating with Academy of Applied Science (AAS)	100.0%	0.0%	0.0%	0.0%	0.0%	
	7	0	0	0	0	**7**
Communicating with SEAP organizers	85.7%	0.0%	14.3%	0.0%	0.0%	
	6	0	1	0	0	**7**

Support for instruction or mentorship during program activities	42.9%	28.6%	0.0%	0.0%	28.6%	
	3	2	0	0	2	**7**
Stipends (payment)	100.0%	0.0%	0.0%	0.0%	0.0%	
	7	0	0	0	0	**7**
Research abstract preparation requirements	42.9%	14.3%	0.0%	28.6%	14.3%	
	3	1	0	2	1	**7**
Research presentation process	57.1%	0.0%	0.0%	28.6%	14.3%	
	4	0	0	2	1	**7**

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 strengths of SEAP. Five mentors responded to this question. Mentors included a variety of strengths of SEAP in their responses. These included providing students with real-world experience (3 responses), providing connections with STEM professionals (2 responses), providing career information (2 responses), exposing students to the workplace environment and expectations (2 responses), and general learning about STEM (2 responses).

Mentors were also asked to note three ways in which SEAP should be improved for future participants. The 5 responding mentors focused their responses on expediting computer access and in-processing activities (8 responses). Other improvements suggested included matching student and mentor interests (2 responses), providing more AEOP information (1 responses) and better communication with mentors about the presentation and abstract requirements (1 response). Mentors in focus groups echoed the concerns about computer access and in-processing. As one mentor said,

> *I think the organizational part of it this year was difficulty. My student didn't have a password to get onto a computer until two weeks ago, which was really tough, because she didn't have access to any of our data or programs to run data or email.* (SEAP Mentor)

Mentors in a focus group at one SEAP site felt that the program could benefit from increased participation of mentors. They indicated that Army S&Es might be encouraged to participate in SEAP by providing more program support and outreach to potential mentors. For example,

I think that if [potential mentors] first realize that the stipend is covered for at least one student, that's good, and I think maybe more than just one general announcement [is needed]…everyone's just insensitive to email announcements here. It just needs more publicity. (SEAP Mentor)

It would be helpful even if management gave us some overhead labor hours, 10 or 20, just something to say, 'We appreciate what you're doing. We know it's going to take some of your time.' (SEAP Mentor)

Mentors in focus groups were also asked to comment on ways that the program might be marketed to underserved or underrepresented populations. Mentor responses included the need for funding and the need to address logistical issues such as transportation. As two mentors said,

I think part of [engaging underserved and under-represented groups] boils down to finding funding opportunities…to get the kids that would be interested in these kind of programs. I think NSF is actually having a seminar where they're bringing in some students from various colleges to give seminars at NSF here. I think that would be a good opportunity to speak to people, tell them about what's going on, and then open up their eyes to the websites for applications and those kinds of things. It would be nice if there were funding directed specifically toward that purpose. (SEAP Mentor)

The problem we have in our community with those groups is transportation…that's the biggest drawback we have on getting any kind of student here, is the transportation part of it…I don't know if they would offer bus passes, maybe, to help pay for their summer bus pass to get them to and from work if they show the need. (SEAP Mentor)

Mentors were asked to share their overall satisfaction with their SEAP experience in an open-ended survey item as well. All 5 of the mentors who responded to this question provided positive comments such as:

It was a very pleasant experience and I hope it was so for our student! (SEAP Mentor)

[Our student] was awesome. She texted me before the program to ask for information that could prepare her for the experience. She did not complain when doing the mundane and quickly got the work done…Definitely would repeat this summer. (SEAP Mentor)

Three of these 5 respondents also identified areas for improvement. One respondent suggested revising the survey, one mentioned lack of student interest in the research to which they had been assigned, and two others cited problems with computer access and other in-processing activities. For example:

The SEAP program is outstanding! However, for DoD, the time involved in getting a background check completed, computer access, ID's, building access, is ridiculous. We began 4 weeks prior to the students' arrival, and they were still without computers or capabilities three weeks into the program. (SEAP Mentor)

In summary, findings from the Actionable Program Evaluation indicate that apprentices in the SEAP program are working both independently and collaboratively on research projects. The majority of apprentices interact consistently with STEM professionals, have satisfying relationships with their mentors, learn about new STEM topics, and apply STEM to real-life situations. Findings also indicate that apprentices learned about at least one DoD or STEM job/career during their SEAP experience. 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 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.

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,

[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.

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

Table 35 provides a summary of apprentice reports about their gains in STEM knowledge as a result of the SEAP program. A majority of respondents reported large or extreme gains in each area. For example, 88% reported large or extreme gains in their knowledge of what everyday research work is like in STEM, 81% in knowledge of research conducted in a STEM topic or field, and 75% in their in-depth knowledge of a STEM topic(s). 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, and no mentors reported that apprentices had no gain in any area.

Table 35. Apprentice Gains in STEM Knowledge (n=72)

	No gain	A little gain	Some gain	Large gain	Extreme gain	Response Total
In depth knowledge of a STEM topic(s)	1.4%	5.6%	18.1%	47.2%	27.8%	
	1	4	13	34	20	**72**
Knowledge of research conducted in a STEM topic or field	1.4%	2.8%	15.3%	45.8%	34.7%	
	1	2	11	33	25	**72**
Knowledge of research processes, ethics, and rules for conduct in STEM	1.4%	5.6%	15.3%	43.1%	34.7%	
	1	4	11	31	25	**72**
Knowledge of how scientists and engineers work on real problems in STEM	1.4%	4.2%	13.9%	44.4%	36.1%	
	1	3	10	32	26	**72**
Knowledge of what everyday research work is like in STEM	1.4%	2.8%	8.3%	38.9%	48.6%	
	1	2	6	28	35	**72**

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 or race/ethnicity for the STEM Knowledge composite variable. In other words, apprentices from different backgrounds reported similar impacts.

Apprentices were asked to respond to an item rating perceived impacts of SEAP participation on STEM competencies, or abilities to use STEM practices. Table 36 displays the results for this item. The vast majority of apprentices reported at least some gain for all areas listed, with many reporting large or extreme gains. For example, 68% reported large or extreme gains in communicating about their experiments and explanations in different ways, 63% in supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge, and 53% in asking a question that can be answered with one or more scientific experiments.

Table 36. Apprentice Gains in STEM Skills (n=72)

	No gain	A little gain	Some gain	Large gain	Extreme gain	Response Total
Asking a question that can be answered with one or more scientific experiments	6.9%	5.6%	34.7%	36.1%	16.7%	
	5	4	25	26	12	**72**
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	8.3%	6.9%	45.8%	19.4%	19.4%	
	6	5	33	14	14	**72**
Organizing data in charts or graphs to find patterns and relationships	4.2%	11.1%	27.8%	26.4%	30.6%	
	3	8	20	19	22	**72**
Considering different interpretations of data when deciding how the data answer a question	6.9%	4.2%	38.9%	23.6%	26.4%	
	5	3	28	17	19	**72**
Supporting an explanation for an observation with data from experiments	4.2%	6.9%	26.4%	31.9%	30.6%	
	3	5	19	23	22	**72**
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	4.2%	7.0%	25.4%	39.4%	23.9%	
	3	5	18	28	17	**71**
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	5.6%	8.3%	40.3%	27.8%	18.1%	
	4	6	29	20	13	**72**

[11] The Cronbach's alpha reliability for these 5 items was 0.943.

Defending an argument that conveys how an explanation best describes an observation	5.6%	12.5%	36.1%	27.8%	18.1%	
	4	9	26	20	13	**72**
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	1.4%	9.7%	30.6%	37.5%	20.8%	
	1	7	22	27	15	**72**
Integrating information from technical or scientific texts and other media to support your explanation of an observation	9.7%	6.9%	23.6%	34.7%	25.0%	
	7	5	17	25	18	**72**
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	1.4%	5.6%	25.0%	40.3%	27.8%	
	1	4	18	29	20	**72**

Composite scores were calculated for apprentice gains in STEM Competencies 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 and races/ethnicities reported similar impacts in these areas.

Apprentices were also asked about the impact of SEAP on their "21st Century Skills," skills and abilities that are necessary across a wide variety of fields (see Table 37). A majority of responding apprentices reported large or extreme gains in each of these skills, including sticking with a task until it is finished (80%), making changes when things do not go as planned (80%), learning to work independently (73%), including others' perspectives when making decisions (66%), and setting goals and reflecting on performance (65%). Apprentices reported similar gains regardless of gender or race/ethnicity.[13] In addition, mentor reports of apprentice gains in this area are generally similar to those of the apprentices.

[12] The STEM Competencies composite has a Cronbach's alpha reliability of 0.949.

[13] The 21st Century Skills composite has a Cronbach's alpha reliability of 0.891.

"The kids that come through her learn a way of thinking that is a little more logical, a little more scientific, and learn how to apply those things to their everyday life, so that we feel like we're helping to produce good citizens as well."-- SEAP Mentor

"SEAP this summer has been absolutely amazing! I have loved these eight weeks, and I have learned so much. I worked on a great team with lots of scientists, postdocs, and two other awesome high school students…I got to ask the scientists about their backgrounds and how they got interested in their STEM careers, while at the same time getting to eat lunch with them or just hanging out…SEAP definitely solidified my desire to become an engineer, and also had other benefits such as payment and the forming of friendships."-- SEAP Apprentice

Table 37. Apprentice Gains in 21st Century Skills (n=72)

	No gain	A little gain	Some gain	Large gain	Extreme gain	Response Total
Learning to work independently	0.0%	2.8%	25.0%	41.7%	30.6%	
	0	2	18	30	22	**72**
Setting goals and reflecting on performance	0.0%	5.6%	29.6%	40.8%	23.9%	
	0	4	21	29	17	**71**
Sticking with a task until it is finished	0.0%	1.4%	18.1%	44.4%	36.1%	
	0	1	13	32	26	**72**
Making changes when things do not go as planned	0.0%	0.0%	20.8%	41.7%	37.5%	
	0	0	15	30	27	**72**
Working well with people from all backgrounds	1.4%	8.3%	26.4%	36.1%	27.8%	
	1	6	19	26	20	**72**
Including others' perspectives when making decisions	4.2%	1.4%	27.8%	40.3%	26.4%	
	3	1	20	29	19	**72**
Communicating effectively with others	0.0%	4.2%	22.2%	37.5%	36.1%	
	0	3	16	27	26	**72**
Viewing failure as an opportunity to learn	2.8%	4.2%	29.2%	29.2%	34.7%	
	2	3	21	21	25	**72**

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. Responses to these items are shown in Table 38 and strongly suggest that SEAP positively impacted apprentices in this area. For example, 80% of responding apprentices reported large or extreme gains in their desire to build relationships with mentors who work in STEM, 74% in feeling prepared for more

[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.

challenging STEM activities, and 73% in their sense of accomplishing something in STEM. Few apprentices reported no gain in these areas Again, there were no differences among subgroups of apprentices on a composite variable created from the STEM Identity items.[15]

Table 38. Apprentice Gains in STEM Identity (n=72)

	No gain	A little gain	Some gain	Large gain	Extreme gain	Response Total
Interest in a new STEM topic	2.8%	6.9%	27.8%	29.2%	33.3%	
	2	5	20	21	24	**72**
Deciding on a path to pursue a STEM career	2.8%	5.6%	33.3%	27.8%	30.6%	
	2	4	24	20	22	**72**
Sense of accomplishing something in STEM	1.4%	4.2%	22.2%	34.7%	37.5%	
	1	3	16	25	27	**72**
Feeling prepared for more challenging STEM activities	0.0%	5.6%	20.8%	37.5%	36.1%	
	0	4	15	27	26	**72**
Confidence to try out new ideas or procedures on my own in a STEM project	2.8%	8.3%	30.6%	27.8%	30.6%	
	2	6	22	20	22	**72**
Patience for the slow pace of STEM research	0.0%	9.7%	27.8%	25.0%	37.5%	
	0	7	20	18	27	**72**
Desire to build relationships with mentors who work in STEM	0.0%	4.2%	16.7%	37.5%	41.7%	
	0	3	12	27	30	**72**
Connecting a STEM topic or field to my personal values	4.2%	8.3%	27.8%	26.4%	33.3%	
	3	6	20	19	24	**72**

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

[15] The Cronbach's alpha reliability for these 8 items was 0.911.

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 in future AEOP programs changed as a result of SEAP. As can be seen in Table 39, apprentices indicated they were more likely to engage in many of these activities as a result of SEAP. For example, 82% reported being more likely or much more likely to work on a STEM project or experiment in a university or professional setting; 76% to take an elective (not required) STEM class; and 75% to mentor or teach other students 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 or race/ethnicity.

Table 39. Change in Likelihood Apprentices Will Engage in STEM Activities Outside of School (n=70-71)

	Much less likely	Less likely	About the same before and after	More likely	Much more likely	Response Total
Watch or read non-fiction STEM	0.0%	1.4%	49.3%	35.2%	14.1%	
	0	1	35	25	10	**71**
Tinker (play) with a mechanical or electrical device	0.0%	2.8%	53.5%	31.0%	12.7%	
	0	2	38	22	9	**71**
Work on solving mathematical or scientific puzzles	0.0%	1.4%	45.1%	38.0%	15.5%	
	0	1	32	27	11	**71**
Use a computer to design or program something	0.0%	4.2%	39.4%	29.6%	26.8%	
	0	3	28	21	19	**71**
Talk with friends or family about STEM	0.0%	0.0%	23.9%	43.7%	32.4%	
	0	0	17	31	23	**71**
Mentor or teach other students about STEM	0.0%	0.0%	25.4%	43.7%	31.0%	
	0	0	18	31	22	**71**
Help with a community service project related to STEM	0.0%	1.4%	31.0%	39.4%	28.2%	
	0	1	22	28	20	**71**
Participate in a STEM camp, club, or competition	0.0%	0.0%	27.1%	37.1%	35.7%	
	0	0	19	26	25	**70**
Take an elective (not required) STEM class	0.0%	0.0%	24.3%	41.4%	34.3%	
	0	0	17	29	24	**70**

[16] These 10 items had a Cronbach's alpha reliability of 0.900.

Work on a STEM project or experiment in a university or professional setting	0.0%	1.4%	16.9%	39.4%	42.3%	
	0	1	12	28	30	**71**

Apprentices were also asked about their future interest in participating in AEOPs (see Table 40). While 77% of apprentices reported being at least somewhat interested in participating in SEAP again, many had never heard of programs such as UNITE (82%) and JSHS (74%). In spite of the 43% of apprentices who reported not having heard of CQL, another 40% were at least somewhat interested in participating in this program. Likewise, 45% of student reported being at least somewhat interested in the SMART scholarship and 35% of students reported being at least somewhat interested in participating in URAP.

Table 40. Apprentice Interest in Future Participation in AEOPs (n=69-72)

	I've never heard of this	Not at all	A little	Somewhat	Very much	Response Total
UNITE	81.7%	5.6%	5.6%	1.4%	5.6%	
	58	4	4	1	4	**71**
Junior Science & Humanities Symposium (JSHS)	74.3%	7.1%	4.3%	4.3%	10.0%	
	52	5	3	3	7	**70**
Science & Engineering Apprenticeship Program (SEAP)	5.6%	4.2%	14.1%	15.5%	60.6%	
	4	3	10	11	43	**71**
Research & Engineering Apprenticeship Program (REAP)	37.7%	8.7%	17.4%	13.0%	23.2%	
	26	6	12	9	16	**69**
High School Apprenticeship Program (HSAP)	55.7%	14.3%	11.4%	5.7%	12.9%	
	39	10	8	4	9	**70**
College Qualified Leaders (CQL)	43.1%	2.8%	13.9%	8.3%	31.9%	
	31	2	10	6	23	**72**
GEMS Near Peer Mentor Program	38.0%	15.5%	9.9%	18.3%	18.3%	
	27	11	7	13	13	**71**
Undergraduate Research Apprenticeship Program (URAP)	56.9%	0.0%	8.3%	12.5%	22.2%	
	41	0	6	9	16	**72**
Science Mathematics, and Research for Transformation (SMART) College	47.9%	1.4%	5.6%	9.9%	35.2%	
	34	1	4	7	25	**71**
National Defense Science & Engineering	62.0%	1.4%	7.0%	8.5%	21.1%	

Graduate (NDSEG) Fellowship	44	1	5	6	15	**71**

Apprentices were asked to identify the resources that impacted their awareness of the various AEOPs. The responses reflected in Table 41 indicate that participating in SEAP was most likely to impact apprentice awareness of other AEOPs, with 89% of apprentices indicating that this impacted their awareness at least somewhat. Mentors were also rated by a majority of apprentices (67%) as having at least some impact on their awareness of AEOP and 50% of apprentices indicated that the AEOP website was at least somewhat helpful in learning about AEOPs. On the other hand, the majority of apprentices indicated that they did not experience AEOP resources including the It Starts Here! magazine (78%) and the AEOP brochure (65%). Likewise, 72% of responding apprentices had not experienced AEOP on social media.

Table 41. Impact of Resources on Apprentice Awareness of AEOPs (n=71-72)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Army Educational Outreach Program (AEOP) website	15.3%	4.2%	30.6%	22.2%	27.8%	
	11	3	22	16	20	**72**
AEOP on Facebook, Twitter, Pinterest or other social media	72.2%	9.7%	9.7%	6.9%	1.4%	
	52	7	7	5	1	**72**
AEOP brochure	65.3%	11.1%	11.1%	6.9%	5.6%	
	47	8	8	5	4	**72**
It Starts Here! Magazine	77.5%	11.3%	7.0%	2.8%	1.4%	
	55	8	5	2	1	**71**
My SEAP mentor(s)	8.3%	4.2%	20.8%	22.2%	44.4%	
	6	3	15	16	32	**72**
Invited speakers or "career" events during SEAP	38.9%	6.9%	11.1%	23.6%	19.4%	
	28	5	8	17	14	**72**
Participation in SEAP	2.8%	1.4%	6.9%	26.4%	62.5%	
	2	1	5	19	45	**72**

Attitudes toward Research

Apprentices' 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 questionnaire asked about apprentices' opinions of what DoD researchers do and the value of DoD research more broadly (see Table 42). Most responding apprentices agreed or strongly agreed that DoD researchers advance science and engineering fields (95%), that DoD researchers develop new, cutting edge technologies (89%), that DoD researchers solve real-world problems (96%), and that DoD research is valuable to society (97%).

Table 42. Apprentice Opinions about DoD Researchers and Research (n=71-72)

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Response Total
DoD researchers advance science and engineering fields	0.0%	0.0%	5.6%	36.6%	57.7%	
	0	0	4	26	41	**71**
DoD researchers develop new, cutting edge technologies	0.0%	0.0%	11.3%	33.8%	54.9%	
	0	0	8	24	39	**71**
DoD researchers solve real-world problems	0.0%	1.4%	2.8%	37.5%	58.3%	
	0	1	2	27	42	**72**
DoD research is valuable to society	0.0%	0.0%	2.8%	33.3%	63.9%	
	0	0	2	24	46	**72**

Education and Career Aspirations

The SEAP evaluation also examined the program's impact on apprentices' education and career aspirations. In terms of education, the questionnaire asked apprentices how far they wanted to go in school before and after participating in SEAP (see Tables 43 and 44). As can be seen in Table 43, when asked to think back on how far they wanted to go in school before participating in SEAP, 27% indicated wanting to finish college, 28% to get a masters' degree, 15% a Ph.D., and 15% a medical-related degree while 7% aspired to a combined M.D./Ph.D. degree. After SEAP (see Table 44), only 11% of apprentices aspired to a Bachelor's degree, while interest in earning a Ph.D. rose to 27%, and interest in a combined M.D./Ph.D. rose to 14% and interest in a medical-related degree dropped slightly to 13%. While student interest seemed to shift somewhat, particularly in terms of earning Ph.D. 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 (99%). Overall this rate rose to 100% after participation in SEAP.

Table 43. Apprentice Education Aspirations Before SEAP (n=71)

	Before Response Percent	Before Response Total	After Response Percent	After Response Total
Graduate from high school	1.41 %	1	0.00%	0
Go to a trade or vocational school	0.00 %	0	0.00%	0
Go to college for a little while	1.41 %	1	1.41%	1
Finish college (get a Bachelor's degree)	26.76 %	19	11.27%	8
Get more education after college	4.23 %	3	5.63%	4
Get a master's degree	28.17 %	20	28.17%	20
Get a Ph.D.	15.49 %	11	26.76%	19
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	15.49 %	11	12.68%	9
Get a combined M.D. / Ph.D.	7.04 %	5	14.08%	10
Get another professional degree (law, business, etc.)	0.00 %	0	0.00%	0

Apprentices were asked what kind of work they expect to be doing at age 30, reflecting on what their aspiration was before and after participating in SEAP (see Tables 44 and 45). Most apprentices expressed interest in STEM-related careers both before and after participating in SEAP, with about a third of apprentices aspiring to engineering careers (31% before SEAP and 31% after). The number of apprentices interested in biological science increased, rising from 11% before SEAP to 17% after SEAP participation. Nearly all apprentices were interested STEM-related careers both before and after SEAP participation.

Table 44. Apprentice Career Aspirations Before SEAP (n=72)

	Response Percent	Response Total
Undecided	4.17 %	3
Science (no specific subject)	4.17 %	3
Physical science (physics, chemistry, astronomy, materials science)	8.33 %	6
Biological science	11.11 %	8
Earth, atmospheric or oceanic science	1.39 %	1
Environmental science	1.39 %	1

Computer science	6.94 %	5
Technology	0.00 %	0
Engineering	30.56 %	22
Mathematics or statistics	5.56 %	4
Medicine (doctor, dentist, veterinarian, etc.)	15.28 %	11
Health (nursing, pharmacy, technician, etc.)	2.78 %	2
Social science (psychologist, sociologist, etc.)	2.78 %	2
Teaching, STEM	1.39 %	1
Teaching, non-STEM	0.00 %	0
Business	0.00 %	0
Law	0.00 %	0
Military, police, or security	1.39 %	1
Art (writing, dancing, painting, etc.)	0.00 %	0
Skilled trade (carpenter	0.00 %	0
Other	2.78 %	2

Table 45. Apprentice Career Aspirations After SEAP (n=71)

	Response Percent	Response Total
Undecided	2.82 %	2
Science (no specific subject)	1.41 %	1
Physical science (physics, chemistry, astronomy, materials science)	7.04 %	5
Biological science	16.90 %	12
Earth, atmospheric or oceanic science	1.41 %	1
Environmental science	0.00 %	0
Computer science	8.45 %	6
Technology	0.00 %	0
Engineering	30.99 %	22
Mathematics or statistics	5.63 %	4
Medicine (doctor, dentist, veterinarian, etc.)	18.31 %	13
Health (nursing, pharmacy, technician, etc.)	1.41 %	1

Social science (psychologist, sociologist, etc.)	2.82 %	2
Teaching, STEM	0.00 %	0
Teaching, non-STEM	0.00 %	0
Business	0.00 %	0
Law	0.00 %	0
Military, police, or security	1.41 %	1
Art (writing, dancing, painting, etc.)	0.00 %	0
Skilled trade (carpenter, electrician, plumber, etc.)	0.00 %	0
Other, (specify):	1.41 %	1

Apprentices were also asked to indicate 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 46). All apprentices reported that they expect to use STEM in their work and a majority (88%) expect to use STEM 76-100% of the time in their work.

Table 46. Extent to Which Apprentices Expect to Use STEM in Their Work at Age 30 (n=70)

	Response Percent	Response Total
not at all	0.00 %	0
up to 25% of the time	5.71 %	4
up to 50% of the time	5.71 %	4
up to 75% of the time	27.14 %	19
up to 100% of the time	61.43 %	43

Overall Impact

Apprentices reported on the impacts of participating in SEAP more broadly and indicated SEAP had substantial impacts on them (see Table 47). For example, a large majority of responding apprentices indicated that SEAP contributed or was a primary reason for their greater appreciation of Army or DoD STEM research (97%), for them being more confident in their STEM knowledge, skills, and abilities (94%), for their increased interest in participating in STEM activities outside of school requirements (89%), and for their increased interest in pursuing a STEM career with the Army or DoD (79%). The vast majority of responding apprentices (90%) also indicated that SEAP at least contributed to their awareness of other AEOPs. 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

[17] The Cronbach's alpha reliability for these 10 items was 0.858.

impacts on apprentices in most areas were similar to those of the apprentices, however 43% of responding mentors indicated that their students were not more aware of AEOPs after SEAP participation.

Table 47. Apprentice Opinions of SEAP Impact (n=70-71)

	Disagree - This did not happen	Disagree - This happened but not because of SEAP	Agree - SEAP contributed	Agree - SEAP was primary reason	Response Total
I am more confident in my STEM knowledge, skills, and abilities	0.0%	5.6%	63.4%	31.0%	
	0	4	45	22	**71**
I am more interested in participating in STEM activities outside of school requirements	1.4%	9.9%	63.4%	25.4%	
	1	7	45	18	**71**
I am more aware of other AEOPs	8.6%	1.4%	51.4%	38.6%	
	6	1	36	27	**70**
I am more interested in participating in other AEOPs	8.5%	7.0%	47.9%	36.6%	
	6	5	34	26	**71**
I am more interested in taking STEM classes in school	1.4%	28.2%	60.6%	9.9%	
	1	20	43	7	**71**
I am more interested in earning a STEM degree	4.2%	28.2%	56.3%	11.3%	
	3	20	40	8	**71**
I am more interested in pursuing a career in STEM	1.4%	28.2%	49.3%	21.1%	
	1	20	35	15	**71**
I am more aware of Army or DoD STEM research and careers	1.4%	1.4%	47.1%	50.0%	
	1	1	33	35	**70**
I have a greater appreciation of Army or DoD STEM research	1.4%	1.4%	47.9%	49.3%	
	1	1	34	35	**71**
I am more interested in pursuing a STEM	12.7%	8.5%	45.1%	33.8%	

career with the Army or DoD	9	6	32	24	**71**

An open-ended item on the questionnaire asked apprentices to list the three most important ways they benefited from the program. The 40 apprentices who responded referred to a variety of benefits. The most often-mentioned benefits of SEAP were career information and job skills (29 responses) and STEM skills and knowledge (22 responses). Other benefits mentioned included the opportunity to make professional connections (8 responses), exposure to various types of research and technology (8 responses), research and writing skills (6 responses), confidence (4 responses), and teamwork (4 responses).

Focus group participants expanded upon some of these benefits. For instance,

> *[SEAP] has shown me various aspects of physics that I have the possibility of going into. I've learned how to use a lot of equipment.* (SEAP Apprentice)

> *Actually being able to do research [and] to learn to use the atomic force microscope and actually have hands-on experience is the field is something that I'm just so happy to have…I don't have anything like it at school.* (SEAP Apprentice)

> *It's just interesting to see basically how it is to have a group of scientists working together…it can just be fun to experience these new surroundings and experiment, in my case at least, with different kinds of work.* (SEAP Apprentice)

> *I feel like I'm learning a lot not just about the lab, lab etiquette, how different procedures work, and how to work with scientists. I'm also learning a lot about the job.* (SEAP Apprentice)

Summary of Findings

The FY16 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 48.

Table 48. 2016 SEAP Evaluation Findings	
Participant Profiles	
SEAP experienced another year of growth in participation of apprentices from historically underrepresented and underserved populations.	The proportion of females participating in SEAP increased again in FY16 to 55% (compared to 45% in FY15). This is substantial in that females are underrepresented in STEM disciplines overall and to a greater degree in the physical sciences and engineering specifically.
	SEAP continued to serve students from historically underrepresented and underserved race/ethnic groups and experienced growth in percentage of Black or African American apprentices to 19% (comparted to 14% in FY15) and Hispanic or Latino apprentices to 5% (compared to 2% in FY15). This is a second year of growth for SEAP in diversity of participants and should continue to be an area of focus for future growth.
SEAP experienced limited success in recruiting participants from other AEOPs to SEAP.	While over half of SEAP participants had never participated in any other AEOP, 35% had participated in GEMS and small numbers of students had participated in Camp Invention and e-Cybermission in the past. This is a slight increase from FY15 when 32% of respondents reported having participated in GEMS at least once.
SEAP apprentices expressed interest in participating in AEOPs in the future.	Most apprentices were interested in participating in SEAP again and many expressed interest in other AEOPs, such as CQL, and the GEMS Near Peer Mentor program, as well as the SMART scholarship, a workforce initiative to bring research talent into DoD labs.
SEAP increased their number of applicants, but did not reach their FY16 target.	The program fell short of its FY16 goal of 990 applicants. However there was an increase in the number of applicants from FY15 (690 compared to 633).
Actionable Program Evaluation	
Pre-existing relationships continue to be a factor in SEAP recruitment, however students reported hearing about SEAP from a variety of sources.	Mentors' most commonly identified method of student recruitment was informational materials sent to K-12 schools or universities (43%). As in FY14 and FY15, references from workplace colleagues and applications from the AAS or AEOP websites were also commonly reported methods of apprentice recruitment.
	The most often cited source of apprentice information about AEOP was family members. A school or university newsletter, email, or website and someone who works for the DoD were less commonly identified sources of information about SEAP as was the AEOP website.

SEAP apprentices continue to be motivated by a variety of factors.	A range of factors motivated apprentices to participate in SEAP. All responding apprentices identified interest in STEM as a motivator, and nearly all identified a desire to learn something new or interesting. Large proportions of apprentices also identified learning in ways that are not possible in school, the desire to expand laboratory or research skills, and figuring out education or career goals as motivators.
SEAP engaged apprentices in meaningful STEM learning.	A large majority 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, working as part of a team, and using laboratory procedures and tools every day or most days of their SEAP experience.
	Apprentices reported more intensive STEM learning opportunities in SEAP as compared to their typical school experiences.
	Responding mentors reported using a variety of teaching and/or mentoring activities to meet students' needs. Mentors used a variety of strategies to establish relevance of learning activities, support the diverse needs of their students as learners, to support student collaboration and interpersonal skills, support apprentices' engagement in authentic STEM activities, and to support STEM educational and career pathways. The most commonly reported mentoring strategies used (identified by 100% of responding mentors) included asking students about educational or career goals, having students search for and review technical research to support their work, providing students with constructive feedback to improve their STEM competencies, allowing students to work independently, having students work on collaborative activities or projects, and giving students real-life problems to investigate or solve.
SEAP promotes apprentice awareness of DoD STEM research and careers.	A large majority of apprentices reported positive opinions about DoD researchers and research. For example, nearly all apprentices reported that they believe that DoD research is valuable to society and that DoD researchers advance science and engineering fields.
	Nearly all apprentices 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 at least somewhat 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 AEOP programs beyond SEAP. Similarly, responding mentors generally had little awareness of or past participation in other AEOP programs. In spite of this, 89% of apprentices indicated that SEAP contributed to their awareness of other AEOPs and 85% indicated that SEAP contributed to their increased interest in participating in other AEOPs in the future.
The SEAP experience is valued by apprentices and mentors, however apprentices expressed some dissatisfaction with administrative aspects of the program.	Nearly all responding apprentices expressed overall positive perceptions of the program. Most apprentices were at least somewhat satisfied with various aspects of their research experience including their working relation with their mentor, their relationship with their group or team, and the amount of time they spent doing meaningful research. A large majority of apprentices reported being at least somewhat satisfied with SEAP features such as applying or registering for the program, the variety of STEM topics available, and communicating with SEAP host site organizers. Mentors also expressed satisfaction with features of the program they had experienced.
	Administrative aspects of the program were an area of some dissatisfaction for apprentices, as 18% of apprentices reported being not at all satisfied with "other administrative tasks" associated with SEAP including in-processing and network access. This is an increase over FY15 when 15% of students expressed dissatisfaction with these administrative features of SEAP. This theme was echoed in apprentice responses to an open-ended survey item in which respondents emphasized lack of computer access and late stipend payments as areas in which the program could improve. Mentors in focus groups echoed student concerns over delays in apprentice computer access.
Outcomes Evaluation	
SEAP apprentices reported gains in STEM knowledge and competencies.	Nearly all apprentices reported gains in their STEM knowledge, with large or extreme gains in areas such as knowledge of what everyday research work is like in STEM, knowledge of research conducted in a STEM topic or field, and in-depth knowledge of a STEM topic(s).
	A majority of apprentices reported gains in a variety of STEM competencies, including large or extreme gains in areas such as communicating about their experiments and explanations in different ways and supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge.

SEAP participants reported gains in 21st Century Skills.	Apprentices reported gains in their 21st century skills as a result of participating in SEAP. Large or extreme gains were reported in areas such learning to work independently, sticking with a task until it is finished, making changes when things do not go as planned, setting goals and reflecting on performance, and including others' perspectives when making decisions
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 their desire to build relationships with mentors who work in STEM, feeling prepared for more challenging STEM activities, and their sense of accomplishing something in STEM.
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 such as working on a STEM project or experiment in a university or professional setting, taking an elective (not required) STEM class, and mentoring or teaching other students about STEM.
SEAP participants reported aspiring to advanced degrees and STEM careers both before and after SEAP.	Most apprentices indicated wishing to pursue an advanced degree both before and after SEAP, although somewhat more students expressed interest in a Ph.D. or M.D./Ph.D. degree after participating in SEAP.
	Most apprentices expressed interest in STEM-related careers both before and after participating in SEAP, however the number of students interested in careers in biological science increased after SEAP participation.
SEAP participants show interest in future AEOP opportunities.	A majority of apprentices indicated being at least somewhat interested in participating in SEAP again and many expressed interest in participating in CQL and other AEOPs such as the SMART scholarship and URAP.

Responsiveness to FY15 Evaluation Recommendations

The primary purpose of the AEOP program evaluation is to serve as a vehicle to inform future programming and continuous improvement efforts with the goal of making progress toward the AEOP priortiies. In previous years the timing of the delivery of the annual program evaluation reports has precluded the ability of programs to use the data as a formative assessment tool. However, beginning with the FY16 evaluation, the goal is for programs to be able to leverage the evaluation reports as a means to target specific areas for improvement and growth.

In this report, we will highlight recommendations made in FY15 to programs and summarize efforts and outcomes reflected in the FY16 APR toward these areas.

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

Finding: SEAP demonstrated slight growth in diversity. This should be a continued focus area for FY16.

SEAP FY16 Efforts and Outcomes: In FY 16, the number of Black or African American and Hispanic or Latino groups has increased to 25%, up from 20% in FY15. AAS directed outreach to underrepresented schools within proximity to the laboratories. This outreach helped to increase the number of underrepresented populations. AAS will continue this outreach effort. In FY17, the apprentice program will work with one or more strategic partners to increase the under-represented minority population (URM).

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

Finding: SEAP should work to increase the number of mentors – and corresponding capacity to host more apprentices in FY16.

SEAP FY16 Efforts and Outcomes: SEAP mentors remained steady in FY16. AAS has had conversations with lab coordinators to talk about mentor recruitment. During the conversations, AAS was made aware of the following:

a. The Army has issued a "line of sight" directive regarding minors. No minor is allowed to move unaccompanied on a base. This means a minor must be accompanied by an adult from the time the student enters the base to the time the student exits. This is a burden on the mentor to cross the base to walk a student to the place of work and then back again at the end of the day. Many mentors are not willing to put forth this kind of effort.

b. Some lab coordinators indicated that it takes approximately 4 weeks to get a student computer access and process the necessary paperwork. Mentors do not have extra time to devote to paperwork on behalf of a student.

To address some of these concerns, in FY17, SEAP registration will be open from November 1 to February 28 (two months earlier than prior years). AAS anticipates that mentors will review applications by April 30, which will enable student notification in early May and begin the paperwork. Students could be notified in early May and the necessary paperwork set in motion. Students could then begin their apprenticeships in June and with no time lost due to lack of computer access. The lab coordinators have agreed to the new timeline.
AAS recognized the mentors with a certificate of appreciation in FY16. The feedback from this recognition was very positive. The mentors had not received any kind of recognition prior to this time. AAS would like to continue this tradition into FY17.

In addition, AAS would like the opportunity to visit DoD labs and host a recruitment effort in the form of a "lunch and learn" or a variation of that theme. This could bring more recognition to the benefits that mentorship provides, i.e., the impact on a student's future, personal growth, and an opportunity to grow resume experience.

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

FY15 Finding: There is a need to improve the effectiveness of the administration of the SEAP program.

SEAP FY16 Efforts and Outcomes: In FY 16, AAS assumed the administration of all apprenticeship programs. First priority for AAS was to build positive working relationships with the lab coordinators; we will continue this effort in FY17. Battelle and AAS were successful in streamlining the stipend process, ensuring timely stipend payments.

AAS implemented weekly communication with consistent AEOP messaging to students, director/mentors and lab coordinators. AAS also centralized distribution of AEOP materials to students, directors/mentors and lab coordinators. New program flyers were created and distributed in FY16 and AAS will work with Widmeyer to create a consolidated flyer that describes all apprenticeships.

Finding: There is a need to market other AEOPs within the SEAP program.

SEAP FY16 Efforts and Outcomes: In FY16, AAS had ongoing communication throughout the summer to all students, mentors and lab coordinators. As part of the communication, AAS highlighted AEOP programs and the benefits offered. In addition, AAS networked with GEMS to see if additional marketing of SEAP (and all apprenticeships) would be possible by NSTA. They offered to present the apprenticeship marketing materials at NSTA events, once the promotion poster was developed. Brochures were also distributed by lab coordinators to all participants regarding AEOP opportunities as part of a lab welcome packet.

Finding: There is a need to increase SEAP participation in the AEOP evaluation.

SEAP FY16 Efforts and Outcomes: Onsite evaluations were conducted at three labs in FY16 which resulted in some good data. Students were contacted weekly regarding the survey mid-way through the apprenticeship in an effort to encourage completion. The feedback observed regarding the evaluation was that it was too long and took too much time to complete. A shorter, more concise program evaluation may result in greater completion rates. An incentive may encourage evaluation completion, as well, such as a gift card for completion.It would be beneficial to require year end reporting later in the year so that the program evaluation link could remain open until early September.

FY 16 Recommendations

Evaluation findings indicate that FY16 was a successful year overall for the SEAP program. Notable successes for the year include high levels of mentor and apprentice satisfaction with program features; evidence of strong apprentice gains in STEM knowledge, skills, and competencies; and apprentice interest in participating in AEOPs in the future. Apprentices and mentors continue to report high levels of satisfaction with mentor-apprentice relationships, and both groups likewise report strong apprentice gains in 21st Century skills. 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

The AEOP goal of attracting students from groups historically underrepresented and underserved in STEM continues to be met with limited success in SEAP. Many apprentices reported learning about SEAP through personal connections, suggesting that marketing efforts may have limited effectiveness. Since 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 it is recommended that AAS review these processes and identify ways to ensure that SEAP information reaches these students and that the apprentice selection process is not unduly influenced by personal connections. The AAS may also wish to consider mentors suggestions that targeting funding specifically to provide outreach and logistical support (for example bus passes) for students from underserved or under-represented groups may support these students' participation in SEAP. In sum, the program should consider additional/alternate means of broadening the pool of applicants and consider devising strategies for recruiting and selecting apprentices to ensure that SEAP includes diverse groups of highly talented participants.

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. There is a substantial unmet need in terms of mentor capacity with only 113 students (16% of applicants) being placed out of 690 applicants. Program expansion will require active recruitment of additional Army S&Es to serve as mentors. Mentor suggestions to this end include providing more outreach to Army S&Es about the program and providing overhead hour pay to mentors. The AAS may wish to investigate the procedures and resources used to recruit SEAP mentors and identify factors that motivate and discourage Army S&Es from assuming this role.

2. Apprentices and mentors reported that students lacked computer access for long periods of time during their apprenticeships. This lack of access to technology may interfere with apprentices' work and learning experiences and is likely to limit their involvement in research activities. The AAS should work with SEAP site coordinators to identify ways to expedite computer access for students.

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

1. Some features of SEAP program administration continues to be a concern. Student dissatisfaction with timeliness of stipend payments continues to be an issue as do the computer access issues referenced above. The AAS should be mindful of these issues and leverage its past experience with administering apprenticeship programs to streamline processes. It is recommended that AAS work with SEAP site coordinators to identify ways to expedite computer access for students and ensure timeliness of stipend payments.

2. Marketing of SEAP and dissemination of information about AEOPs is an area with continued room for growth within the SEAP program. Although apprentices identify mentors as a key source of information about AEOPs, few mentors or apprentices reported being familiar with most AEOPs for which students currently are or will

soon be eligible. This suggests that the program may benefit from targeting AEOP information to mentors as well as apprentices. In order to meet the AEOP objective of creating a robust pipeline of AEOP programs in which students progress from other AEOPs into SEAP and from SEAP into CQL and other programs, the program may want to consider innovative ways to work with other AEOPs to create a more seamless continuum of programs. In particular, SEAP administrators may wish to target GEMS alumni to participate in SEAP, devising ways to disseminate SEAP information to GEMS participants and alumni. Given the limited apprentice awareness of resources such as the 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 program's participation in the overall AEOP evaluation continues to be lower than desired. The continued low response rates for both apprentice and mentor questionnaires (36% and 6% in FY16) continue to be a challenge which may be attributed to the schedule for apprenticeships compared to the annual AEOP reporting schedule. It is notable that FY16 participation rates represent a substantial decrease from FY15 rates when response rates were 50% for apprentices and 21% for mentors. 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. The evaluation team will work with AAS to administer the survey to more apprentices and earlier in their experience if necessary.

Appendices

Appendix A

FY16 SEAP Evaluation Plan

Questionnaires

Purpose:

As per the approved FY16 AEOP APP, the external evaluation of SEAP 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. 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.

Focus Groups Site Visits/Onsite Focus Groups

Purpose:
As per the approved FY16 AEOP APP, the external evaluation of SEAP includes site visits/onsite focus groups.

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

Evaluation Activities during SEAP Site Visits:

- One or two 45 minute focus group with 6-8 apprentice participants;
- One 45-minute focus group with 6-8 mentors;
- 30-60 minutes to observe the program (specifically, to see students engaged in program activities, preferably with their mentors); and
- 10-15 minute transitions between each evaluation activity for moving groups in and out and providing evaluators with time to organize paperwork and take nature breaks.

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

FY16 SEAP Apprentice Focus Group Protocol

2016 Science & Engineering Apprenticeship Program (SEAP) Evaluation Study Student Focus Group 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 C

FY16 SEAP Mentor Focus Group Protocol

2016 Science & Engineering Apprenticeship Program (SEAP) Evaluation Study Mentor Focus Group 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 haven't been in a focus group before, I'd like to give you some ground rules that I like to use in focus groups. They seem to help the group move forward and make everyone a little more comfortable:

1. What is shared in the room stays in the room.
2. Only one person speaks at a time.
3. If you disagree please do so respectfully.
4. It is important for us to hear the positive and negative sides of all issues.
5. We will be audio recording the session for note-taking purposes only. Audio will be destroyed.
6. Do you have any questions about participating in the focus group?

Key Questions:

1. **When you think about SEAP, what kind of value does this program add**?
    - How do you think students benefit from participating in SEAP?
    - Can you think of a particular student or group of students that benefit the most from SEAP?
    - How have you benefited from participating in SEAP?

One of the primary sponsors of the SEAP program is the Army Educational Outreach Program (AEOP). The AEOP needs specific information to create reports and defend funding for its outreach programs, SEAP included.

2. **We need to understand more about how SEAP is helping students know more about STEM career opportunities in the Department of Defense, especially civilian positions.**
    - Have you seen any efforts by SEAP to educate participants about the Army, DoD, or careers in the DoD?
    - What strategies seem to be the most effective for SEAP students?
    - Do you have any suggestions for helping SEAP teach students about careers in the DoD?

The AEOP sponsors a wide range of national STEM outreach programs that these students qualify for.

3. **The AEOP needs to know if SEAP is teaching students about the other STEM outreach programs that it sponsors.**
    - First, are you aware of the other programs offered by the AEOP? (e.g., SEAP, CQL, CQL, SMART, etc.)
    - Have you seen any efforts at SEAP to educate adults or students about the other AEOP programs?
    - What seems to work the best? The worst?
    - Any suggestions for helping the AEOP educate these students about the other programs?

4. **The AEOP is trying to make sure that its programs become more effective at reaching adult and youth participants from underserved and underrepresented groups (racial/ethnic groups, low SES, etc.).**
    - Have you seen any efforts by SEAP to help engage underserved or underrepresented groups of adults and youth?
    - What strategies seem to work the best? The worst?
    - Any suggestions for helping SEAP reach new populations of adult and youth participants?

5. **What suggestions do you have for improving SEAP?**
6. **Last Chance - Have we missed anything? Tell us anything you want us to know that we didn't ask about.**

Appendix D

FY16 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

4. What grade will you start in the fall? (select one)	
Select one.	
○	9th
○	10th
○	11th
○	12th
○	College freshman
○	Choose not to report
○	Other, (specify)::

5. What is your gender?	
Select one.	
○	Male
○	Female
○	Choose not to report

6. What is your race or ethnicity?

Select one.

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

7. Do you get free or reduced lunches at school?

Select one.

○	Yes
○	No
○	Choose not to report

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
○	Technology
○	Engineering
○	Mathematics

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	○	○	○	○	○
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	○	○	○	○	○

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

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 E

FY16 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

4. What is your gender?	
Select one.	
○	Male
○	Female
○	Choose not to report

5. What is your race or ethnicity?	
Select one.	
○	Hispanic or Latino
○	Asian
○	Black or African American
○	Native American or Alaska Native
○	Native Hawaiian or Other Pacific Islander
○	White
○	Choose not to report
○	Other race or ethnicity, (specify)::

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
○	MARYLAND - Edgewood Chemical Biological Center - ECBC - Gunpowder, MD

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 serve as mentor to 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 Academy of Applied Science (AAS) 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 Academy of Applied Science (AAS)	○	○	○	○	○
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	○	○	○	○	○

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

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	○	○	○	○	○

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

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 F

Academy of Applied Science (AAS)
FY16 Evaluation Report Response