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Army Educational Outreach Program

Science and Engineering Apprenticeship Program (SEAP)



2017 Annual Program Evaluation Report

PART 1: Executive Summary

January 2018



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2 | Executive Summary

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 participants 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.

This report documents the evaluation of one of the AEOP elements, the Science & Engineering Apprenticeship Program (SEAP). In FY17, 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.

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. The use of the term “mentor” throughout this report will therefore refer to the Army S&E 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.

This report documents the evaluation of the FY17 SEAP program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and SEAPs overall effectiveness in meeting AEOP and program objectives.

2017 Fast Facts	
Description of program	STEM Apprenticeship Program – Summer, at Army laboratories with Army S&E mentors
Participant Population (who is eligible for program)	9th-12th grade students
Number of Applicants	852
Number of Registered Participants	113
Number of Underserved registered participants	25%
Placement Rate	13%
Number of Army S&Es	119
Number of Army/DoD Research Laboratories	11
Number of K–12 Schools (Home, Private, Public, DoDEA)	55
Number of K–12 Schools — Title I	14
No. of DoDEA Students	0
No. of DoDEA Schools	0
Total Cost	\$419,955
Stipend Cost (paid by participating labs)	\$356,132
Administrative Costs (salaries, fringe, indirect, cost share)	\$59,180
Cost Per Student Participant	\$3,717

Summary of Findings

The FY17 evaluation of SEAP collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP's and SEAP's program objectives and intended outcomes. A summary of findings is provided in the table below.

2017 SEAP Evaluation Findings	
Participant Profiles	
SEAP enrollment and participation of apprentices from historically underserved populations remained relatively constant at FY16 levels. The number of SEAP mentors declined slightly in FY17.	There was a 20% increase in SEAP applications received in FY17 (852). However, the number of apprentices enrolled remained at FY16 levels (113) due to the limited number of mentors available. The number of SEAP mentors decreased slightly from 128 in FY16 to 119 in FY17 (8%).
	SEAP continued to serve students from groups underserved in STEM. As in FY16, slightly over half of apprentices were female (54% in FY17 compared to 55% in FY16). The proportion Black or African American apprentices dropped slightly to 17% (compared to 19% in FY16), as did the proportion of Hispanic or Latino apprentices (3% in FY17 compared to 5% in FY16).
SEAP continued to have limited success in recruiting students from other AEOPs.	As in FY16, just over a third of students (36% in FY17 compared to 35% in FY16) had participated in GEMS in the past. Another 13% of students reported participating in Camp Invention. No students had participated in JSHS, however, and 40% had never participated in another AEOP.

Actionable Program Evaluation	
SEAP apprentices continued to learn about AEOP most frequently through personal connections.	Personal connections were primary means of information for most apprentices, with the most frequently reported sources of information being a family member (43%), someone who works for the DoD (34%), and a friend (30%).
	Mentors who were aware of how apprentices were recruited most often cited personal and professional connections as apprentice recruitment strategies. The two recruitment sources most frequently chosen by mentors were personal acquaintance(s) (31%) and colleague(s) in their workplace (23%).
SEAP apprentices were motivated to participate in the program by a variety of factors.	A range of factors motivated apprentices to participate in SEAP. Nearly all responding apprentices identified interest in STEM as a motivator (99%), and a large majority (78%-82%) identified a desire to learn something new or interesting, learning in ways that are not possible in school, the desire to expand laboratory or research skills, the opportunity to use advanced laboratory technology, and figuring out education or career goals as motivators.
SEAP exposes apprentices to STEM jobs and careers, both in general and within the DoD.	Large majorities of students had learned about at least one STEM job or career (93%) and about at least one DoD STEM job or career (87%). Over half of apprentices had learned about 5 or more STEM jobs or careers (56%) and about 5 or more DoD STEM jobs or careers (55%).
	Apprentices cited their participation in SEAP (71% reported this as “very much” impactful) and their mentors (64% reported this as “very much” impactful) as the most impactful resources for their awareness of DoD STEM jobs or careers.
SEAP engaged apprentices in STEM activities regularly.	Large majorities of apprentices reported engaging regularly (at least weekly) in STEM activities such as interacting with STEM researchers (97%), working with a STEM researcher or company on a real-world STEM research project (95%), analyzing data or information and drawing conclusions (85%), working collaboratively as part of a team (84%), and identifying questions or problems to investigate (84%).
	Apprentices reported significantly more intensive engagement in STEM in SEAP as compared to their typical school experiences.
Mentors used a variety of mentoring strategies when working with apprentices.	Mentors reported using a variety of teaching and/or mentoring 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 used mentoring strategies included becoming familiar with students’ backgrounds at the beginning of the SEAP experience (97%), giving students real-life problems to investigate (94%), having students listen to the ideas of others with an open mind (94%), supervising students while they practiced STEM skills (94%), and allowing students to work independently (94%).

SEAP apprentices expressed interest in participating in AEOPs in the future, however mentors provided only limited information about AEOPs.	<p>Over three-quarters of apprentices reported being more aware of AEOPs (79%) and more interested in participating in them in the future (85%) after participating in SEAP. Over half of respondents indicated being at least somewhat interested in participating in programs such as CQL (53%), the SMART Scholarship (57%), and the GEMS Near Peer Mentor program (51%). Nearly a third or more of respondents (31%-41%) had not heard of CQL, URAP, and the NDSEG Fellowship.</p>
	<p>Participation in SEAP and their mentors were cited by apprentices as the most important sources of information about AEOPs (75% reported this was at least somewhat impactful), however two-thirds of mentors reported that they did not recommend AEOPs to students that aligned with students' goals. In spite of this, more than a quarter of mentors reported discussing CQL (40%) and the SMART scholarship (26%) with students.</p>
	<p>More than half of mentors (69%) reported that the SEAP program administrator or site coordinator was a somewhat or very much useful resource in efforts to inform students about AEOPs, however most had not experienced AEOP resources such as the AEOP website (60%), AEOP on social media (74%), the AEOP brochure (71%), and invited speakers or career events (57%).</p>
Apprentices expressed high levels of satisfaction with SEAP program features, citing various program benefits and providing suggestions for improvements.	<p>A large majority of apprentices were satisfied with all SEAP features about which they were asked. For example, more than 90% of apprentices were at least somewhat satisfied with SEAP features such as the teaching or mentoring provided during SEAP activities (95%), the stipend amount (93%), the timeliness of payment of stipends (93%), and the physical location of SEAP activities (93%).</p>
	<p>Large majorities of apprentices were satisfied with all aspects of the research experience such as their relationship with their mentors, the amount of time they spent doing meaningful research, and the research experience overall. More than 85% of responding apprentices indicated being somewhat or very much satisfied with each aspect of their research experience.</p>
	<p>Students were most likely to cite gains in their STEM knowledge or skills, opportunities for hands-on experiences, career information, and the opportunity to develop workplace skills as benefits of SEAP.</p>
	<p>About a fifth of apprentices expressed dissatisfaction with administrative tasks associated with SEAP such as security clearances and issuance of CAC cards. Apprentices suggested improvements to the program including providing more opportunities for apprentices to interact with one another, providing opportunities to learn about other research projects and other departments, and improving the information mentors provided to apprentices.</p>
Mentors expressed high levels of satisfaction with SEAP program features, citing various program strengths and providing suggestions for improvements.	<p>Most mentors were at least somewhat satisfied with the SEAP features they had experienced. Approximately 70% of mentors were at least somewhat satisfied with the research abstract preparation requirements, the research presentation process, and communicating with SEAP organizers. Most mentors reported not having experienced communication with AAS (77%), stipend payment timeliness (69%), or stipend amount (57%).</p>

	Mentors cited a variety of strengths of SEAP including apprentices' opportunities for laboratory/hands-on experiences, exposure to real-world research and STEM topics, networking, and the opportunity to build the STEM talent pipeline.
	Mentors suggested various program improvements including better defining mentor responsibilities and/or providing mentor training, streamlining apprentice in-processing and computer access, and improving communication from program coordinators.
Outcomes Evaluation	
SEAP apprentices reported gains in STEM knowledge and STEM competencies.	Nearly all apprentices reported some level of gains in their STEM knowledge. Large majorities (nearly 90% or more) of apprentices indicated that they had experienced some gains or large gains for each area of STEM knowledge. For example, 92% reported at least some gain in their in-depth knowledge of a STEM field, and 93% reported at least some gain in their knowledge of how scientists and engineers work on real problems in STEM.
	A large majority of apprentices reported some level of gains in a variety of STEM competencies. Approximately two-thirds or more of apprentices reported at least some gains for all STEM competencies, with many reporting large gains. For example, 84% reported at least some gains in communicating about their experiments and explanations in different ways, 84% in identifying strengths and limitations of data, and 80% in supporting an explanation for an observation with data from experiments.

SEAP participants reported gains in 21st Century Skills.	More than three-quarters of responding apprentices reported at least some gains in each of the 21 st Century Skills. For example, 84% of apprentices reported at least some gain in sticking with a task until it is finished, 85% in making changes when things do not go as planned, and 75% in learning to work independently.
SEAP apprentices reported gains in their STEM identities and confidence.	Large majorities of apprentices reported at least some gains in areas of STEM identity such as their desire to build relationships with mentors who work in STEM (94%) and sense of accomplishing something in STEM (89%). Few apprentices reported no gain in any areas of STEM identity.
	Nearly all apprentices (93%) reported increased confidence in their STEM knowledge, skills, and abilities as a result of their SEAP experiences.
SEAP participants reported increased interest in future STEM activities.	Apprentices reported that after participating in SEAP they were more likely to engage in STEM activities outside of school. For example, 74% reported being more likely or much more likely to work on a STEM project or experiment in a university or professional setting; 74% to talk with friends or family about STEM; and 71% take an elective (not required) STEM class.
SEAP apprentices had positive opinions about DoD Research and Researchers.	A large majority of apprentices reported that they believe that DoD researchers advance science and engineering fields (92%) and DoD research is valuable to society (98%).
	Nearly all apprentices (93%) reported having a greater appreciation of Army or DoD STEM research after participating in SEAP and 69% were more interested in pursuing a STEM career with the Army and DoD as a result of their SEAP experiences.

Responsiveness to FY16 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 priorities. 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 FY16 to programs and summarize efforts and outcomes reflected in the FY17 APR toward these areas.

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

FY16 Finding: The AEOP goal of attracting students from groups historically 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 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 mentor's suggestions that targeting funding specifically to provide outreach and logistical support (for example bus passes) for students from underserved 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/suggestions to offer Army personnel for recruiting and selecting apprentices to ensure that SEAP includes diverse groups of highly talented participants.

SEAP FY17 Efforts and Outcomes: Monthly marketing efforts were targeted to high schools located within a two-hour radius of each lab. This effort increased SEAP applications and increased students who attend Title I schools from 17% in FY16 to 26% in FY17. However, student participation for this population continues to be a challenge in DoD laboratories.

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

FY16 Finding: 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.

SEAP FY17 Efforts & Outcomes: FY17 saw an even greater applicant interest in the program. The "line of sight" and funding continues to be an issue for the labs. To address the time delay in getting CAC cards, AAS opened the application two months early. This gave more time for selections and necessary paperwork to be completed earlier.

FY16 Finding: 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.

SEAP FY17 Efforts and Outcomes: None noted in APR.

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

FY16 Finding: 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.

SEAP FY17 Efforts and Outcomes: In FY17, AAS and Battelle collaborated to develop a streamlined stipend funding process which has worked well. There were few delays in stipend payments and students expressed satisfaction with the timeliness of payments.

FY16 Finding: 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.

SEAP FY17 Efforts and Outcomes: In FY17 special effort was made to market the apprenticeships to alumni of GEMS, UNITE, REAP, HSAP, and JSBS. This outreach and marketing effort resulted in a greater number of applications to all the apprenticeships.

FY16 Finding: 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.

SEAP FY17 Efforts and Outcomes: Weekly communication with Lab coordinators, mentors and students has been done regarding the completion of the evaluation. Mentors are not motivated to complete the survey because it offers no useful feedback such as, specific ways to improve interaction between mentor and student and organization at the lab, according to discussions held with lab coordinators.

Recommendations for FY18 Program Improvement/Growth

Evaluation findings indicate that FY17 was a successful year overall for the SEAP program. There continues to be increased interest in SEAP, noted by 20% growth in applicants for FY17. 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 FY18 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 underserved in STEM continues to be met with limited success in SEAP. As in FY16, many apprentices report learning about SEAP through personal connections, suggesting that marketing efforts may have limited effectiveness and may not be widely reaching outside of laboratory connections. Participation of underserved groups decreased somewhat in FY17. There was a 2% decrease (17% compared to 19%) in Black or African-American apprentices and similarly, Hispanic or Latino participation also decreased 2% (3% compared to 5%). 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

As in FY16, there is a continued need for SEAP to grow the number of participating mentors in the program. There was an 8% decrease in the number of mentors for SEAP in FY17 with a 20% increase in applicants, resulting in a substantial unmet need in terms of mentor capacity with only 113 students (16% of applicants) being placed out of 852 applicants. Program expansion will require active recruitment of additional Army S&Es to serve as mentors. It is recommended that AAS investigate the procedures and resources used to recruit SEAP mentors and identify factors that motivate and discourage Army S&Es from assuming this role.

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

1. Both apprentices and mentors reported lack of information regarding other AEOPs being conveyed in SEAP in FY17. Two-thirds (66%) of mentors reported they did not discuss other AEOPs to apprentices. More than 33% of apprentices had not heard of CQL, URAP, and the NDSEG Fellowship. SEAP should work to invest efforts in FY18 to address this communication and marketing issue. It is critical that participants are informed of other opportunities available to them in the AEOP pipeline.
2. Apprentice participation in the SEAP evaluation improved in FY17 to 54%. However, mentor participation should be increased in FY18 to reach a level of at least 40% participation (compared to 29% in FY16).