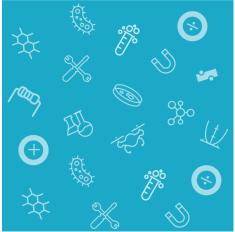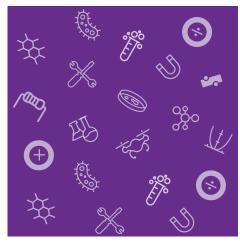IT STARTS HERE. ★

ARMY EDUCATIONAL OUTREACH PROGRAM

Summative Evaluation Report

2019 Annual Program Evaluation Report
Executive Summary

December 2020

aeop
ARMY EDUCATIONAL
OUTREACH PROGRAM

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3 | Introduction

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

> **AEOP Priorities**
>
> **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.

Table 1 displays program reports of youth and adult participation in AEOPs in 2019. A total of 28,947 youth participated in AEOPs in 2019, a 4.5% decrease from 2018 when 30,311 youth participated and a 12% decrease as compared to 2017 when 32,947 youth participated in AEOPs. Over half of these youth participants (56%) met the AEOP definition of underserved[1] as compared to 46% in 2018. A total of 6,138 adults participated in 2019, a 37% decrease as compared to the 9,774 adults reported to participate in AEOPs in 2018 and a 29% decrease from the 8,607 adults who participated in 2017. These adults included 938 DoD S&Es and other adults serving in mentor roles for research apprenticeships (CQL, REAP, SEAP, and URAP), judges for competitions (eCM, JSS, and JSHS), and presenters in STEM enrichment activities (GEMS and Unite) as well as in Army/DoD STEM showcases at competitions (eCM and JSHS).

Costs associated with the implementation of the 2019 AEOP portfolio of programs are detailed in Table 2. The portfolio is broken into four categories of programming: competitions, STEM enrichment programs, apprenticeships, and STEM educator programs. As in previous years, the apprenticeship programs and the

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[1] The AEOP defines underserved and underrepresented (U2) participants as those who possess at least two of the following criteria: attend a rural, urban, or frontier/tribal school; identify as female; identify as racial/ethnic minority; receive free or reduced lunch price at school or receive Pell Grant; speak a language other than English as their primary language; or have no parents who attended college.

STEM educator program (RESET) had the highest costs per participant while the competitions were the least costly of the AEOPs on a per student basis. The cost of AEOP competitions (eCM, JSS, and JSHS) in 2019 ranged from $114 per student (JSS) to $733 per student (JSHS). The cost of STEM enrichment programs (CII, GEMS, Unite) ranged from $227 per student for CII, typically a 1-week summer STEM experience, to $1,607 for Unite, a 4-6-week summer STEM experience for students from historically underserved and under-represented groups. Apprenticeship program (CQL, HSAP, REAP, SEAP, URAP) costs ranged from $2,680 per apprentice (REAP) to $8,840 per apprentice (CQL), with cost variations reflecting the duration of the program and academic level of apprentices. RESET is currently the only STEM educator program in the AEOP and cost $5,847 per participant in 2019.

Seven programs, CII, GEMS, HSAP, JSS, REAP, Unite, and URAP had slightly lower costs per student participant in FY19 as compared to FY18. All other programs experienced slight increases in cost per student in FY19 as compared to FY18.

Table 1. 2019 AEOP Participation by Youth and Adults Reported by Programs		Youth	Adults
CII	Camp Invention Initiative	2,140	180
CQL	College Qualified Leaders	204	178
eCM	eCYBERMISSION	17,944	1,733
GEMS	Gains in the Education of Mathematics & Science	2,985	351
HSAP	High School Apprenticeship Program	29	40
JSHS	Junior Science & Humanities Symposium	2,651	2,636
JSS	Junior Solar Sprint	2,224	326
REAP	Research & Engineering Apprenticeship Program	168	132
RESET*	Research Experiences for STEM Educators and Teachers	0	22
SEAP	Science & Engineering Apprentice Program	108	123
Unite	Unite	440	366
URAP	Undergraduate Research Apprenticeship Program	54	51
	Total 2019 AEOP Participants	**28,947**	**6,138**

*Note – RESET participants are teachers, therefore this program has no youth participants.

Table 2. 2019 AEOP Costs				
	Program Type	**Program Cost**	**Cost Per Participant**	**Average Stipend Per Participant**
CII	STEM Enrichment Program (grades K-6)	$485,310	$227	N/A
CQL	STEM Apprenticeship Program (undergraduate/graduate)	$1,803,439	$8,840	$8,552
eCM	STEM Competition (grades 6-9)	$2,954,682	$165	NA
GEMS	STEM Enrichment Program (grades 5-12)	$1,206,887	$404	$91
HSAP	STEM Apprenticeship Program (grades 9-12)	$102,785	$3,544	$2,679
JSHS	STEM Competition (grades 9-12)	$1,943,752	$733	N/A
JSS	STEM Competition (grades 5-8)	$253,663	$114	N/A
REAP	STEM Apprenticeship Program (grades 9-12)	$450,165	$2,680	$1,423
RESET	STEM Educator Program	$128,631	$5,847	$2,170
SEAP	STEM Apprenticeship Program (grades 9-12)	$482,304	$4,466	$3,407
Unite	STEM Enrichment Program (grades 9-12)	$706,997	$1,607	N/A
URAP	STEM Apprenticeship Program (undergraduate)	$256,654	$4,753	$3,877

Collaboration with other organizations and the involvement of adult participants who serve as mentors, judges, team advisors, and in various other roles are key assets of the AEOP. In particular, AEOP initiatives are distinguished from other STEM outreach programs by the AEOP's ability to leverage Army and DoD S&Es and Army and DoD laboratories and centers in its programs. Table 3 displays the numbers of organizations and the number of Army S&Es participating in each AEOP in 2019. Because these institutions and S&Es may participate in multiple AEOPs, no totals are displayed in Table 3. Instead, Table 4 provides information for the number of unique (duplicates eliminated) institutions participating in AEOP and Table 5 provides the numbers of unique K-12 teachers and S&Es participating in AEOPs in 2019. AEOP youth and adult participants represented 2,539 K-12 schools nationwide, and 328 colleges and universities (86 of which were HBCUs/MSIs) were either home institutions for AEOP participants or acted as host sites for programs. 46 Army-funded university labs and 63 Army labs and centers or agencies participated in AEOPs in 2019. A total of 1,238 K-12 teachers and 938 DoD S&Es participated in the various AEOPs in 2019.

Table 3. Number of 2019 Collaborating Schools, Laboratories, Army/DoD S&Es, and Other Organizations							
	K-12 Schools		Colleges/Universities (represented by participants or serving as host sites)		Army and DoD Labs and Centers	Army-Funded University Labs	Army and DoD Scientists & Engineers (S&Es)	Other Collaborating Organizations
Program	Total	Title I	Total	HBCU/ MIs				
Camp Invention (CII)	26	25	N/A	N/A	14	N/A	N/A	N/A
College Qualified Leaders (CQL)	N/A	N/A	N/A	N/A	16	N/A	178	N/A
eCYBERMISSION (eCM)	444	154	131	15	33	N/A	449	0
Gains in the Education of Mathematics and Science (GEMS)	1,463	409	68	3	15	N/A	175	17
High School Apprenticeship Program (HSAP)	28	8	25	10	N/A	26	N/A	N/A
Junior Science and Humanities Symposium (JSHS)	810	111	204	17	34	N/A	252	144
Junior Solar Sprint (JSS)	353	149	N/A	N/A	6	N/A	0	1
Research and Engineering Apprenticeship Program (REAP)	143	70	55	29	N/A	N/A	N/A	N/A
Research Experiences for STEM Educators (RESET)	20	15	1	0	2	N/A	3	1
Science and Engineering Apprentice Program (SEAP)	64	25	N/A	N/A	10	N/A	123	N/A
Unite	189	92	27	13	2	N/A	25	125
University Research Apprenticeship Program (URAP)	N/A	N//A	41	10	N/A	42	N/A	N/A

Table 4. Total Number of Unique Schools and Laboratories Participating in AEOPs in 2019	
Type of Institution	**Total Number of Unique Institutions**
K-12 Schools	2,539
Colleges/Universities represented by participants or serving as host sites (HBCU/MSI)	328 (86)
Army-Funded University Labs	46
Army and DoD Labs and Centers	63
Other Organizations	279

Table 5. Total Number of Unique Teachers and Army DoD Scientists and Engineers Participating in AEOPs in 2019	
Type of Participant	**Total Number of Unique Participants**
K-12 Teachers	1,238
Army/DoD Scientists and Engineers	938

4 | Summary of Findings and Recommendations

The 2019 AEOP evaluation collected data about participants, their perceptions of program processes, resources, and activities, and indicators of achievement related to outcomes aligned with AEOP and program objectives. A summary of findings is provided in Tables 6 and 7.

Table 6. 2019 Summary of Findings - Near Term	
Priority 1: STEM Literate Citizenry *Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base.*	
Finding #1	**Decline in overall student participation.** A total of 28,947 youth participated in AEOPs in 2019, a 4.5% decrease from 2018 when 30,311 youth participated and a 12% decrease as compared to 2017 when 32,947 youth participated in AEOPs. This continues the downward trend in enrollments since 2014 that was reversed in FY17 (41,802 in FY14; 38,039 in FY15; 30,972 in FY16; 32,947 in FY17; 30,311 in FY18; 28,947 in FY19). Enrollment increased in three programs (CII – 16%, JSS – 51%, and REAP – 17%), compared to enrollment increases in seven programs in FY18. The slight increases in enrollment in these four programs were offset by enrollment decreases in CQL (-5%), eCM (-11%), GEMS (-9%), HSAP (-66%), JSHS (16%), SEAP (-6%), Unite (-20%), and URAP (-24%).
	Decline in overall and adult participation. A total of 6,138 adults, including K-12 teachers and Army and DoD S&Es, engaged in AEOPs. Adult participation decreased by 37% as compared to FY18 (9,774) and 29% as compared to FY17 (8,607).
Finding #2	**Slight decline in participation for apprenticeship programs.** While participation in REAP grew in FY19 as compared to FY18 (18% increase), overall enrollment in apprenticeships decreased by 3% as compared to FY18 due to the enrollment decreases in all other apprenticeship programs noted above.
Finding #3	**Slight decline in number of applications to participate in AEOPs while placement rates remained similar to FY18.** The various AEOPs received a total of 38,339 applications in FY19, a 3% decrease from the 39,325 applications received in FY18, and a 21% decrease from the 48,419 applications received in FY17, but an increase of 2% over the 37,399 applications received in FY16. The overall placement rate across AEOPs for FY19 was similar to that of FY18 (76% in FY19, 77% in FY18), but higher than the 68% placement rate in FY17. All programs except for REAP had decreases in placement rates as compared to FY18 and most as compared to FY17. REAP placement increased to 20% (15% in FY18 and 17% in FY17): • CQL placed 31% of applicants in FY19 compared to 37% in FY18, and 41% FY17 • GEMS placed 56% of applicants in FY19 compared to 61% in both FY18 and FY17 • HSAP placed 4% of applicants as compared to 9% in both FY18 and FY17

	• SEAP placed 8% of applicants in FY19 as compared to 13% in both FY18 and FY17 • Unite placed 54% of applicants, a decrease compared to the 59% of applicants who were placed in FY18, but an increase over FY17 when 45% of Unite applicants were placed • URAP placed 19% of applicants in FY19, a slight decrease from the 20% who were placed in FY18 but an increase from the 9% placed in FY17. The placement rate for apprentice programs overall decreased from 18% in FY18 to 15% in FY19.
Finding #4	**AEOPs continued to serve underserved populations and served a larger proportion of U2 students in FY19 as compared to FY18.** The AEOPs continued to prioritize the participation of students from traditionally underserved groups, per the AEOP definition of underserved (U2): *AEOP's definition of underserved includes at least two of the following: low-income students; students belonging to racial and ethnic minorities that are historically underrepresented in STEM; students with disabilities; students with English as a second language; first-generation college students; students in rural, frontier, or other federally targeted outreach schools; females in certain STEM fields.* Overall, 56% of AEOP youth participants in FY19 met the AEOP definition of U2, an increase from FY18 when 46% of youth participants met the definition of U2. REAP and UNITE served a population of students that was comprised of over 90% U2 participants. JSS, HSAP, and eCM each had more than 50% U2 participants. GEMS, JSHS, CQL and SEAP had between 30% and 45% U2 participation. One apprenticeship program (URAP) included less than 30% U2 students.
Finding #5	**Participants reported engaging in STEM practices significantly more in their AEOP programs as compared to in their typical school experiences for most programs.** In all programs except JSS and JSHS, student participants reported engaging in STEM practices significantly more frequently in their AEOPs compared to in their typical school experiences, indicating that AEOPs exposed participants to more intensive engagement in STEM than they typically experience in school. Significant differences ranged from medium to extremely large effect sizes. It is important to note that competition programs (eCM, JSS, and JSHS) may be used as part of students' in-school learning experiences. Thus, students in these programs may not easily distinguish between their AEOP and in-school STEM engagement.
Finding #6	**Participants reported increased STEM competencies, STEM skills, STEM knowledge, STEM practices, and confidence in STEM after participating in AEOPs.** • Participants from all programs reported gains in their STEM knowledge after participating in AEOPs. All programs averaged between "some" and "large" gains, with the exceptions of eCM and JSS which averaged slightly lower gains ("a little" to "some" gains). • AEOP participants across all programs reported gains in their STEM competencies. FY19 gains were slightly greater than those in FY18 for approximately half of the programs (CQL, HSAP, JSHS, JSS, SEAP, URAP).

	• Participants in each program reported gains in their 21st Century skills. Most programs reported slightly lower gains in FY19 compared to FY18 except for eCM NJ&EE and SEAP which reported slightly greater gains. • Participants across AEOPs reported some level of gains in their STEM identity, and these gains were greater in the FY19 evaluation compared to FY18 for all programs except for JSS and Unite. • Approximately half or more of participants across programs (range 48%-100%) agreed their AEOP experience contributed to their increased confidence and/or interest in each item. As in past years, students were most likely to agree strongly that AEOP impacted their confidence in their STEM knowledge, skills, and abilities (range 62%-100%).
Finding #7	**Participants demonstrated increased attainment toward mastery of 21st Century skills across their participation in the AEOPs.** Participants from apprenticeship programs (CQL, SEAP, REAP, URAP, HSAP) and STEM programs and competitions (Unite and eCM mini-grant) demonstrated growth in their 21st Century skills as measured by their mentors using the 21st Century Skills Assessment from baseline (first days of program) to the end of the program. This growth was significantly significant in most cases: • Statistically significant growth in creativity and innovation skills was observed for all programs (range +0.48 to +0.87) except for SEAP (+0.13). • Statistically significant growth in participant critical thinking and problem solving skills was observed for all programs (range +0.45 to +0.86) except SEAP (+0.31). • Statistically significant growth in communication, collaboration, social, and cross-cultural skills was observed for all programs (range +0.34 to +1.31) except SEAP (+0.25). • Statistically significant growth in information, media, and technological literacy skills was observed for all programs (range +0.50 to +0.84) except for CQL (+0.33). • Statistically significant growth in flexibility, adaptability, initiative, and self-direction was observed for all programs (range +0.43 to +0.87) except CQL (+0.30). • Statistically significant growth in productivity, accountability, leadership, and responsibility skills was found for all programs (range +0.50 to +1.25) except for CQL (+0.24) and SEAP (+0.35), programs for which baseline assessments were slightly higher than other programs.
Finding #8	**Participants reported positive attitudes toward Army/DoD STEM Research.** A majority of participants across programs agreed that Army/DoD research and researchers advance science and engineering fields. With the exception of eCM on two items, more than half of participants in all programs agreed that Army/DoD research and researchers advance science and engineering fields (range 46%-100%); develop new cutting-edge technologies (range 47%-97%); that DoD researchers solve real-world problems (range 52%-100%); and that DoD research is valuable to society (range 52%-100%). The strongest rates of agreement with these statements (averaging 90% or higher) continues to be from apprentices at programs hosted at DoD laboratories and centers (CQL and SEAP) and DoD-sponsored college/university laboratories (HSAP and URAP). Participants at programs hosted by non-DoD affiliated college/university laboratories and settings (REAP and Unite) had positive, but somewhat lower, rates of agreement.

	Competition programs (eCM and JSS) had the lowest rates of agreement, averaging two-thirds or below (range 46%-67%), however JSHS and eCM NJ&EE averaged over three-quarters (range 77%-99%) agreement across items.
Finding #9	**Evaluation findings indicated that the AEOP exposed participants to STEM careers generally and to Army and DoD STEM careers, and indicated that participating in AEOPs increased participants' interest in pursuing STEM careers.** In all programs except eCM (42%) and HSAP (33%), approximately half or more of participants (range 49%-94%) reported learning about three or more general STEM careers. Smaller proportions of students (range 10%-89%) had learned about Army/DoD STEM careers as compared with STEM careers more generally). Half or more of students (range 51%-89%) in CQL, eCM NJ&EE, GEMS, SEAP, and Unite reported learning about three or more DoD STEM careers. Half or more of students (range 51%-89%) in CQL, eCM NJ&EE, GEMS, SEAP, and Unite reported learning about three or more DoD STEM careers. In FY19 a greater proportion of participants in four programs (CQL, eCM NJ&EE, and Unite) reported having learned about these jobs as compared to FY18. As in previous years, comparisons of participants in AEOPs held at Army laboratories and centers (CQL, GEMS, and SEAP), with participants at Army-sponsored university labs (HSAP and URAP), and non-Army affiliated settings (eCM Regional, JSHS, REAP, and Unite) show that, on average, participants at DoD sites learned about more DoD STEM careers. It is important to note, however, that nearly all (89%) of eCM National students and more than half of Unite students (61%) reported learning about three or more DoD STEM careers although they participated in programs at non-Army affiliated settings. As in previous years, more participants in some programs reported their AEOP experiences were impactful in this area (e.g., SEAP – 100%, URAP – 90%, CQL – 79% and eCM NJ&EE – 79%) than did participants in programs such as regional e-CM (35%) and JSHS (43%). Programs for which participants tend to report the greatest impact in this area are those in which participants have exposure to Army/DoD STEM researchers and/or facilities during program activities.
Priority 2: STEM Savvy Educators *Support and empower educators with unique Army research and technology resources.*	
Finding #1	**Adult participants (i.e. mentors, S&E's, Team Advisors, teachers) reported use of effective mentoring strategies in varying degrees across the AEOPs in FY19.** A majority of mentors across programs reported using strategies associated with each area of effective mentoring. Across programs, mentors were most likely to indicate they implemented strategies to engage students in authentic STEM activities (range 75%-98%) and support the development of collaboration and interpersonal skills (range 75%-93%). Mentors were least likely to report using strategies to support students' STEM educational and career pathways (range 51%-81%).

Finding #2	**In FY19, participants continued to be satisfied with the support received from their mentors/S&Es/Team Advisors/teachers.** More than half of students across AEOPs reported high levels of satisfaction with their mentors and the quality of instruction they received (range 57%-90%). Compared to FY18, levels of satisfaction with mentorship were slightly higher in FY19 for SEAP, Unite, and URAP and were unchanged for CQL. However, levels of satisfaction with mentors in GEMS, HSAP, and REAP were lower than in FY18.

Priority 3: Sustainable Infrastructure
Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.

Finding #1	**The primary means of learning about AEOPs and associated opportunities continues to be personal connections, school/university connections, past participants, or someone connected directly with AEOPs.** A continued strength of AEOP is the expansive network of connections to local communities that serves as a continued means of recruitment for the program, suggesting that program alumnae and those who work for the DoD often act as informal ambassadors for these programs. For REAP, GEMS, SEAP, and HSAP, about a fifth or more of youth participants (21%-28%) reported that the AEOP website was a source of information about AEOPs. The same was true for adult participants (20%-43%) in JSS, REAP, URAP, and HSAP. Overwhelmingly, participants and mentors reported that AEOP social media was much less frequently used as a means for introducing them to the AEOP.
Finding #2	**Despite limited past participation and awareness of AEOP opportunities on the part of both participants and mentors, FY19 participants reported interest in participating in AEOP initiatives in the future.** Very few participants had ever participated in any AEOP other than the one in which they were currently enrolled with the exception of the 23% of CQL apprentices who reported they had participated previously in GEMS, and the 38% of SEAP participants who reported having participated in GEMS. These findings suggest there is a relatively robust pipeline relationship between the Unite and REAP and GEMS and SEAP programs. Findings suggest that youth participants and mentors across the AEOP continue to have limited awareness of AEOPs other than those in which they are currently participating. Participants primarily expressed interest in repeating participation in the AEOP in which they were currently enrolled (range of 50%-91%), but also expressed interest in participating in other AEOPs. The most interest was expressed in SMART, a program for which nearly half or more of participants in the following programs expressed interest: URAP (45%), Unite (46%), REAP (58%), HSAP (61%), CQL (70%), and SEAP (91%).
Finding #3	**Participation rates in the AEOP evaluation increased overall for FY19 but room for improvement remains.** Participation in the evaluation questionnaire increased overall from 12% in FY18 to 16% in FY19. Rates of response in six programs increased: GEMS (students), HSAP (apprentices and mentors), JSHS (regional and national students and mentors), JSS (mentors), Unite (students), URAP (apprentices and mentors). All Unite students (100%) responded to the questionnaire in FY19.

	Participation for all programs and groups other than those mentioned above declined slightly for FY19, with substantial declines in the participation of REAP apprentices and mentors (19% and 30% respectively in FY19 compared to 48% and 57% in FY18). Questionnaire participation rates were particularly low for JSS (3.5% for students and 3% for mentors) and for mentors in CQL (8%), GEMS (7%), and SEAP (9%).

Table 7. 2019 Summary of Findings - Mid to Long Term	
Priority 1: STEM Literate Citizenry *Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base.*	
Finding #1	**AEOP alumni report sustained interest and engagement in STEM.** A majority of AEOP alumni reported being interested in participating in a wide variety of STEM activities. Nearly all alumni (90% or more) reported at least some interest in the following activities: learning about new things in STEM (94%); participating in STEM community service projects (92%); participating in STEM camps, clubs, or competitions (92%); participating in STEM projects at universities/professional settings (92%); taking STEM electives (90%); earning a STEM degree (90%); and pursuing a STEM career (90%).
Finding #2	**Alumni are engaged in pursuing STEM opportunities and careers.** Nearly half (45%) of alumni reported that they were currently taking a STEM elective course. Over a quarter (27%) indicated they were currently pursuing a STEM degree, and 14% reported that they were already working in a STEM career.
Finding #3	**AEOP Alumni participate in other STEM-related activities.** Three-quarters or more of alumni reported either sometimes or frequently engaging in activities such as learning about new things in STEM (81%) and solving math/science puzzles (77%). Additionally, half or more of alumni reported engaging in STEM sometimes or frequently by reading/watching STEM non-fiction (56%) and talking with friends or family about STEM (66%).
Finding #4	**Alumni hold positive views toward the AEOP and Army/DoD STEM.** More than three-quarters of alumni indicated that their AEOP participation had impacted their knowledge of STEM (85%) and problem solving skills (80%). Nearly all alumni indicated that they believe Army/DoD research is valuable to society (94%), solves real-world problems (93%), advances STEM fields (92%), and develops new, cutting edge technologies (91%).
Finding #5	**Alumni report awareness of and interest in STEM careers generally, as well as with the Army/DoD specifically.** Nearly 90% of alumni indicated that they were interested in pursuing a STEM career (87%). Approximately two-thirds indicated they were aware of Army/DoD STEM careers (64%), and 73% of alumni indicated they would be interested in learning more about Army/DoD STEM careers. More than half (59%) of alumni indicated that they were currently interested in pursuing an Army/DoD STEM career.
Finding #6	**AEOP Alumni reported completing STEM coursework and being enrolled in STEM degree programs.** Between one- and two-thirds of alumni reported having completed higher level STEM classes in high school such as AP Math (32%), Calculus (36%), AP Science (40%), Physics (51%), and Chemistry (72%). While more than half of alumni completing the survey were still in high school, a third (33%) indicated that they were enrolled in STEM post-secondary education (Certificate – 5%, Associate – 7%, Bachelor's – 21%). Alumni currently enrolled in post-secondary programs were most likely to be

	enrolled in engineering-focused programs (12%), followed by physical science (5%), technology/computer science (3%), life science (3%), and medicine (2%). Less than 1% of alumni reported pursuing a teaching degree. Most alumni in college reported having completed credits toward a STEM degree. A small number of alumni respondents (7%) reported that they were post-secondary STEM degree graduates. Among those, approximately one-third had earned either a STEM Certificate (14%) or bachelor's degrees (29%). Fewer had earned master's degrees (19%), doctorates (10%), or associate's degrees (10%) in STEM.
Priority 2: STEM Savvy Educators *Support and empower educators with unique Army research and technology resources.*	
Finding #1	**Alumni reported very positive impacts of their mentors and agreed mentoring is a valuable aspect of AEOPs.** More than three-quarters of alumni reported that their AEOP mentoring experience was very positive (81%), enhanced their learning (80%), and was a valuable aspect of their AEOP (80%). Many alumni also believed their AEOP mentor helped influence their future academic career decisions (73%) and helped them learn about Army/DoD careers (65%). While the reported mentoring relationships appeared to be strong, only half (51%) reported staying in touch with their AEOP mentor after the program.
Priority 3: Sustainable Infrastructure *Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.*	
Finding #1	**Alumni reported strong interest in participating in other AEOPs, although alumni familiarity with other AEOPs is still limited** More than half of alumni (54%) indicated that they were familiar with other AEOPs (53% in FY18), and 75% reported being interested in participating in other AEOPs (77% in FY18).

What AEOP Participants are saying…..

*"I am very satisfied with my [**CQL**] experience. I would highly recommend my colleagues to look into participating in the program to understand what a career in the Army or DoD is like. I certainly gained a better idea of what a career in the Army or DoD is like. I can confidently say that I am considering this career path because of my time in the program."* (CQL Apprentice)

*"Having been a participant in **CQL** and the **SMART** program myself, I wouldn't be here without the AEOP and everyone behind it. Thank you. Now today as a researcher, I couldn't do my job without the CQL program, specifically. It's the easiest and best way that I can get the best talent to work with me here at the lab."* (CQL Mentor)

*"I was very happy with my experience in **eCYBERMISSION**. I think this competition is a great experience for all new researchers to 'dip their toes in the water' of the vast pool that is the world of STEM. As this was my first research competition, I can definitely say that I have a newfound interest in widening my horizons and continuing to explore STEM."* (eCM-R Student)

*"I've participated in **eCYBERMISSION** for 17 years and absolutely LOVE this competition. The experience is unmatched in the middle school competition-world for benefits to students and the quality of the competition. From the high-quality interactions with cyber guides and NSTA personnel to the process itself, eCM can't be beaten... Solving real-world problems using STEM and working as a team are obvious benefits but our students learn so much more in a comprehensive program like this. They not only learn science, they learn many types of technology skills, interpersonal skills, skills for interviews and phone calls, work etiquette with professionals and much more."* (eCM Team Advisor)

*"My **GEMS** experience was great. I got to meet new people and learn how to do things I can do at home…My mentors were very nice and helped me whenever I needed them to. The [speakers] they brought in were really cool and showed us a lot of cool stuff."* (GEMS Student)

*"I really enjoyed participating in **GEMS** as a mentor. I feel like I had the opportunity to impact a lot of kids lives because of this program. I hope that I was able to share my love for science with the kids and that they also developed a love for STEM overall. I also felt like I learned a lot through this program. I hope to be back again next year."* (GEMS NPM)

*"Working [in **HSAP**] was an excellent experience. It provided me a lot of knowledge and meaningful experience, giving me the opportunity to do and learn things…[The] mentoring was also excellent. My mentor was outstanding and had a lot of experience and knowledge, besides being very dedicated to our work and to this program. Honestly, this program was just excellent."* (HSAP Apprentice)

*"I enjoy it when you see the smile when the students learn a new thing. There's these wow moments and light bulb moments... I will benefit from [the **HSAP** and **URAP**] network…it's a mutual educational benefit."* (HSAP Mentor)

*"I had an amazing time at **JSHS**. The biggest takeaway for me is that I want to look into research opportunities for the DoD. Meeting the judges and researchers at the competition inspired me to potentially pursue going into STEM research to help defend our country."* (N-JSHS Student)

*"I greatly appreciate **JSHS** as an educator. It provides an important venue for students to think and interact like professional scientists."* (JSHS Mentor)

*"**JSS** has helped me learn new creative skills, leadership, and participation abilities I hope to use in the future."* (JSS Student)

"*I am very satisfied with the **JSS** experience. I am so grateful for having this opportunity with my students. I want to say THANK YOU to TSA and everyone who was involved in this unforgettable event. Thank you!*" (JSS Team Advisor)

"*I have enjoyed my experience in the AEOP **REAP** program. Getting to work with a variety of researchers in a more sophisticated educational environment has been invaluable. From getting first-hand experience in cell culture to listening in on visiting speaker's lectures, I have gained an enormous amount of knowledge on careers and fields in STEM research. My mentor also made sure there was always an opportunity for me to learn and practice laboratory skills as well as talked to me about my future plans and gave me valuable advice.*" (REAP Apprentice)

"*[**REAP**] is one of the most meaningful activities I participate in during the year.. It is amazing to see the transformation of these students, who are wonderful and talented to begin with, throughout the summer. They gain confidence, build both technical and communication skills and become team members within their labs…The project is so beneficial to our faculty too. Thank you for allowing my campus participate!*" (REAP Mentor)

"*I had an amazing [**SEAP**] experience. My mentor was always understanding and so caring. She contributed so much to the new information I have learned in terms of both core STEM knowledge and troubleshooting when an experiment does not go as expected. This was a very valuable unique experience.*" (SEAP Apprentice)

"*I think [**SEAP** is an] almost unmatched program for the opportunity to work in a lab, and to really get lab exposure if they're interested in a career in science*" (SEAP Mentor)

"*[**Unite**] gave me the opportunity to be ahead of my classes, meet new people, come out of my comfort zone and express and project my voice... also it gave me the feeling and view of college - what it would be like, classes and how professors really teach.*" (Unite Student)

"*The [**Unite**] program continues to be an excellent means for introducing high school students to STEM fields that they might not otherwise be exposed to.*" (Unite Mentor)

"*This summer [in **URAP**] I gained a new perspective and appreciation for the research process. I was able to work in a completely new field and learn about my strengths and weaknesses in research…I was able to start refining my research interests. Overall, this summer was extremely impactful in allowing me to realize that with time and dedication I can conduct scientific research.*" (URAP Apprentice)

"*For me, [serving as a **URAP** mentor] has meant giving opportunities to these students whom I care about, and showing them research, what it should be, and how the Army fits into the picture of basic research.*" (URAP Mentor)

Recommendations for FY20 Program Improvement/Growth

AEOP had another very successful year in FY19 of program implementation. Thousands of students in K-12 schools were engaged in STEM programs, competitions, and apprenticeships including a growing percentage of underserved students (56% for FY19 compared to 46% in FY18). Post-secondary students were also engaged in apprenticeships with university and Army researchers. As in previous years, much can be learned from the experiences of our participants and partners. The evaluation team has synthesized FY19 evaluation findings to provide recommendations for FY20 and beyond that will drive continuous program improvement and those are shared in alignment with the AEOP Priorities below:

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

Increase and broaden participation in selected AEOP programs. AEOP continued to engage thousands of participants in FY19 (29,847) and CII, JSS, and REAP all experienced individual program growth. However, there was a slight decrease in participants (4.5%) for the year overall. Some can be attributed to some programs having fewer sites who participated this year. HSAP had the greatest decrease in numbers, dropping 66% followed URAP at 24% and Unite at 20%. It is recommended that in FY20 and beyond that programs which have the capacity to grow utilize new and innovative means to market and communicate opportunities to new audiences. This may include new initiatives to engage a larger group of teachers though webinars and other forms of virtual communication due to COVID-19 challenges. A majority of participants in AEOP programs are recruited by a teacher or the school that they attend.

Examine means for increasing infrastructure to grow placement rates in JSHS and apprenticeship programs. Placement rates in FY19 remained steady compared to FY18 at around 76% indicating that AEOP programs overall have not been able to grow their capacity of students served. It is understood that most programs do not have the financial or structural means to grow the number of participants. However, there remains a much greater demand for AEOP programming than the current consortium is positioned to meet. This presents an opportunity for strategic investments in new efforts to engage more people if the Army is interested in doing so.

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

As in FY17, continue to focus on strengthening role of adults in mentoring and instruction. In FY18, most program mentors reported 75-98% use of the various effective mentoring strategies with their participants. In FY19 the area that emerged as the most challenging for mentors and less frequently used were strategies to support students' STEM educational and career pathways. It is recommended that the Army and AEOP consortium consider developing resources for mentors that could be used across programs to engage students in learning more about the possibilities for their future in STEM degree programs and careers. This can also include an emphasis on DoD and Army STEM careers.

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

Increase awareness of AEOP programs. The impact of AEOP participation is significant on AEOP Alumni. However, in the FY19 evaluation, Alumni expressed strong interest in participation in other AEOP's despite very little familiarity with what was available. It is recommended that more effort be expended to provide resources to all current AEOP participants regarding AEOP programming. Further, a communication plan for alumni should be implemented that includes more frequent and varied ways of connecting information about programs with alumni.

Participation in AEOP evaluation. As in FY18, there were some programs that had less than desired engagement in the evaluation activities – including student participants (JSS), and low mentor participation (CQL, GEMS, and SEAP). Undoubtedly these challenges will continue with COVID-19 impacts on programming for FY20. It is recommended that the AEOP programs continue to communicate the importance of participation in the evaluation and provide multiple reminders across the duration of their program at strategic times to make completion of the tasks a bit easier for staff.