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ARMY EDUCATIONAL OUTREACH PROGRAM

2020 Annual Program Evaluation Report
Summative Findings

August 2021

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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 participants 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.

2020 Portfolio Overview

In FY20, AEOP was successful in operating programming at a slightly reduced level due to COVID-19 pandemic challenges, except for the JSS program which did have any AEOP sponsored participants in FY20. Programs were responsive and many moved to a virtual delivery format or had events/competitions that took place prior to April 2020. Therefore, a full evaluation of AEOP was conducted for FY20 as in previous years. A detailed summary of FY20 AEOP activities are presented in this report. Individual program level data are outlined in Table 1. This includes applicant and participant data, numbers of Army and DoD S&Es, participating K-12 schools, and colleges/universities, collaborating organizations including Army and DoD laboratories and centers, and cost data. Table 2 summarizes overall participant data for AEOP students and adults by program. Data presented in Table 2 were provided by each program, and in some instances, uses a combination of data gathered from the Cvent registration portal and individual program site records. Historically underserved participant calculations were computed from Cvent registration data alone as these data were able to be verified independently by the evaluation team (Table 3).

AEOP partner engagement details are provided in Table 4. This includes the number of collaborating educational organizations (both K-12 and college/universities), participating Army and DoD laboratories and centers, and individual scientists and engineers (S&Es) by program.

Several AEOP partners engaged with multiple AEOP programs. The sum of unduplicated organizational partners (K-12 schools, college/universities, and Army/DoD laboratories and centers) is documented in Table 5. Unique adult participant (K-12 teachers and Army S&Es) totals are listed in Table 6. Finally, AEOP individual program costs are provided in Table 7. The reported travel costs for FY20 programs are from pre-pandemic travel (Oct 2019-Feb 2020) and from non-refundable travel expenses that were booked prior to shifting to virtual programming.

Table 1. 2020 AEOP Initiatives	
Camp Invention Initiative (CII) **Program Administrator: U.S. Army Corps of Engineers – Engineering Research & Development Center (ERDC)**	
Description	One-week STEM enrichment activity
Participant Population	K-6 students
Number of Applicants	2,773
Number of Participants	2,771
Change in Participation Compared to FY19 (+/-)	29%
Number/Percentage of Underserved Participants	2,131/77%
Change in Percentage of Underserved Compared to FY19 (+/-)	Not available
Total Number of Adults (Teachers & Other Volunteers)	111
Number of Sites	26
Number of Army/DoD Laboratories and Centers	14
Number of K-12 Schools	26
Number of K-12 Schools – Title I	25
Total Cost	$499,365
Cost Per Student	$180
College Qualified Leaders (CQL) **Program Administrator: Rochester Institute of Technology (RIT)**	
Description	STEM apprenticeship program – summer or school year, at Army laboratories with Army S&E mentors
Participant Population	College undergraduate students
Number of Applicants	582
Number of Participants	159
Change in Participation Compared to FY19 (+/-)	-22%
Number/Percentage Underserved Participants*	41/26%
Change in Percentage of Underserved Compared to FY19 (+/-)	-9%
Placement Rate	27%
Total Number of Adults	89
Number of Army S&Es	89
Number of Army/DoD Laboratories and Centers	15
Number of Colleges/Universities	N/A
Number of HBCU/MIs	N/A
Total Cost	$1,482,699
Total Travel	$496
Participant Travel	$0
Total Awards	$1,413,821

Student Awards/Stipends	$1,413,821
Adult/Teacher/Mentor Awards	$0
Cost Per Student	$9,325
eCYBERMISSION (eCM) **Program Administrator: National Science Teachers Association (NSTA)**	
Description	STEM competition - nationwide (including DoDEA schools), web-based, including one national event
Participant Population	6th-9th grade students
Number of Student Applicants	16,053
Number of Participants	14,245
Change in Participation Compared to FY19 (+/-)	-21%
Number/Percentage of Underserved Participants*	7,911 / 56%
Change in Percentage of Underserved Compared to FY19 (+/-)	-3%
Placement Rate	89%
Registered Teams (complete)	4,016
Students Attending National Event	87 total 73 National Finalists 14 STEM-in-Action
Teams Attending National Event	24 total 20 National Finalists 4 STEM-in-Action
Submission Completion Rate	73%
Total Number of Adults (Team Advisors and Volunteers – incl. S&Es and Teachers)	2,174
Number of Team Advisors (Predominantly math and science teachers)	578
Number Volunteers (Ambassadors, Cyberguides, Virtual Judges)	37 Ambassadors 27 Cyber Guides 843 Virtual Judges 689 Student Virtual Judges
Number of Army S&Es	316
Number of Army/DoD Laboratories & Centers	24
Number of K-12 Teachers (including pre-service teachers)	576
Number of K-12 Schools	341
Number of K-12 Schools – Title I	146
Number of Colleges/Universities	95
Number of HBCU/MSIs	17
Number of DoDEA Students	403
Number of DoDEA Teachers	14
Number of DoDEA Schools	11
Number of Other Collaborating Organizations	30
Total Cost	$2,553,753
Total Travel	$151,420
Participant Travel	$109,868
Total Awards	$633,974
Student Awards/Stipends	$628,574
Adult/Teacher/Mentor Awards	$5,400

Cost Per Student	$179
Gains in the Education of Mathematics & Science (GEMS) **Program Administrator: National Science Teachers Association (NSTA)**	
Description	STEM enrichment activity - at Army laboratories, hands-on
Participant Population	5th-12th grade students (secondary audience: college undergraduate near-peer mentors, teachers)
Number of Applicants	4,533
Number of Participants	2,203
Change in Participation Compared to FY19 (+/-)	-26%
Number/Percentage Underserved Participants*	832 (40%)
Change in Percentage of Underserved Compared to FY19 (+/-)	-2%
Placement Rate	48%
Total Number of Adults	214
Number of Near-Peer Mentors	106
Number of Resource Teachers	38
Number of Army S&Es	40
Other Adult Volunteers	30
Number of Army/DoD Laboratories & Centers	18
Number of K-12 Teachers	38
Number of K-12 Schools	747
Number of K-12 Schools – Title I	250
Number of Colleges/Universities	33
Number of HBCU/MSIs	9
Other Collaborating Organizations	0
Number of DoDEA Students	21
Number of DoDEA Teachers	0
Number of DoDEA Schools	1
Total Cost	$1,253,707
Total Travel	$7,443
Participant Travel	$0
Total Awards	$801,049
Student Awards/Stipends	$282,864
Adult/Teacher/Mentor Awards	$518,185
Cost Per Student	$569
High School Apprenticeship Program (HSAP) **Program Administrator: Rochester Institute of Technology (RIT)**	
Description	STEM apprenticeship program – summer, in Army-funded laboratories at colleges/universities nationwide, with college/university S&E mentors
Participant Population	11th-12th grade students
Number of Applicants	434
Number of Participants	32
Change in Participation Compared to FY19 (+/-)	10%

Number/Percentage Underserved Participants*	15/47%
Change in Percentage of Underserved Compared to FY19 (+/-)	-19%
Placement Rate	7%
Total Number of Adults	26
Number of College/University S&Es	26
Number of K-12 Schools	30
Number of K-12 Schools – Title I	11
Number of Army-Funded College/University Laboratories	20
Number of College/Universities	20
Number of HBCU/MSIs	7
Total Cost	$181,626
Total Travel	$110
Participant Travel	$0
Total Awards	$150,000
Student Awards/Stipends	$150,000
Adult/Teacher/Mentor Awards	$0
Cost Per Student	$5,676
Junior Science & Humanities Symposium (JSHS) **Program Administrator: National Science Teaching Association (NSTA)**	
Description	STEM competition - nationwide (incl. DoDEA schools), research symposium that includes 47 regional events and one national event
Participant Population	9th-12th grade students
Number of Applicants	4,511
Number of Regional Competition Student Participants	3,462
Number of National Competition Student Participants	217 total 215 presenters 2 observers
Change in Participation Compared to FY19 (+/-)	31%
Number/Percentage Underserved Participants*	1,372 / 44%
Change in Percentage of Underserved Compared to FY19 (+/-)	3%
Placement Rate	N/A
Total Number of Adults (Mentors, Regional Directors, Volunteers – incl. Teachers and S&Es)	2,025
Number of Army and DoD S&Es	233
Number of Army/DoD Laboratories and Centers	20
Number of K-12 Teachers	589
Number of K-12 Schools	714
Number of K-12 Schools – Title I	441
Number of DoDEA Students	229
Number of DoDEA Teachers	7
Number College/University Personnel	774
Number of Colleges/Universities	85
Number of HBCU/MSIs	19
Number of Other Collaborating Organizations	2
Total Cost	$1,243,304

Total Travel	$13,404
Participant Travel	$8,024
Total Awards	$407,405
Student Awards/Stipends	$387,405
Adult/Teacher/Mentor Awards	$20,000
Cost Per Student	$359
Junior Solar Sprint (JSS) **Program Administrator: Technology Student Association (TSA)**	
Description	STEM competition - solar car competition regional events at Army laboratories, TSA state events, and a national event hosted in conjunction with the TSA national conference
Participant Population	5th-8th grade students
Number of Applicants/Participants	0
Change in Participation Compared to FY19 (+/-)	0
Number/Percentage of Underserved Participants*	0
Change in Percentage of Underserved Compared to FY19 (+/-)	0
Placement Rate	N/A
Total Number of Adults (Mentors and Volunteers – incl. Teachers and Army S&Es)	0
Number of K–12 Teachers (including preservice)	0
Number of Army S&Es	0
Number of Army/DoD Laboratories and Centers	0
Number of K-12 Schools	0
Number of K-12 Schools – Title I	0
Number of Other Collaborating Organizations	0
Total Cost	$136,637
Total Travel	$1,325
Participant Travel	$0
Total Awards	$0
Student Awards/Stipends	$0
Adult/Teacher/Mentor Awards	$0
Cost Per Student	N/A
Research & Engineering Apprenticeship Program (REAP) **Program Administrator: Rochester Institute of Technology (RIT)**	
Description	STEM apprenticeship program – Summer, at colleges/university laboratories, targeting students from groups historically underserved and under-represented in STEM, college/university S&E mentors
Participant Population	Rising 10th, 11th, and 12th grade high school students, rising first-year college students from groups historically underserved and under-represented in STEM
Number of Applicants	527

Number of Participants	86
Change in Participation Compared to FY19 (+/-)	-49%
Number/Percentage Underserved Participants*	81/94%
Change in Percentage of Underserved Compared to FY19 (+/-)	-5%
Placement Rate	16%
Total Number of Adults	66
Number of College/University S&Es	66
Number of College/Universities	47
Number of HBCU/MSIs	23
Number of K–12 Schools	69
Number of K–12 Schools — Title I	37
Total Cost	$393,099
Total Travel	$993
Participant Travel	$0
Total Awards	$265,821
Student Awards/Stipends	$211,821
Adult/Teacher/Mentor Awards	$54,000
Cost Per Student	$4,571
Research Experiences for STEM Educators and Teachers (RESET) **Program Administrator: Tennessee Tech University (TTU)**	
Description	RESET provides a summer research experience at participating Army laboratories and on-line for teachers and educators across the nation.
Participant Population	Middle school and high school STEM educators
Number of Applicants/Teachers	27
Number of Participants	27
Change in Participation Compared to FY19 (+/-)	23%
Placement Rate	100%
Total Number of Adults	44
Number of Army S&Es	17
Number of Army/DoD Laboratories and Centers	7
Number of K–12 Teachers	27
Number of K–12 Schools	25
Number of K–12 Schools — Title I	18
Number of Colleges/Universities	1
Number of Other Collaborating Organizations	0
Total Cost	$175,220
Total Travel	$1,331
Participant Travel	$0
Total Awards	$58,000
Student Awards/Stipends	$58,000
Adult/Teacher/Mentor Awards	$0
Cost Per Participant	$6,490
Science & Engineering Apprentice Program (SEAP) **Program Administrator: Rochester Institute of Technology (RIT)**	

Description	STEM apprenticeship program – Summer, at Army laboratories with Army S&E mentors
Participant Population	9th-12th grade students
Number of Applicants	938
Number of Participants	28
Change in Participation Compared to FY19 (+/-)	-74%
Number/Percentage Underserved Participants*	6/21%
Change in Percentage of Underserved Compared to FY19 (+/-)	-11%
Placement Rate	3%
Total Number of Adults	22
Number of Army S&Es	22
Number of Army/DoD Laboratories and Centers	3
Number of K-12 Schools	19
Number of K-12 Schools – Title I	7
Total Cost	$210,427
Total Travel	$496
Participant Travel	$0
Total Awards	$141,549
Student Awards/Stipends	$141,549
Adult/Teacher/Mentor Awards	$0
Cost Per Student	$7,515
Unite **Program Administrator: Technology Student Association (TSA)**	
Description	STEM enrichment activity - pre-collegiate, engineering summer program at university host sites, targeting students from groups historically underserved and under-represented in STEM
Participant Population	Rising 9th – 12th grade students from groups historically underserved and under-represented in STEM
Number of Applicants	738
Number of Participants	448
Change in Participation Compared to FY19 (+/-)	2%
Number/Percentage of Underserved Participants*	399/95%
Change in Percentage of Underserved Compared to FY19 (+/-)	1%
Placement Rate	61%
Total Number of Adults	273
Number of Army S&Es	25
Number of Army/DoD Laboratories and Centers	0
Number of K-12 Teachers	35
Number of University Educators	78
Number of University Student Mentors	43 Undergraduate Students 20 Graduate Students
Number of K-12 Schools	209
Number of K-12 Schools – Title I	108

Number of Colleges/Universities	29
Number of HBCU/MSIs	9
Other Collaborating Organizations	74
Total Cost	$665,941
Total Travel	$826
Participant Travel	$0
Total Awards	$180,460
Student Awards/Stipends	$176,060
Adult/Teacher/Mentor Awards	$4,400
Cost Per Student	$1,486
Undergraduate Research Apprenticeship Program (URAP) **Program Administrator: Rochester Institute of Technology (RIT)**	
Description	STEM apprenticeship program – Summer, in Army-funded labs at colleges/universities nationwide, with college/university S&E mentors
Participant Population	College undergraduate students
Number of Applicants	258
Number of Participants	49
Change in Participation Compared to FY19 (+/-)	-9%
Number/Percentage Underserved Participants*	14/29%
Change in Percentage of Underserved Compared to FY19 (+/-)	7%
Placement Rate	19%
Total Number of Adults	39
Number of College/University S&Es	39
Number of Army-Funded College/University Laboratories	30
Number of College/Universities	30
Number of HBCU/MSIs	6
Total Cost	$338,126
Total Travel	$110
Participant Travel	$0
Total Awards	$292,500
Student Awards/Stipends	$292,500
Adult/Teacher/Mentor Awards	$0
Cost Per Student	$6,901

*Underserved participation rate calculated using data for participants whose demographic information was provided in Cvent.

Table 2 presents student and adult participation data reported by individual programs. A total of 23,483 students participated in AEOP in 2020, representing an 19% decrease from 2019 when 28,947 students participated. A total of 5,066 adults participated in 2020, a 19% decrease from 2019 when 6,138 adults participated. Of the 2020 participants, 653 students and 21 teachers were from DoDEA schools (participating in eCM, GEMS, and JSHS).

Table 2. 2020 AEOP Participation by Students and Adults Reported by Programs			
		Students	**Adults**
CII	Camp Invention Initiative	2,771	111
CQL	College Qualified Leaders	159	89
eCM	eCYBERMISSION	14,245	2,174
GEMS	Gains in the Education of Mathematics & Science	2,203	214
HSAP	High School Apprenticeship Program	32	26
JSHS	Junior Science & Humanities Symposium	3,462	2,025
JSS	Junior Solar Sprint	N/A	N/A
REAP	Research & Engineering Apprenticeship Program	86	66
RESET*	Research Experiences for STEM Educators and Teachers	0	27
SEAP	Science & Engineering Apprentice Program	28	22
Unite	Unite	448	273
URAP	Undergraduate Research Apprenticeship Program	49	39
	Total 2020 AEOP Participants	**23,483**	**5,066**

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

Most adults, including Army S&Es and K-12 teachers, volunteered in the eCM (2,174 adults) and JSHS (2,025 adults) competitions. Student participation increased in four programs (CII, HSAP, JSHS, and Unite) and declined in the other seven (CQL, eCM, GEMS, REAP, SEAP, and URAP) as compared to 2019.

AEOP participant demographics and underserved status (Underserved) is presented in Table 3. In FY20, the percentage of Underserved student participants decreased by 6% to 52.5% overall, compared to 56% in FY19, but increased by 14% as compared to 46% in FY18. AEOP defines underserved and underrepresented (Underserved) 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 Grants; speak a primary language other than English; or have no parents who attended college.

Table 3. 2020 AEOP Student Participant Underrepresented (Underserved) Data by Program							
Program	**School – Rural, Urban, Frontier**	**Female**	**Racial/ Ethnic Minority**	**Low SES***	**ELL**	**College First Generation**	**Underserved**
CQL (n=159)	N/A	56 (35.2%)	33 (20.8%)	33 (20.8%)	7 (4.4%)	29 (18.2%)	**41 (25.8%)**
HSAP (n=32)	15 (46.9%)	14 (43.8%)	8 (25.0%)	5 (15.6%)	9 (28.1%)	2 (6.3%)	**15 (46.9%)**
REAP (n=86)	46 (53.4%)	60 (69.8%)	66 (76.7%)	43 (50.0%)	28 (32.6%)	25 (29.1%)	**81 (94.2%)**
SEAP (n=28)	5 (17.9%)	10 (35.7%)	7 (25.0%)	1 (3.6%)	0 (0%)	0 (0%)	**6 (21.4%)**
Unite (n=419)	307 (73.3%)	275 (65.6%)	292 (69.7%)	305 (72.8%)	55 (13.1%)	223 (53.2%)	**399 (95.2%)**
URAP (n=49)	N/A	22 (44.9%)	13 (26.5%)	12 (24.5%)	7 (14.3%)	7 (14.3%)	**14 (28.6%)**
eCM	5,807	7,000	5,302	4,260	2,270	1,886	**7,911**

(n=14,234)	(40.8%)	(49.2%)	(37.2%)	(29.9%)	(15.9%)	(13.2%)	**(55.6%)**
eCM NJ&EE (n=73)	28 (38.4%)	42 (57.5%)	9 (12.3%)	11 (15.1%)	6 (8.2%)	3 (4.1%)	**28 (38.4%)**
R-JSHS (n=3,129)	1,207 (38.6%)	1,806 (57.7%)	581 (18.6%)	455 (14.6%)	408 (13.1%)	322 (10.3%)	**1,372 (43.8%)**
N-JSHS (n=217)	76 (35.0%)	130 (59.9%)	24 (11.1%)	16 (7.4%)	23 (10.6%)	9 (4.1%)	**74 (34.1%)**
GEMS (n=2,087)	574 (27.5%)	1,047 (50.2%)	828 (39.7%)	239 (11.5%)	56 (2.7%)	162 (7.8%)	**832 (39.9%)**
Total (N=20,513)	8,065 (39.3%)	10,462 (51.0%)	7,163 (34.9%)	5,380 (26.2%)	2,869 (13.9%)	2,668 (13.0%)	**10,773 (52.5%)**

*Low Socio-Economic Status (SES) is measured by the number of participants eligible for free or reduced lunch for K-12 students or participants who have received Pell Grants for undergraduate students.

NOTE. Underserved calculations were performed using data for participants who provided demographic information in Cvent. Data for some programs must be interpreted with caution as there were some missing/choose not to respond demographic data in registration files, which introduces measurement error in determining Underserved status.

CQL: 1%-9% missing individual demographics; 12 (7.5%) participant Underserved not calculated
HSAP: 0%-6% missing individual demographics; 3 (9.3%) participant Underserved not calculated
REAP: 0%-4% missing individual demographics; 2 (2.3%) participant Underserved not calculated
SEAP: 0%-4% missing individual demographics; 0 (0%) participant Underserved not calculated
Unite: 0%-5% missing individual demographics; 8 (1.9%) participant Underserved not calculated
URAP: 0%-4% missing individual demographics; 3 (6.1%) participant Underserved not calculated
eCM: 3%-19% missing individual demographics; 1,821 (12.8%) participant Underserved not calculated
NJ&EE: 1%-4% missing individual demographics; 2 (2.7%) participant Underserved not calculated
R-JSHS: 1%-7% missing individual demographics; 243 (7.8%) participant Underserved not calculated
N-JSHS: 0%-7% missing individual demographics; 10 (4.6%) participant Underserved not calculated
GEMS: 0%-15% missing individual demographics; 232 (11.1%) participant Underserved not calculated

REAP and Unite reached a population of students that was comprised of over 90% Underserved participants. eCM overall had more than 50% Underserved participants. HSAP, eCM NJ&EE, JSHS, and GEMS had between 30% and 50% Underserved participation. CQL, SEAP, and URAP included less than 30% Underserved students.

A key to AEOP's sustainability and success is collaboration with other organizations and the involvement of adult participants who serve as mentors, judges, team advisors, and in various other roles. The ability to leverage Army and DoD S&Es and Army and DoD laboratories in AEOP initiatives distinguishes it from other STEM outreach programs. Numbers of organizations and Army S&Es participating in each FY20 AEOP are listed in Table 4. No totals are displayed as institutions and S&Es may participate in multiple AEOP.

Table 4. Number of 2020 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/ 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
CQL	N/A	N/A	N/A	N/A	15	N/A	89	N/A
eCM	341	146	95	17	24	N/A	316	30
GEMS	747	250	33	9	18	N/A	40	0
HSAP	30	11	20	7	N/A	20	N/A	N/A
JSHS	714	441	85	19	20	N/A	233	2
JSS	0	0	N/A	N/A	0	N/A	0	0
REAP	69	37	47	23	N/A	N/A	N/A	N/A
RESET	25	18	1	0	7	N/A	17	0
SEAP	19	7	N/A	N/A	3	N/A	22	N/A
Unite	209	108	29	9	0	N/A	25	74
URAP	N/A	N/A	30	6	N/A	30	N/A	N/A

The number of unique (duplicates eliminated) institutions participating in an FY20 AEOP is provided in Table 5, and the numbers of unique K-12 teachers and S&Es participating in AEOP in FY20 are presented in Table 6. AEOP students and adult participants represented 2,065 K-12 schools nationwide, and 221 colleges and universities (54 of which were HBCUs/MSIs) were either home institutions for AEOP participants or acted as host sites for programs. Thirty-four Army-funded university labs and 50 Army/DoD labs and centers participated in AEOP in 2020. A total of 1,093 K-12 teachers and 473 DoD S&Es participated in the various AEOP in 2020.

Table 5. Total Number of Unique Schools and Laboratories Participating in AEOP in 2020	
Type of Institution	**Total Number of Unique Institutions**
K-12 Schools	2,065
Colleges/Universities represented by participants or serving as host sites (HBCU/MSI)	221 (54)
Army-Funded University Labs	34
Army and DoD Labs and Centers	50
Other Organizations	105

Table 6. Total Number of Unique Adults Participating in AEOP in 2020	
Type of Participant	**Total Number of Unique Participants**
K-12 Teachers	1,093
Army/DoD Scientists and Engineers	473

Table 7 details the costs associated with implementation of the FY20 AEOP portfolio. AEOP's portfolio is divided into four programming categories: competitions, STEM enrichment programs, apprenticeships, and STEM educator programs. Aligned with previous years, competitions were least costly on a per student basis. STEM enrichment programs were the next costly on a per student basis, followed by the apprenticeship programs and the STEM educator program (RESET). STEM enrichment programs (CII, GEMS, Unite) costs ranged from $180 per student for CII, typically a 1-week summer STEM experience, to $1,486 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 $4,571 per apprentice (REAP) to $9,325 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 portfolio and costs were $6,490 per participant in 2020.

Three programs (CII, JSHS, and Unite) had slightly lower costs per student participant in FY20 as compared to FY19. All other programs experienced increases in cost per student from FY19 to FY20.

Table 7. 2020 AEOP Program Total Costs				
	Program Type	**Program Cost**	**Cost Per Participant**	**Average Stipend Per Participant**
CII	STEM Enrichment Program (grades K-6)	$499,365	$180	N/A
CQL	STEM Apprenticeship Program (undergraduate/graduate)	$1,482,699	$9,325	$8,892
eCM	STEM Competition (grades 6-9)	$2,587,477	$182	N/A
GEMS	STEM Enrichment Program (grades 5-12)	$1,258,283	$571	$127
HSAP	STEM Apprenticeship Program (grades 9-12)	$181,626	$5,676	$4,688
JSHS	STEM Competition (grades 9-12)	$1,253,819	$362	N/A
JSS	STEM Competition (grades 5-8)	$136,637	N/A	N/A
REAP	STEM Apprenticeship Program (grades 9-12)	$393,099	$4,571	$2,463
RESET	STEM Educator Program	$175,220	$6,490	$2,148
SEAP	STEM Apprenticeship Program (grades 9-12)	$210,427	$7,515	$5,055
Unite	STEM Enrichment Program (grades 9-12)	$665,941	$1,486	N/A
URAP	STEM Apprenticeship Program (undergraduate)	$338,126	$6,901	$5,969

4 | Evaluation Strategy

The 2020 AEOP portfolio evaluation was conducted by NC State University. The evaluation was comprised of a two-pronged strategy. The first and primary focus of the evaluation was to assess current program year effectiveness for each of eleven AEOP elements: CQL, eCM, GEMS, HSAP, JSHS, REAP, RESET, SEAP, Unite, and URAP. The secondary focus of the evaluation is the long-term alumni study. This component includes an examination of the mid to long-term outcomes of the AEOP.

The evaluation team conducted all data collection for FY20 including questionnaire data for programs and alumni and individual phone interviews with selected program participants (both current and alumni). NC State University conducted all data analysis and prepared all AEOP FY20 evaluation reports except for the Camp Invention Initiative (CII). NC State University assessed and evaluated these AEOP elements in collaboration with AEOP CA consortium members,[1] individual program administrators (IPAs), the Army Cooperative Agreement Managers (CAMs), and personnel responsible for implementing programs at specific sites (Command Level Coordinators, Lab Coordinators, Regional Directors, etc.). The 2020 AEOP evaluation was standardized across all programs, except for RESET, to allow for the reporting of consistent information about program quality and impacts. Because of the small number of RESET participants, a formative approach consisting of interviews with participants and information provided by the IPA was utilized to evaluate the program. Elements of the data available through Camp Invention that were aligned with the overall AEOP portfolio evaluation are included for reference in this report.

The 2020 evaluation was informed by AEOP priorities and by the objectives of individual AEOP elements (Table 8). Evaluation studies were carried out using a logic model that proposes a pathway of influence for the AEOP, ultimately linking AEOP inputs and activities to intended outcomes that align with AEOP priorities and objectives as well as federal requirements for reporting on federal STEM investments. The logic model provides a framework for the near- and long-term AEOP evaluation plan, ensuring that evaluation questions yield information that is valuable to the AEOP and that evaluation assessments include appropriate measures of intended outputs and outcomes that align with the AEOP's priorities and objectives and federal requirements.

[1] The 2020 AEOP consortium members included the Rochester Institute of Technology (RIT; Apprenticeship Programs), the Technology Student Association (TSA, Unite), the National Science Teaching Association (NSTA; eCM, GEMS, JSHS), NC State University (Evaluation Lead); Metriks Amerique (Alumni Management); Widmeyer (Communications and Marketing); Battelle Memorial Institute (Lead Organization).

Table 8. AEOP Priorities and Objectives (2020)
PRIORITY ONE: STEM Literate Citizenry
Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.
Objectives
• Encourage and reward student participation in STEM opportunities.
• Inspire students to excel in science and mathematics.
• Increase participation of underserved populations in the AEOP.
• Expand the involvement of students in ongoing DoD research.
• Increase awareness of DoD STEM career opportunities.
PRIORITY TWO: STEM Savvy Educators
Support and empower educators with unique Army research and technology resources.
Objectives
• Partner with schools and teachers at local and state educational agencies for shared standards in science and mathematics.
• Use incentives to promote teacher participation in the AEOP.
• Provide online resources for educators to share best practices.
• Provide and expand mentor capacity of the Army's highly qualified scientists and engineers.
PRIORITY THREE: Sustainable Infrastructure
Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.
Objectives
• Develop and implement cohesive program metrics for each individual program and across all of the AEOP.
• Provide STEM educational opportunities for students at all stages of their K-12 education.
• Integrate programs in a central branding scheme, inclusive of a centralized website, for a strategic and comprehensive marketing strategy.
• Establish a competitive process for funding new STEM investments that align to the overall program strategy.

In 2020, the AEOP evaluation studies focused predominantly on assessing the impact of AEOP programs as well as near- and mid-term outcomes. Thus, data collection included questions about the benefits of participation to participants, program strengths and challenges, and overall effectiveness in meeting AEOP and program objectives. In addition, each program evaluation noted which recommendations from previous evaluations had been implemented (evidence-based change). Figure 1 provides a simple graphic depiction of the AEOP Evaluation logic model.

Figure 1. AEOP Evaluation Logic Model

Inputs	Activities	Outputs	Outcomes (Near-term)	Impact (Mid- and Long-Term)
• US Army sponsorship • Broad roster of AEOP initiatives available for student engagement • IPAs providing coordination and oversight of programs • Operations conducted at Army/DoD laboratories and centers, universities, schools, and local/regional and national competitions and virtually • Army/DoD and university S&Es, local and DoDEA/DoDDS educators, and other volunteers serving as STEM "mentors" • Online and on-site curricular resources • Stipends and awards for students and educator participants • Centralized branding and comprehensive marketing • Centralized evaluation and annual reporting	• Engagement in "authentic" STEM experiences through: • Curriculum-driven summer programs at Army research institutions and universities • Summer and academic year apprenticeship programs at Army research institutions and universities • Local/regional and national STEM competitions • Virtual delivery of all of the above	• Increasing numbers and diversity of student participants • Increasing numbers and diversity of mentor participants • Increasing numbers and diversity of Army/DoD scientists and engineers engaged in programs • Increasing numbers of K-college schools served through participant engagement • Increasing number of curricular resources distributed through websites and program participation • Students, mentors, site coordinators, and IPAs contributing to evaluation	• Increased student interest and engagement in STEM (formal and informal) • Increased participant STEM skills, knowledge, abilities, and confidence • Increased participant knowledge of other AEOP opportunities • Increased participant knowledge of Army/DoD STEM research and careers • Implementation of evidence-based recommendations to improve programs	• Increased student participation in other AEOP opportunities and DoD scholarship/ fellowship programs • Increased student interest in and pursuit of STEM coursework in secondary and post-secondary schooling • Increased student interest in and pursuit of STEM degrees • Increased student interest in and pursuit of STEM careers • Increased student interest in and pursuit of Army/DoD STEM careers • Continuous improvement and sustainability of the AEOP

The 2020 AEOP evaluation plan is summarized by program in Table 9. In short, most evaluations utilized participant questionnaires, as well as focus groups or interviews with student participants (herein called students and apprentices) and adult participants who led educational activities or supervised research (herein called mentors, team advisors, or adults).

Table 9. 2020 AEOP Evaluation Strategy

AEOP Element	Assessment Tools	Program-Level Objectives
CQL	Program Evaluation: • Apprentice questionnaire • Mentor questionnaire • Apprentice interviews • Mentor interviews	• To nurture interest and provide research experience in STEM for college students. • To provide opportunities for continued association with the DoD laboratories and STEM enrichment of previous SEAP, GEMS, and other AEOP program participants as well as allow new college students the opportunity to engage with DoD laboratories. • To outreach to participants inclusive of students from groups historically under-represented and underserved in STEM. • To increase participant knowledge in targeted STEM areas and develop their research and laboratory skills as evidenced by mentor evaluation and the completion of presentations of research (poster, paper, oral presentation, etc.). • To educate participants about careers in STEM fields with a particular focus on STEM careers in DoD laboratories. • To acquaint participants with the activities of DoD laboratories in a way that encourages a positive image and supportive attitude towards our defense community. • To provide information to participants about opportunities for STEM enrichment and ways they can mentor younger STEM students through GEMS, eCYBERMISSION, and other AEOP opportunities.
eCM	Program Evaluation: • Student questionnaire • Mentor questionnaire • Student interviews • Mentor interviews	• Increase number of student and Team Advisor registrants and folder submissions. • Increase the number of participants from Title I schools. • Increase the number of volunteers and Army volunteers. • Increase Team Advisor retention rate and implement programs to exceed our target rate. • Increase number of classroom integrated programs. • Increase number of students from DoDEA schools. • Increase participants' awareness of other AEOP and DoD STEM opportunities and Army/DoD technologies and increase student interest in STEM learning and pursuit of STEM-related degrees.
GEMS	Program Evaluation: • Student questionnaire	• To nurture interest and excitement in STEM for middle and high school participants.

	• Mentor questionnaire • Student interviews • Mentor interviews	• To nurture interest and excitement in STEM for mentor participants. • To implement STEM enrichment experiences through hands-on, inquiry-based educational modules that enhance in-school learning. • To increase participant knowledge in targeted STEM areas and laboratory skills. • To increase the number of outreach participants inclusive of students from groups historically under-represented and underserved in STEM. • To encourage participants to pursue secondary and post-secondary education in STEM. • To educate participants about careers in STEM fields with a particular focus on STEM careers in Army laboratories. • To provide information to participants about opportunities for STEM enrichment through advancing levels of GEMS as well as other AEOP initiatives.
HSAP	<u>Program Evaluation:</u> • Apprentice questionnaire • Mentor questionnaire • Apprentice interviews • Mentor interviews	• 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. • Expand cross marketing and outreach of apprenticeship programs to include other AEOP programs to mentors and LPCs. • Encourage apprentices to continue pursuit of AEOP STEM/Army STEM careers • Encourage more students already in the AEOP pipeline to continue with an apprenticeship program • Increase participant's knowledge of other AEOP programs and STEM careers • Improve the overall participant and mentor apprenticeship experience.
JSHS	<u>Regional Symposia Evaluation:</u> • Student questionnaire • Mentor questionnaire <u>National Symposium Evaluation:</u> • Student interviews • Mentor interviews	• To promote research and experimentation in STEM at the high school level. • To recognize the significance of research in human affairs and the importance of humane and ethical principles in the application of research results. • To search out talented students and their teachers, recognize their accomplishments at symposia, and encourage their continued interest and participation in the sciences, mathematics, and engineering. • To recognize innovative and independent research projects of students in regional and national symposia.

		• To expose students to academic and career opportunities in STEM and to the skills required for successful pursuit of STEM. • To expose students to STEM careers in Army and/or DoD laboratories. • To increase the future pool of talent capable of contributing to the nation's scientific and technological workforce.
REAP	<u>Program Evaluation:</u> • Apprentice questionnaire • Mentor questionnaire • Apprentice interviews • Mentor interviews	• To provide high school students from groups historically under-represented and underserved in STEM, including alumni of the AEOP's Unite program, with an authentic science and engineering research experience. • To introduce students to the Army's interest in science and engineering research and the associated opportunities offered through the AEOP. • To provide participants with mentorship from a scientists or engineer for professional and academic development purposes. • To develop participants' skills to prepare them for competitive entry into science and engineering undergraduate programs.
RESET	<u>Program Evaluation:</u> • Participant interviews	• To increase teacher knowledge and access to research. • To create digital professional learning community (D-PLC) for educators and mentors to share best practices. • To prepare teacher participants to create Legacy Cycle lessons based on DoD research and careers.
SEAP	<u>Program Evaluation:</u> • Apprentice questionnaire • Mentor questionnaire • Apprentice interviews • Mentor interviews	• To acquaint qualified high school students with activities of Army laboratories and centers through summer research and engineering experiences. • To provide students with opportunities and exposure to scientific and engineering practices and personnel not available in their school environments. • To 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. • To establish a pool of students preparing for careers in science and engineering with a view toward potential government service. • To 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. • To involve a larger percentage of students from previously under-represented segments of our population, such as women, African-Americans and

		Hispanics, in pursuing science and engineering careers.
Unite	<u>Program Evaluation:</u> • Student questionnaire • Mentor questionnaire	• To effectively show participants the real word applications of math and science. • To raise participant confidence in the ability to participate in engineering activities. • To inspire participants to consider engineering majors in college. • To remove social barriers and negative attitudes about engineering. • To promote collaboration and problem solving in a team environment. • To expose participants to STEM careers in the Army and DoD. • To increase the number of STEM graduates to fill the projected shortfall of scientists and engineers in national and DoD careers.
URAP	<u>Program Evaluation:</u> • Apprentice questionnaire • Mentor questionnaire • Apprentice interviews • Mentor interviews	• 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. • Expand cross marketing and outreach of apprenticeship programs to include other AEOP programs to mentors and LPCs. • Encourage apprentices to continue pursuit of AEOP STEM/Army STEM careers • Encourage more students already in the AEOP pipeline to continue with an apprenticeship program • Increase participant's knowledge of other AEOP programs and STEM careers • Improve the overall participant and mentor apprenticeship experience.

Evaluation instruments are reviewed annually by individual program administrators (IPAs), the Army Cooperative Agreement Managers (CAMs), and evaluators and revised as necessary. All instruments and protocols were approved by NC State University's Institutional Review Board (IRB) for the protection of human research subjects.

5 | Study Sample

Surveys were the primary data collection method for the FY20 AEOP evaluation. Response rates by program along with their corresponding margins of error at the 95% confidence level were computed for students and mentors within each group (Table 10). Acceptable margin of error rates ranges from 2-5%. The reduced rate of participation in programs coupled with challenges of recruitment for participation in the evaluation due to COVID-19 virtual delivery of most programming resulted in a less than desired response rate for the FY20 questionnaires. With the exceptions of eCM overall and GEMS, no other programs met this standard. A larger than acceptable margin of error can suggest response bias (those who chose to respond to the questionnaire may not be representative of the entire population). In terms of participation rate, some programs had less than 20 survey participants in either the student or mentor groups (CQL, HSAP, REAP, SEAP, URAP). Yet multiple programs exceeded the 40% benchmark participation rate for students (NJ&EE, GEMS, Unite). Consequently, results from these survey data should be viewed as preliminary indicators of program quality and impact, but not as conclusive.

Table 10. 2020 AEOP Program Participant Questionnaire Participation

Program	2020 Questionnaire	Sample	Population*	Participation Rate	Margin of Error @ 95% Confidence[2]
CQL	Apprentice	52	159	32.7%	±11.18%
	Mentor	6	89	6.7%	±38.86%
eCM	Overall Participant	1,810	14,234	12.7%	± 2.15%
	NJ&EE Participant	53	73	72.6%	± 7.09%
	Team Advisor	187	578	32.4%	± 5.89%
GEMS	Student	913	2,087	43.7%	±2.43%
	Mentor	24	214	11.2%	±18.89%
HSAP	Apprentice	8	32	25.0%	±30.49%
	Mentor	1	26	3.8%	±98.00%
JSHS	Regional Student	285	3,129	9.1%	±5.54%
	National Student	N/A	N/A	N/A	N/A
	Mentor	102	2,025	5.0%	±9.46%
JSS	Student	N/A	N/A	N/A	N/A
	Mentor	N/A	N/A	N/A	N/A
REAP	Apprentice	17	86	19.8%	±21.41%
	Mentor	14	66	21.2%	±23.43%
SEAP	Apprentice	3	28	10.7%	±54.44%

[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.

	Mentor	3	22	13.6%	±53.82%
Unite	Student	295	419	70.4%	±3.11%
	Mentor	62	273	22.7%	±10.96%
URAP	Apprentice	16	49	32.7%	±20.31%
	Mentor	10	39	25.6%	±27.07%
Alumni Study		577	11,236	5.1%	±3.97%
Total AEOP Questionnaire Participation		**4,438**	**34,864**	**12.7%**	**±1.37%**

*Cvent enrollment data was used for statistical analysis of evaluation survey findings throughout the program evaluations

No program site visits were made 2020 due to COVID-19 related restrictions and due to the virtual delivery method for most programs and travel restrictions in place at NC State University. Telephone interviews with participants and mentors were therefore conducted in lieu of focus groups. Program administrators and site coordinators worked with evaluation staff to recruit interview participants. In total, 159 students, apprentices, and mentors participated in interviews. Table 11 summarizes interview participation.

Table 11. 2020 AEOP Program Participant Interview Participation

Program	2020 Interviews	Participants
CQL	Appretice	9
	Mentor	4
eCM	NJ&EE Student	12
	NJ&EE Team Advisor	10
GEMS	Student	11
	Near-Peer Mentor	10
	Resource Teacher	3
	S&E Mentor	2
HSAP	Apprentice	5
	Mentor	6
JSHS	National Symposium Participants	12
	Competition Advisor/Mentor	6
	Regional Directors	2
	Regional Representatives (adult)	2
JSS	Student	N/A
	Mentor	N/A
REAP	Apprentice	11
	Mentor	1
RESET	Teacher participants	10
SEAP	Apprentice	5
	Mentor	1
Unite	Student	11
	Mentor	5
URAP	Apprentice	15
	Mentor	6
Total AEOP Interview Participation		**159**

The mid to long-term study of AEOP alumni continued with the FY20 evaluation. Table 12 provides the alumni respondent profile data.

Table 12. Alumni Respondent Profile (Longitudinal FY20 participants)		
Demographic Category	**Questionnaire Respondents**	
Gender (*n*=577)		
Female	330	57.2%
Male	236	40.9%
Choose not to report	11	1.9%
Race/Ethnicity (*n*=577)		
Asian	103	17.9%
Black or African American	94	16.3%
Hispanic or Latino	65	11.3%
Native American or Alaska Native	7	1.2%
Native Hawaiian or Other Pacific Islander	7	1.2%
White	263	45.6%
Other race or ethnicity (specify)	35	6.1%
Choose not to report	3	<1%
Program Year (*n*=577)		
2020	104	18.0%
2019	57	9.9%
2018	213	36.9%
2017	118	20.5%
2016	55	9.5%
2015	15	2.6%
2014	4	<1%
2013	5	1.0%
2012	6	1.0%
High School Graduation Year (*n*=577)		
Before 2012	74	12.8%
2012	3	<1%
2013	3	<1%
2014	11	1.9%
2015	15	2.6%
2016	19	3.3%
2017	16	2.8%
2018	29	5.0%
2019	57	9.9%
2020	67	11.6%
2021	144	25.0%
2022	63	10.9%
2023	42	7.3%
2024	10	1.7%
2025	1	<1%
Choose not to report	23	4.0%

6 | Evaluation Findings

FY20 AEOP evaluation findings are organized by the three AEOP priorities with their corresponding research questions aligned to demonstrate portfolio progress toward achieving desired outcomes of the AEOP. Table 13 presents priorities and research questions for the near-term (annually). While Table 14 shows mid- to long-term (multiple years) research questions aligned with AEOP priorities.

Table 13. AEOP Priorities and Near-Term Research Questions (2020)
PRIORITY ONE: STEM Literate Citizenry
Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.
Research Question #1 - To what extent do participants report growth in interest and engagement in STEM?
Research Question #2a - To what extent do participants report increased STEM competencies, 21st Century/STEM skills, STEM knowledge, STEM abilities, and STEM confidence?
Research Question #2b – To what extent do participants demonstrate use of and growth in 21st Century skills?
Research Question #3 - To what extent do participants and mentors report increased participant interest in STEM research and careers?
Research Question #4 - To what extent do participants and mentors report increased awareness of and interest in Army/DoD STEM research and careers?
Research Question #5 - To what extent do participants report increased enrollment, achievement, and completion of STEM degree programs?
PRIORITY TWO: STEM Savvy Educators
Support and empower educators with unique Army research and technology resources.
Research Question #6 - What is the impact of scientist and engineer (S&E) mentors on AEOP participants?
Research Question #7 - To what extent do teacher participants report increased use of new approaches to teaching research concepts within STEM practices, and infusion of careers?
PRIORITY THREE: Sustainable Infrastructure
Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.
Research Question #8 - To what extent do participants report growth in awareness of and/or interest in AEOP opportunities?

Table 14. AEOP Priorities and Mid to Long Term Research Questions (2020)
PRIORITY ONE: STEM Literate Citizenry
Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.
Research Question #1 - To what extent do alumni report positive, sustained interest and engagement in STEM?
Research Question #2 - To what extent do alumni report positive attitudes toward STEM, and particularly Army/DoD STEM?
Research Question #3 - To what extent do alumni report pursuit of and achievement in STEM courses in secondary school, post-secondary STEM degrees, STEM careers, and Army/DoD STEM careers?
Research Question #4 - To what extent do alumni report awareness of and interest in STEM research and careers overall and for the Army/DoD specifically?
Research Question #5 – To what extent do alumni report an increase in STEM career participation and success overall, as well as within the Army/DoD specifically?
PRIORITY TWO: STEM Savvy Educators
Support and empower educators with unique Army research and technology resources.
Research Question #6 - What is the impact of scientist and engineer (S&E) mentors on AEOP alumni?
Research Question #7 – Are there measurable changes in teacher approaches to teaching research concepts within STEM practices, and careers after participation in AEOP (RESET)?
PRIORITY THREE: Sustainable Infrastructure
Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.
Research Question #8 - To what extent do alumni report increased awareness of and/or interest in AEOP opportunities?
Research Question #9 - To what extent do alumni report participation in an AEOP program multiple times, in other AEOP elements, or in other DoD workforce development programs?

Near-Term Evaluation – Findings for FY20 AEOP

Priority One: STEM Literate Citizenry

AEOP evaluation findings from FY20 show progress toward achieving a STEM literate citizenry. Supporting trends in achieving this AEOP priority from survey and interview evidence inform findings that are presented below by related research question(s).

Research Question #1 - To what extent do participants report growth in interest and engagement in STEM?

AEOP continued to engage a strong pool of diverse future STEM talent – over 23,000 participants, including 53% underserved students. The AEOP portfolio consisted of STEM programs designed to nurture students' STEM interests and aspirations throughout their educational careers. AEOP include STEM competitions (eCM and JSHS), STEM enrichment activities (CII, GEMS, and Unite), and STEM apprenticeship programs (CQL, HSAP, REAP, SEAP, and URAP). The GEMS Near-Peer Mentor (NPM) program also provided opportunities for undergraduate student scientists and engineers (S&Es)-in-training, to lead educational activities for students in the GEMS program and RESET provided professional development experiences for STEM educators by offering on-line learning and on-site research experiences.

In FY20, 23,483 student participants were engaged in an AEOP. This is an 19% decrease from 2019 when 28,947 students participated, and a 22% decrease as compared to 2018 when 30,311 students participated in AEOP. This decrease continues a three-year downward trend in enrollment. Enrollments since FY18 were as follows: 30,334 in FY18; 28,947 in FY19; 23,483 in FY20. In FY20, most programs experienced a decline in student participation due to the transition to virtual events or cancellation of sites as a result of Covid-19. eCM, the AEOP that serves the greatest number of students, experienced an enrollment decline of 21% in FY20, following an 11% decrease in FY19, and a 6% decrease in FY18 as compared to the prior program years. However, the number of students enrolled in JSHS in FY20 increased by 31% as compared to FY19.

Table 15 displays AEOP student application numbers and placement rates for FY20. Across AEOP, a total of 31,347 applications were received in FY20. This is a 18% decrease compared to the 38,339 applications in FY19, a 20% decrease from the 39,325 applications received in FY18. The number of applications that AEOP receive indicates a strong student interest in AEOP and there continues to be considerably higher demand for many programs than available spaces.

The overall placement rate across AEOP for FY20 (75%) was like that of FY19 (76%) and FY18 (77%). Four programs (CQL, GEMS, SEAP, REAP) had decreases in placement rates as compared to prior years, while three programs (HSAP, Unite, URAP) increased or stayed the same:

- CQL placed 27% of applicants in FY20 compared to 31% in FY19, and 37% in FY18
- GEMS placed 48% of applicants in FY20 compared to 56% in FY19, and 61% in FY18
- HSAP placed 7% of applicants in FY20 compared to 4% in FY19, and 9% in FY18
- SEAP placed 3% of applicants in FY20 compared to 8% in FY19, and 13% in FY18
- Unite placed 61% of applicants in FY20 compared to 54% in FY19, 59% in FY18
- URAP placed 19% of applicants in FY20 compared to 19% in FY19, and 20% in FY18
- REAP placed 16% of applicants in FY20 compared to 20% in FY19, and 15% in FY18

More than 5,000 adults, including K-12 teachers and Army and DoD S&Es, engaged in AEOP in FY20, leading educational activities, supervising research, or serving as competition advisors, judges, event hosts or other volunteers. These numbers do not capture numerous other adults who may have been impacted within the organizations of those participating in AEOP. Nor do these numbers reflect the potentially broader and undetermined impact of the AEOP's online educational resources made freely available through eCM, or those resources available to GEMS NPMs and GEMS resource teachers. Adult participation (5,066) was approximately 19% lower than in FY19 (6,138), 46% lower than in FY18 (9,774), and 38% lower than in FY17 (8,607).

eCM, a web-based STEM competition for 6th-9th grade students, continues to enroll the largest number of participants among AEOP, enrolling 60% of the total number of AEOP participants in FY20 (60% in FY19, 66% in FY18). JSHS, another STEM competition, was similarly open to all those who met registration qualifications and increased participation by 31% from FY19 to FY20. All programs except for CII, HSAP, JSHS, and Unite experienced declines in enrollment as compared to FY19.

Placement rates varies across AEOP due to individual program capacities and differing levels of interest. Apprenticeship programs (CQL, HSAP, REAP, SEAP, URAP) continued to be competitive, with placement rates ranging from 3% (SEAP) to 27% (CQL). The number of applicants across the AEOP apprenticeship portfolio decreased to 2,739, a 27% decrease from FY19 (3,756 applicants), a 16% decrease from FY18 (3,275 applicants), and a 19% decrease from FY17 (3,384 applicants). Of those applying for apprenticeships in FY20, 354 were selected for participation. The placement rate for apprentice programs overall was 13% in FY20, as compared to 15% in FY19, 18% in FY18, 27% in FY16, and 33% in FY15, which represents an overall multi-year decrease in placement rate. Apprenticeship programs serving high school students (HSAP, REAP, SEAP) were most competitive, and had a combined placement rate of only 8% in FY20, as compared to 11% in both FY19 and FY18, 13% in FY17, 25% in FY16, and 17% in FY15 and FY14. This represents a slight decrease in placement rate for high school apprenticeships between FY20 and FY19 and FY18, but a substantial decrease from FY16. Placement in undergraduate apprenticeships (CQL and URAP) decreased to 25% in FY20 compared to 27% in FY19 and 32% in FY18 but is like the 24% placement rate in FY17. Overall enrollment in apprenticeship program declined by 37% in FY20 (354 apprentices) as compared to FY19 (563 apprentices) and decreased by 39% as compared to FY18 (582 apprentices).

Table 15. 2020 AEOP Number of Students Applications and Placement Rates					
		Students Applicants	**Students Participants**	**Placement Rate**	**Change in Students Participants, FY20 vs. FY19**
CII	STEM Enrichment Activity	2,773	2,771	N/A[†]	29%
CQL	STEM Apprenticeship Program (undergrad)	582	159	27%	-22%
eCM	STEM Competition	16,053	14,245	89%	-21%
GEMS	STEM Enrichment Activity	4,533	2,203	48%	-26%
HSAP	STEM Apprenticeship Program (high school)	434	32	7%	10%
JSHS	STEM Competition	4,511	3,462	N/A	31%
JSS	STEM Competition	N/A	N/A	N/A	N/A
REAP	STEM Apprenticeship Program (high school)	527	86	16%	-49%
SEAP	STEM Apprenticeship Program (high school)	938	28	3%	-74%
Unite	STEM Enrichment Activity	738	448	61%	2%
URAP	STEM Apprenticeship Program (undergrad)	258	49	19%	-9%
	Total	**31,347**	**23,483**	**75%**	**-13%**

[†] *In 2020, all students who met registration requirements for CII and JSHS were able to participate.*

The AEOP continued to make progress toward its goal of serving groups underserved in STEM, as mentioned previously, with a 53% Underserved population for FY20. AEOP's definition of underserved includes at least two of the following: low-income students; students belonging to race and ethnic minorities that are historically underrepresented in STEM; students who speak English as a second

language; first-generation college students; students in rural, frontier, or other federally targeted outreach schools; students who receive free and reduced-price school meals (FARMS) or Pell Grants; and females in certain STEM fields.

Student demographic information for students who completed the FY20 evaluation survey are presented in Table 16. Participation of females in the evaluation varied widely among programs (range of 23%-100%). AEOP FY20 female participation increased over FY19 levels for seven programs (eCM overall, HSAP, REAP, SEAP, Unite, URAP), while female participation decreased in the four other programs (CQL, eCM NJ&EE, GEMS, JSHS). The proportion of student survey respondents identifying themselves as belonging to racial/ethnic minority groups has fluctuated over time and across programs (range of 0%-63%). Students who reported they were eligible for free or reduced-price lunch or were Pell Grant recipients also varied greatly between programs (range of 0%-64%) and differed by year.

Participants in the questionnaire also reported on school location (range of 12%-67% rural/urban/frontier), ELL status (range of 0%-29%), and first-generation college status (range of 0%-41%) demographics. These variables were used to calculate underrepresented student classification (Underserved) by program (range of 17%-89%). Most programs had half or more of their evaluation survey participants classified as Underserved (HSAP, JSHS, REAP, SEAP, Unite), while the remaining AEOP had less than half (CQL, eCM, eCM NJ&EE, GEMS, URAP).

Table 16. AEOP Evaluation Survey Participant Demographics														
Program	**Females**		**Racial & Ethnic Minorities**		**Low SES***		**School: Rural/Urban/Frontier**		**ELL**		**College 1st Generation**		**Underserved**	
	2019	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
CQL	55%	40%	20%	15%	32%	17%	N/A†	N/A†	9%	6%	20%	19%	41%	23%
eCM	48%	56%	35%	33%	43%	26%	51%	32%	4%	11%	14%	10%	53%	44%
eCM NJ&EE	58%	50%	16%	11%	10%	8%	9%	37%	0%	7%	0%	0%	16%	17%
GEMS	52%	23%	42%	15%	20%	5%	39%	12%	2%	1%	8%	4%	47%	18%
HSAP	61%	63%	39%	13%	21%	25%	73%	50%	17%	25%	17%	0%	44%	50%
JSHS	61%	59%	15%	14%	12%	15%	43%	52%	3%	7%	5%	9%	40%	50%
JSS	37%	N/A	13%	N/A	44%	N/A	38%	N/A	2%	N/A	18%	N/A	33%	N/A
REAP	64%	82%	65%	59%	71%	35%	65%	47%	21%	29%	39%	24%	89%	82%
SEAP	75%	100%	13%	0%	0%	0%	0%	67%	13%	0%	0%	0%	12%	67%
Unite	58%	65%	75%	63%	74%	64%	73%	62%	10%	6%	45%	41%	94%	89%
URAP	33%	38%	30%	38%	N/A†	38%	N/A†	N/A†	20%	13%	10%	19%	24%	38%

*Low Socio-Economic Status (SES) is measured by the number of participants eligible for free or reduced lunch for K-12 students or those who have received the Pell Grant for college students.

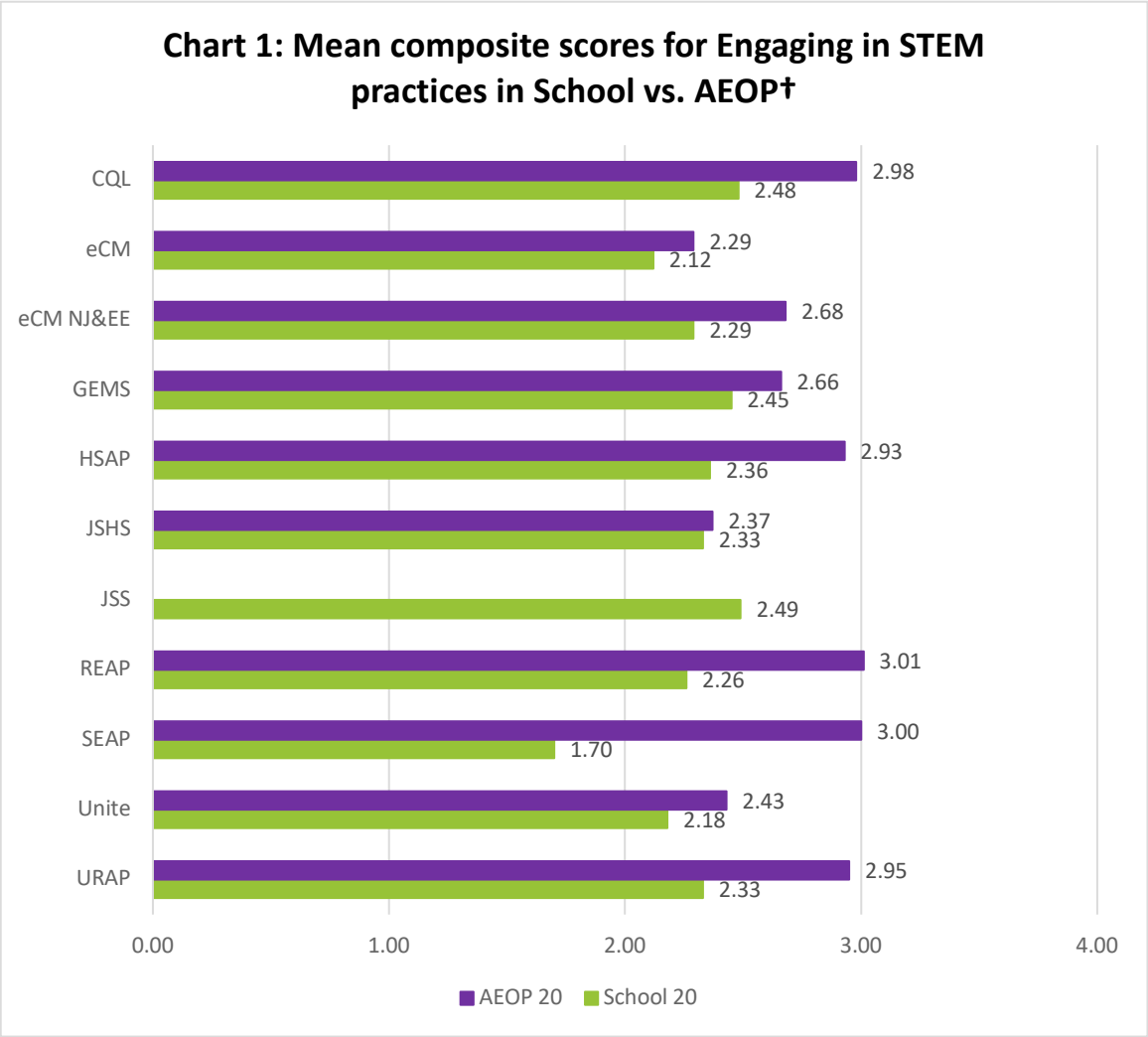
†*Not applicable – college program.*

Table 17 presents items participants were asked to report on related to STEM practice engagement during in their AEOP program. Participants also responded to a parallel set of items to compare these STEM practices to their experiences in school. Both sets of items were combined into their respective composite variables for comparison.

Table 17. Items that Form the Engaging in STEM Practices in School and Engaging in STEM Practices in AEOP Composites
1. Work with a STEM researcher or company on a real-world STEM research project
2. Work with a STEM researcher on a research project of your own choosing
3. Design my own research or investigation based on my own question(s)
4. Present my STEM research to a panel of judges from industry or the military
5. Interact with STEM researchers
6. Use laboratory procedures and tools
7. Design and carry out an investigation
8. Analyze data or information and draw conclusions
9. Work collaboratively as part of a team
10. Solve real world problems

Average composite scores for participant engagement in STEM practices are shown by program in Chart 1. Similar to past years, with the exception of JSHS, participants across all other programs reported engaging in STEM practices to a significantly greater extent in their AEOP programs compared to their standard school experiences. Effect sizes for these significant differences ranged from medium to extremely large.[3] Further, effect size measurements indicate the magnitude of difference or impact. AEOP competition programs (eCM, JSHS) are often implemented during in-school learning experiences. As such, students participating in these programs may not differentiate between their AEOP related learning activities and in-school STEM engagement.

[3] Effect sizes: CQL, *d* = 1.26, large; eCM overall, *d* = 1.34, large; N-eCM = 0.79, medium; GEMS, *d* = 0.70, medium; HSAP, *d* = 2.26, extremely large; REAP, *d* = 2.79, extremely large; SEAP, *d* = N/A; Unite, *d* = 0.79, medium; and URAP, *d* = 2.45, extremely large.



† *Response options for the items forming this composite were: 1 – Not at all, 2 – At least once, 3 – Most Days, 4 – Every day.*

Findings from the 2020 evaluation indicated that AEOP consistently provided opportunities for participants to engage in authentic STEM activities that are more intensive than those they experience in their typical school settings. This was also reflected in participants' responses to open-ended questionnaire responses and in comments made in interviews. Participants' comments included the following:

> *"It was just a whole new experience... [CQL] was a lot more of thinking critically about different problems. And so that was something that I… appreciated and wished there was more of in school…It was just getting that hands-on experience you really can't get in the classroom."* (CQL Apprentice)

> *"I love eCYBERMISSION because of how it has pushed WAY past my comfort zone. I love how the participants can choose a world-saving topic and gets to choose it themselves, as well as an AMAZING experience to meet important people in the US Army."* (eCM-N Student)

"eCYBERMISSION has allowed me to connect student learning to the real world. Students are able to take what they are learning in class and apply it to a real-world problem. To say I am satisfied with my eCYBERMISSION experience is an understatement." (eCM Team Advisor)

"[In school, teachers] don't have a lot of time to implement science and social studies...with GEMS, the students are really experiencing science and math without the time constraint...it's opening, their minds to be critical thinkers, to be creative, to problem solve...it exposes them to science in a different way. They are able to participate in the hands-on experiments. They're able to learn science concepts and to learn about the different jobs that are available in the STEM world that they're not exposed to in their regular classrooms." (GEMS RT)

"STEM classes [in school] are boring and…they don't have any rigor to it, whereas with HSAP, I certainly actually learned stuff, and I had the chance to apply my knowledge to some real problems" (HSAP Apprentice)

"I think [HSAP] students in the future will definitely remember this experience. I think they learn more efficiently than they [do] in school year for four years." (HSAP Mentor)

"If you listen to other people's presentations, you're able to learn about topics that don't get covered in your typical chemistry or biology curriculum. And it's really cool to learn about specific fields of STEM people are pursuing within their research projects." (N-JSHS Student)

"In school, we just learn facts. In REAP, I'm able to apply these facts to learn new things." (REAP Apprentice)

"[Unite] was more…teach yourself…and then receive help from the professor. So, you weren't leaning on the professor for like the entire course...in my school…they don't really do it that way...I really appreciate that because it was really helpful to me, and I learned a lot." (Unite Student)

"[URAP is] a lot more hands on [than my coursework], and I would say it's even a lot more enjoyable. You get to work with other people that are working on similar things to you but also, you get that independent time. Also, a mentor that's readily available. It helps a lot, because you can get instant feedback, or if you have any questions, you can ask them, and you'll get instant responses." (URAP Apprentice)

Research Question #2a - To what extent do participants report increased STEM competencies STEM skills, STEM knowledge, abilities, and confidence?

Participants reported that their AEOP experiences improved their STEM-specific and 21st Century STEM skills competencies. They also reported gains in their abilities to use the science and engineering practices described in the Next Generation Science Standards (NGSS) and reported gains in their STEM confidence and identity.

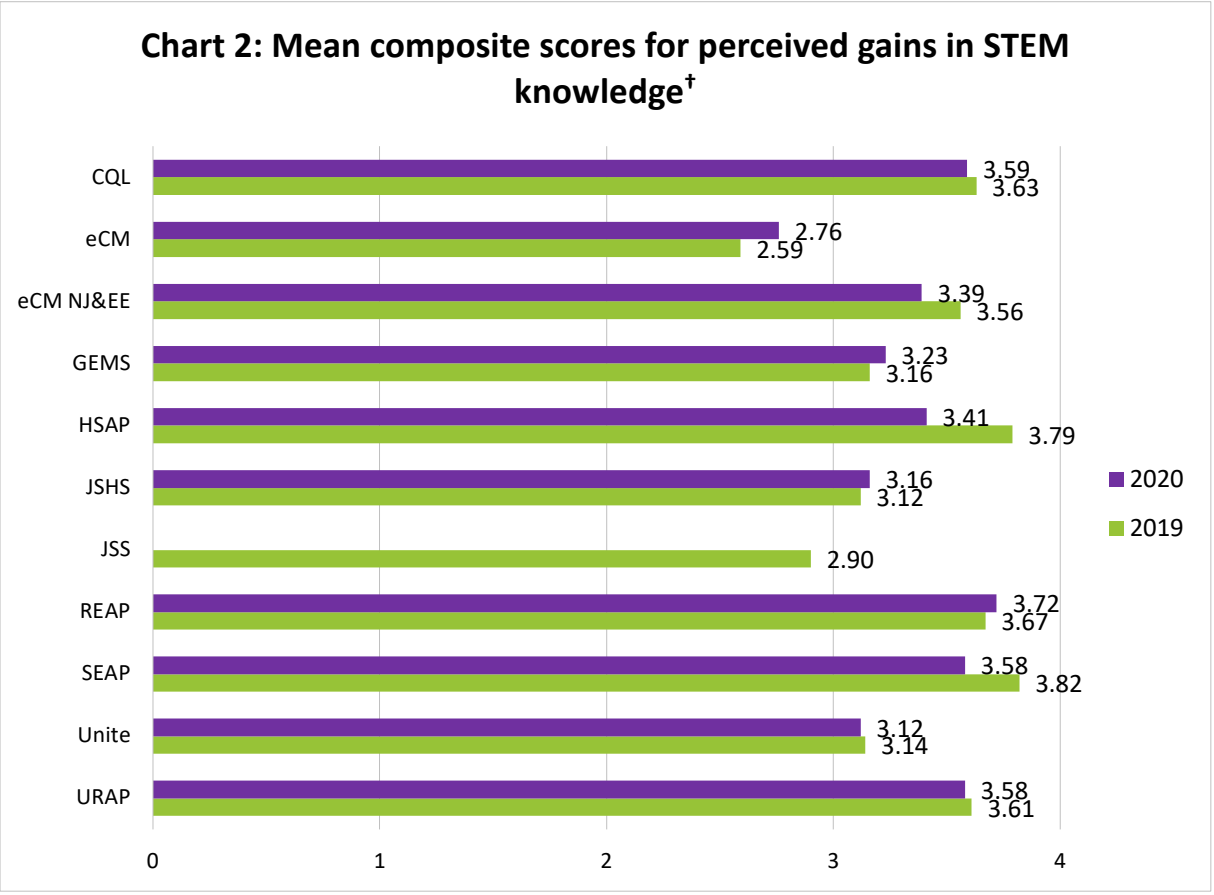
An aim of AEOP is to develop program participants' STEM knowledge, skills, and abilities, their 21st Century skills and their abilities to appropriately apply these skills. Further, deepening AEOP participants' STEM knowledge and skills are key factors in increasing the chance that these students will pursue STEM education and/or careers in their future.[4] As such, the FY20 AEOP evaluation examined participants reported gains in their STEM-specific and 21st Century skills, confidence in STEM, and on their STEM identities because of program participation.

Depending on the AEOP program, four or five items were included on evaluation surveys to gauge participants' STEM knowledge gains (Table 18). A 4-point rating scale ranging from "no gain" to "large gain" was used across these items. Participants across AEOP reported some level of gains in their STEM knowledge after participating in their program (Chart 1). With the exceptions of eCM overall, which averaged slightly lower gain ranges ("a little" to "some"), all other programs' participants reported average gains in STEM knowledge that were between "some" and "large".

Table 18. Items that form the Perceived Gains in STEM Knowledge Composite
1. In depth knowledge of a STEM topic(s)
2. Knowledge of research processes, ethics, and rules for conduct in STEM[†]
3. Knowledge of how scientists and engineers work on real problems in STEM
4. Knowledge of what everyday research work is like in STEM

[†] *This item was not included on the GEMS version of the survey.*

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

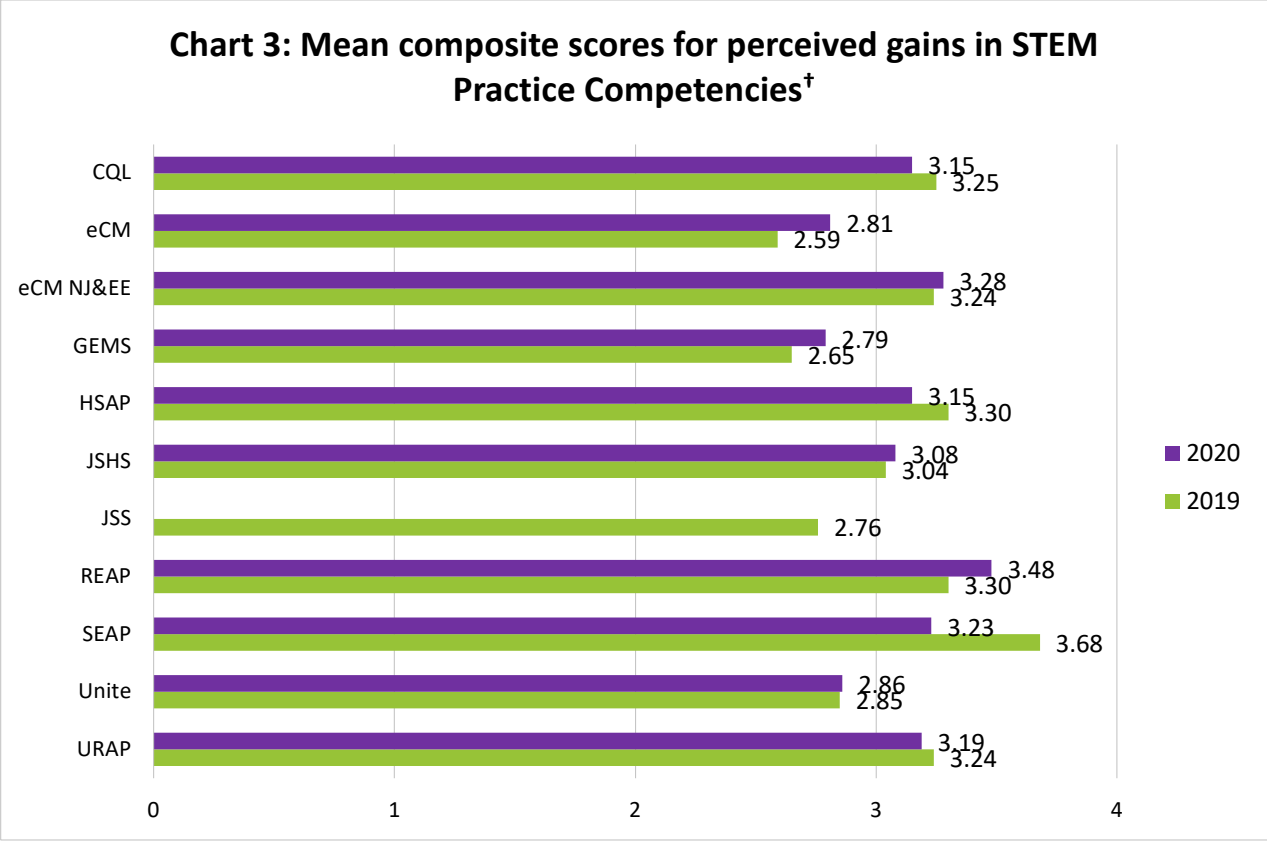


† *Response options for the items forming this composite were: 1 – No gain, 2 – Small gain, 3 – Medium gain, 4 – Large gain.*

AEOP students' growth in STEM competencies, as described in the Next Generation Science Standards (NGSS)[5], were assessed on the evaluation survey. Survey items evaluating students' STEM competency gains are provided in Table 19, and Chart 3 presents a comparison of findings from AY19 and AY20. Across programs, AEOP participants noted STEM competency increases as a result of engaging in their AEOP program. Further, FY20 gains were slightly stronger in approximately two-thirds of programs (Unite, REAP, JSHS, GEMS, eCM NJ&EE, eCM overall) compared to FY19 gains.

[5] http://www.nextgenscience.org/sites/default/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FIN/AL%20060513.pdf

Table 19. Items that form the Perceived Gains in STEM Competencies Composite
1. Defining a problem that can be solved by developing a new or improved product or process
2. Creating a hypothesis or explanation that can be tested in an experiment/problem†
3. Using my knowledge and creativity to suggest a solution to a problem
4. Making a model to show how something works
5. Designing procedures or steps for an experiment or designing a solution that works
6. Identifying the limitations of the methods and tools used for collecting data†
7. Carrying out an experiment and recording data accurately
8. Creating charts or graphs to display data and find patterns
9. Considering multiple interpretations of data to decide if something works as intended
10. Supporting an explanation with STEM knowledge†
11. Identifying the strengths and limitations of data or arguments presented in technical or STEM texts
12. Presenting an argument that uses data and/or findings from an experiment or investigation
13. Defending an argument based upon findings from an experiment or other data



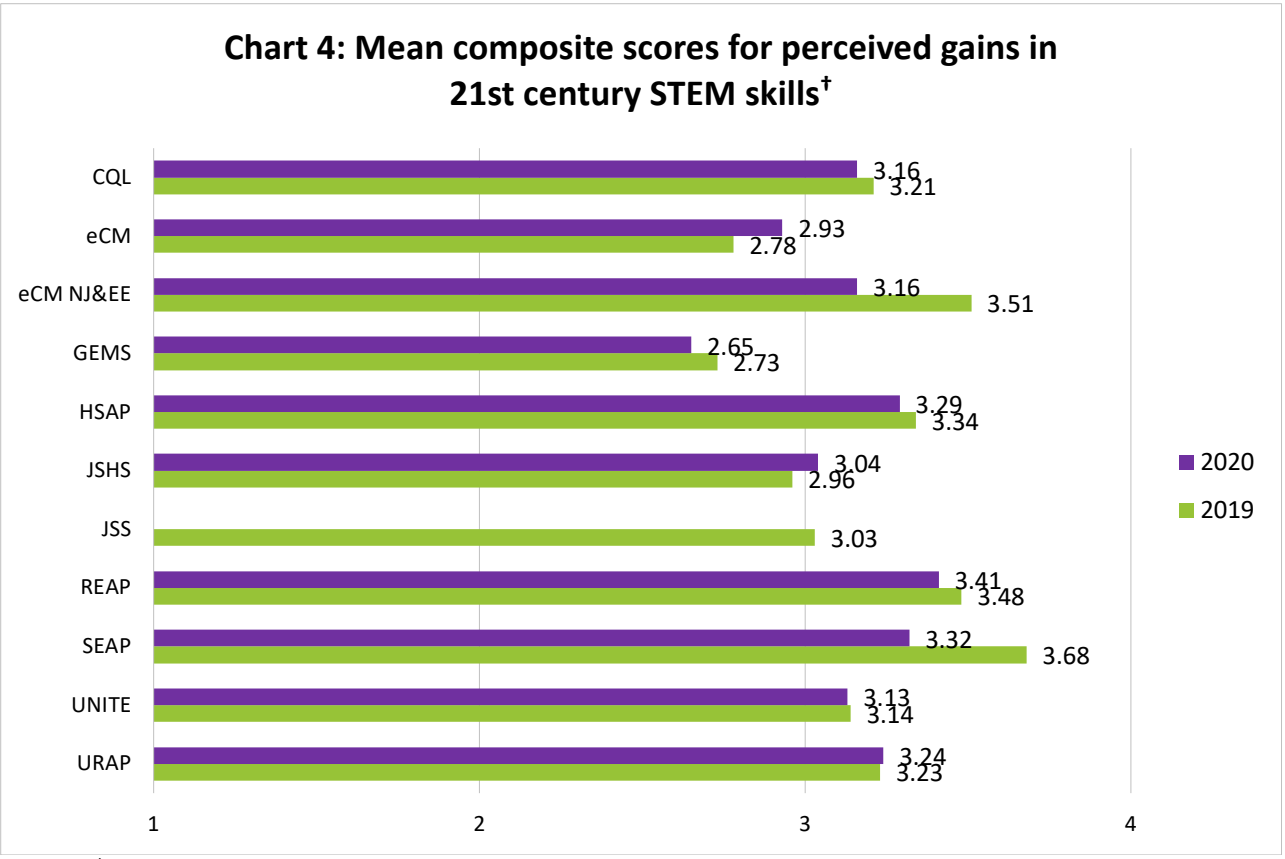
† *Response options for the items forming this composite were: 1 – No gain, 2 – Small gain, 3 – Medium gain, 4 – Large gain.*

Success in STEM, as well as other careers require mastery of 21st Century skills such as collaboration, communication, perseverance, and problem solving. As such, AEOP participants were asked about the extent to which participating in their program enabled them to grow a variety of 21st Century skills (Table

20). Chart 4 shows that participants in all programs indicated 21st Century skills gains. For FY20, AEOP participants in CQL, eCM NJ&EE, HSAP, JSHS, REAP, SEAP, Unite, and URAP indicated medium to large gains. eCM and GEMS reported small to medium gains.

Table 20. Items that form the Perceived Gains in 21st Century STEM Skills Composite
1. Thinking creatively
2. Working creatively with others
3. Using my creative ideas to make a product
4. Thinking about how systems work and how parts interact with each other
5. Evaluating others' evidence, arguments, and beliefs
6. Solving problems
7. Communicating clearly (written and oral) with others
8. Collaborating with others effectively and respectfully in diverse teams
9. Interacting effectively with others in a respectful and professional manner
10. Accessing and evaluating information efficiently (time) and critically (evaluates sources)
11. Using and managing data accurately, creatively and ethically
12. Analyzing media (news) - understanding points of view in the media
13. Creating media products like videos, blogs, social media
14. Use technology as a tool to research, organize, evaluate, and communicate information
15. Adapting to change when things do not go as planned
16. Incorporating feedback on my work effectively
17. Setting goals and utilizing time wisely†
18. Working independently and completing tasks on time
19. Taking initiative and doing work without being told to
20. Prioritizing, planning, and managing projects to achieve completion†
21. Producing results - sticking with a task until it is finished
22. Leading and guiding others in a team or group
23. Being responsible to others - thinking about the larger community

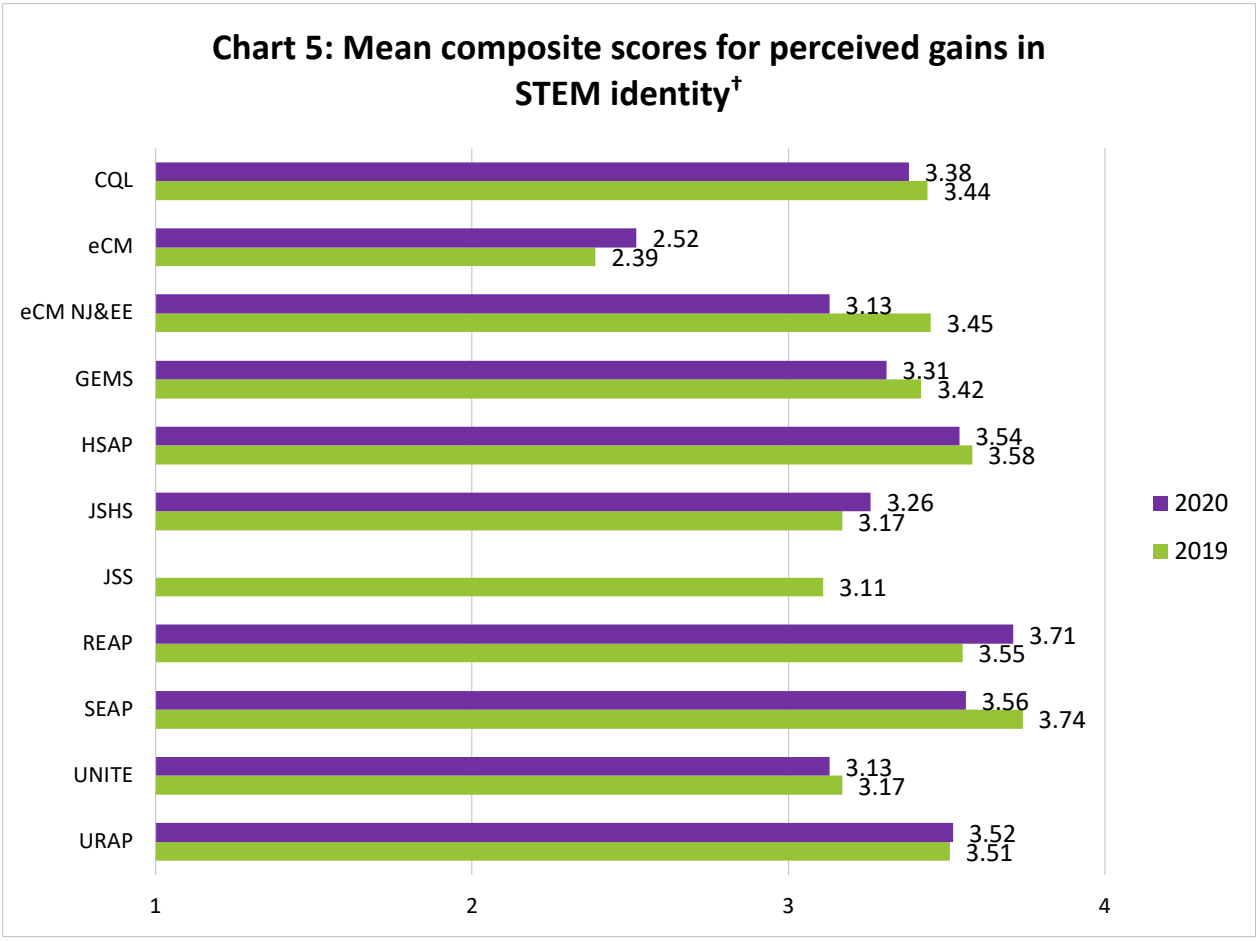
† *These items were not included on the GEMS version of the survey.*



† *Response options for the items forming this composite were: 1 – No gain, 2 – Small gain, 3 – Medium gain, 4 – Large gain.*

Students were asked to indicate their growth in STEM identity because of participation in their program. STEM identity is like self-confidence or self-efficacy, which have been shown to be related to interest in STEM fields and careers. Survey items aligned with the concept of STEM identity are listed in Table 21. Students in all FY20 AEOP reported some level of STEM identity gains which were at similar ranges to FY19 findings by program, with CQL, eCM NJ&EE, GEMS, HSAP, JSHS, REAP, SEAP, Unite, and URAP all reporting medium to large gains. eCM overall reported small to medium gains.

Table 21. Items that form the Perceived Gains in STEM Identity Composite
1. Interest in a new STEM topic
2. Interest in pursuing a STEM career
3. Sense of accomplishing something in STEM
4. Feeling prepared for more challenging STEM activities
5. Confidence to try out new ideas or procedures on my own in a STEM project
6. Desire to build relationships with mentors who work in STEM



† *Response options for the items forming this composite were: 1 – No gain, 2 – Small gain, 3 – Medium gain, 4 – Large gain.*

AEOP participants rated their level of agreement with items associated with impacts on their STEM confidence and interest in STEM because of program participation. Table 22 shows these items and presents findings of half or more of participants (range 50%-100%) agreeing that their experience in an AEOP contributed to personal increased confidence and/or interest across items. A continued theme amongst these items over time shows that students are most likely to agree their AEOP participation impacted their confidence in STEM knowledge, skills, and abilities (range 67%-100%).

Table 22. Students Agreeing that the Program Contributed to their STEM Confidence and Interest												
	Year	**CQL**	**eCM**	**eCM NJ& EE**	**GEMS**	**HSAP**	**JSHS**	**JSS**	**REAP**	**SEAP**	**Unite**	**URAP**
I am more confident in my STEM knowledge, skills, and abilities.	2019	96%	62%	97%	90%	100%	83%	89%	97%	100%	92%	97%
	2020	***96%***	***74%***	***96%***	***92%***	***100%***	***81%***	***N/A***	***100%***	***67%***	***92%***	***100%***
I am more interested in participating in STEM activities outside of school requirements.	2019	75%	49%	88%	82%	89%	74%	83%	81%	91%	86%	87%
	2020	***85%***	***52%***	***85%***	***84%***	***63%***	***77%***	***N/A***	***82%***	***100%***	***84%***	***88%***
I am more interested in taking STEM classes in school.	2019	64%	48%	85%	76%	67%	62%	73%	68%	91%	83%	81%
	2020	***69%***	***50%***	***76%***	***79%***	***63%***	***69%***	***N/A***	***77%***	***67%***	***80%***	***69%***

Students and apprentices in all programs reported that they had improved their STEM-specific skills and competencies because of participating in AEOP. Participants reported gains in the science and engineering practices described in the NGSS and reported gains in their STEM identities and confidence in their STEM abilities. These gains were apparent both from participants' questionnaire responses and from comments made by students and adult participants during interviews. For example, participants said the following:

> *"I have really appreciated the CQL program. My skills as a researcher have vastly improved...My mentor is very helpful and highly available, and I have learned a lot."* (CQL Apprentice)

> *"[My CQL apprentice is able to] apply technical skills and engineering skills to actual projects…he's getting the real project experience working with real customers and actually interacting with those customers as well...He gets to build that kind of a foundation of people skills…It's kind of a transition between the classroom to the real-world application, to a real job, a real profession."* (CQL Mentor)

> *'[eCYBERMISSION] is probably the hardest I've worked on a project, and that taught me many life skills such as time management, thinking creatively, and working with a team. I had an amazing learning experience with eCYBERMISSION, and I hope that more students will do it next year so they can experience and learn the skills they need for our growing world."* (e-CM-R Student)

> *"I loved [GEMS]! I learned so much about how to do things on Scratch. I probably wouldn't be so interested in computer programming without this class. If you posted a comment about a problem*

on your project, it gets answered almost immediately. It was fun, unlike some STEM camps, and that encouraged me to do the work. It was also fun to impress my parents with my work. Thank you for this awesome experience for me this summer!" (GEMS Student)

"[GEMS is] immensely valuable to the students because it gives them an early exposure to real-life scientists and engineers doing real cutting-edge science. It gives them exposure to the many different career paths and how they all tie in. It gives them exposure to honestly a world that a lot of students don't know exists inside of the Department of Defense and the Army…It makes the military real to the students." (GEMS RT)

"[A benefit of HSAP] is just gaining some research skills and some general STEM knowledge. In the first couple of weeks of the program, we were in a learning stage where our mentors were giving us lectures and assignments related to some basic STEM stuff.... The next thing, which I think is probably the most valuable, is the research experience all the HSAP students get...Those were really unique experiences and I'm really grateful for that opportunity. It's rare to have the opportunity to work on something that's cutting edge like that. I'm pretty grateful for that." (HSAP Apprentice)

"JSHS was truly a great experience for me. JSHS guided me on how to work on research papers and how to manage time while doing individual sections during the research process. The best experience I have was that I was able to present my research to a bigger audience which gave me a lot of confidence and encouraged me to work further on my passions and interests in scientific research. I was also able to interact with students of my similar interests." (R-JSHS Student)

"[JSHS students are] learning how to do that research, analyze, draw conclusions, all of the things you want college kids to do. In general, it just teaches them…really good skills on problem-solving." (JSHS Mentor)

"I found [REAP] a really great opportunity for me to expand my research skills and learn more about research in general. I thought it was really cool that I could be paired with college professors. I've learned so much about how research is used in real life and how college professors do research." (REAP Apprentice)

"Despite having to work remotely due to COVID, both apprentices learned research techniques and conducted work that contribute to larger ongoing projects in the lab…We look forward to continue being REAP site and potentially participating in other AEOP programs in the future." (REAP Mentor)

"I took three different professional developments this summer and, by far, RESET…was the best, as far as virtual learning is concerned...This was by far the best PD that I've done, I'd say, in 20 years." (RESET Level I Participant)

"I really liked the [RIT apprenticeship] summer course. It has been a great opportunity for me to learn more practical basic STEM skills like writing a lab report, but it also gave me the opportunity to learn about bigger topics in STEM, such as ethics and discrimination. I also appreciate all of the speakers they course brought in. It was really helpful to see how different STEM majors and subjects can be applied in the working world and how they are all connected." (RIT Apprenticeship Course Student Participant)

"I was very satisfied with my [SEAP] experience. My mentor was always happy to provide assistance and discuss ideas with me. I felt respected, and I felt like I was really contributing to the team. I also gained confidence in my computer programming skills." (SEAP Apprentice)

"In the Unite program I have gained many kinds of experiences such as how to communicate well with each other, learn more about engineering, have become more interested in science and technology and have become interested in doing something better in the future." (Unite Student)

"Unite is fantastic…The students benefited by improving their technology skills, but also strengthening communication, analytical, problem-solving, and leadership competencies." (Unite Mentor)

"In [URAP] I was able to learn a lot, including writing, presenting, and other technical STEM skills. I was able to communicate with my mentor every day, sometimes multiple times a day, and participate in professional meetings with other researchers. I also got the chance to present my research to a symposium and also to a conference. I was given a lot of opportunities through the Apprenticeship Program to learn and develop skills." (URAP Apprentice)

Research Question #2b – To what extent do participants demonstrate use of and growth in 21st Century skills?

The 21st Century Skills Assessment was not implemented in FY20 due to lack of face-to-face apprenticeship and other programming (e.g., Unite, eCM). Typically, a 21st Century Skills Assessment (Johnson & Sondergeld, 2016) is used in the annual AEOP evaluation where mentors assessed their participants in a pre/post manner. This assessment is used to determine the growth toward mastery for each participant during their AEOP program. Mentors rate each participant's skills in six domains of 21st Century Skills:

1. Creativity and Innovation
2. Critical Thinking and Problem Solving
3. Communication, Collaboration, Social, and Cross-Cultural Skills
4. Information, Media, & Technological Literacy
5. Flexibility, Adaptability, Initiative, and Self-Direction
6. Productivity, Accountability, Leadership, and Responsibility

Due to constraints related to COVID-19, the 21st Century Skills Assessment was not implemented in FY20, but will return as soon as AEOP are back in a face-to-face environment.

Research Question #4 - To what extent do participants and mentors report increased awareness of and interest in Army/DoD STEM research and careers?

The AEOP's efforts to engage students in and/or expose them to DoD research continues to be a challenge met with mixed results. While students reported positive attitudes toward DoD STEM research and researchers, findings related to mentors discussing DoD STEM research and STEM opportunities in the DoD with apprentices and students varied widely across programs. AEOP continued to emphasize DoD STEM research through activities that offer participants with meaningful exposure to DoD research. A selection of these efforts is provided in Table 23.

Table 23. 2020 Participant Engagement in and Exposure to DoD Research

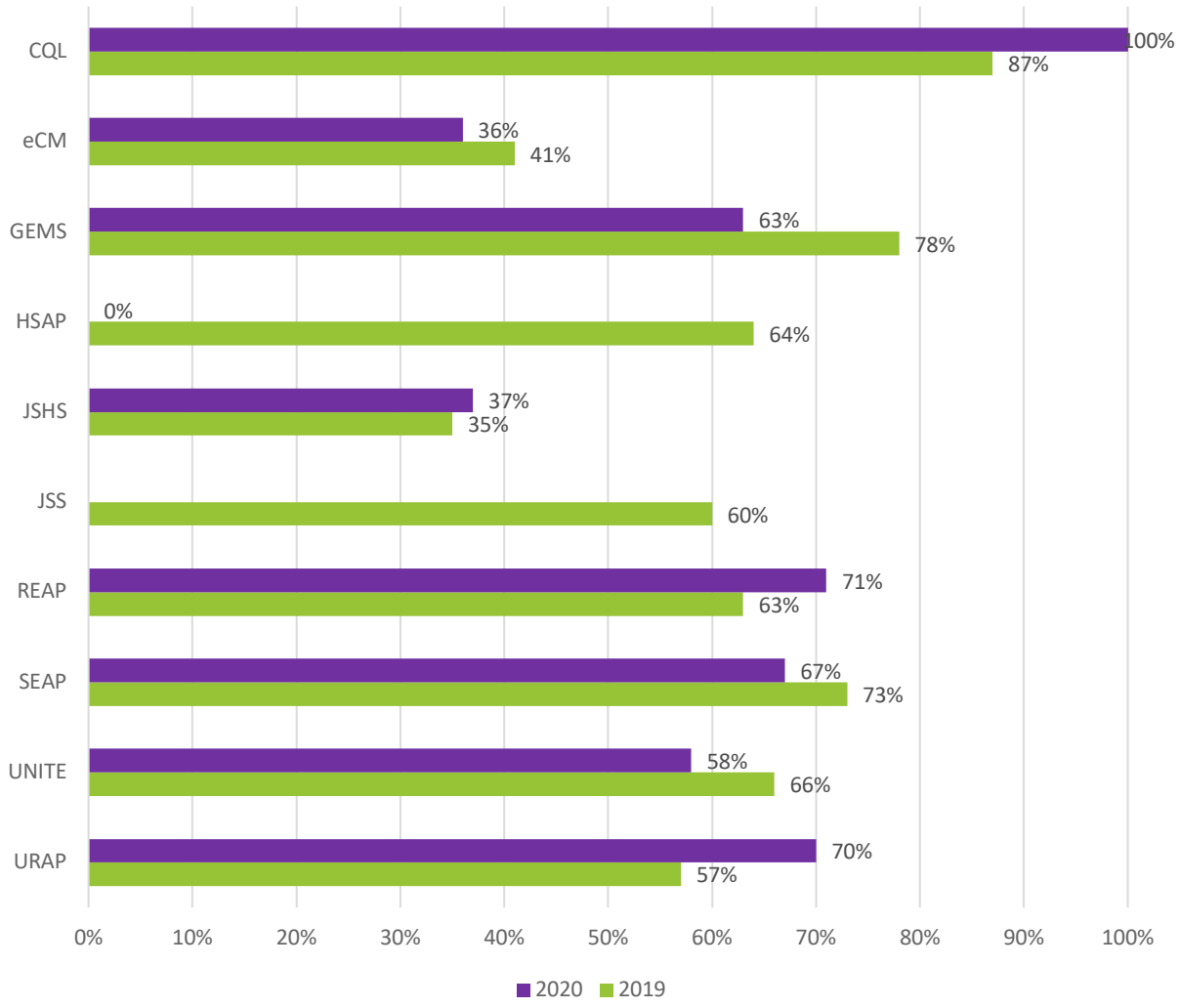
AEOP	Engagement in DoD Research
CQL, SEAP	**187** high school and undergraduate participants (**28 for SEAP, 159 for CQL**) serving as apprentices on DoD research projects at Army or DoD laboratories and centers
HSAP, URAP	**81** (**32 for HSAP, 49 for URAP**) high school and undergraduate participants serving as apprentices on Army research projects at college/university research laboratories
GEMS	**2,203** elementary, middle, and high school participants, **106** NPMs and **38** K-12 teachers serving as Resource Teachers were engaged in DoD research through GEMS activities hosted by Army laboratories and centers
AEOP	**Exposure to DoD Research**
eCM	**87** participants and their team advisors (in-service teachers) were exposed to DoD research through the National Judging & Educational Event activities
JSHS	**217** participants and their teachers were exposed to DoD research through the National Symposium activities **3,462** students were exposed to DoD research through DoD S&Es who participated at regional JSHS symposia
Unite	**448** high school participants and **273** program mentors participated in experiences including field trips and speakers about the work of DoD STEM personnel and/or DoD research facilities

While AEOP vary in focus, programs all share a common goal of exposing participants to Army/DoD research and careers. Apprenticeships (CQL, HSAP, REAP, SEAP, URAP) connect participants to DoD research projects by having students work directly with Army and university S&Es to engage in meaningful research contributions. STEM enrichment AEOP offer students hands-on and interactive opportunities at nearby Army labs and centers. For example, GEMS DoD S&Es (or NPMs under the mentorship of S&Es) convert DoD research into appropriate grade-level educational activities. This allows GEMS participants to engage in real-world research through questions and problems directed by DoD researchers and their research. Various AEOP also include DoD STEM-expos, laboratory tours, expert panels, and professional development events aligned to school curricular topics to expose participants to DoD STEM careers and research.

Mentors in AEOP programs are responsible for sharing information about the DoD and STEM research within the DoD with their program participants. The continued variability in evaluation results by program is shown in Chart 6. It is important to note that less than five mentors from HSAP (*n*=1) and SEAP (*n*=3) responded to the mentor evaluation survey. Thus, when presenting mentor results, these programs will not be included in the discussion of findings. Among the other programs with more than five mentors

responding, only a third of eCM mentors (36%) and JSHS mentors (37%) said they talked about DoD STEM opportunities with students. However, more than half of mentors in all other AEOP (range 52%-100%) did note having these conversations with their students. Mentors from four programs (CQL, JSHS, REAP, URAP) in FY 20 indicated discussing these opportunities at slightly greater rates compared to FY19.

Chart 6: Percent of Mentors Who Report Discussing STEM Opportunities in the DoD with Apprentices/Students



Students indicated their agreement level with several statements related to their awareness of the impact of the work of DoD research and researchers. Table 24 shows participants have maintained a consistently positive attitude across FY19 and FY20. More than 80% participants across AEOP agreed that: Army/DoD research and researchers advance science and engineering fields (range 84%-100%); develop new cutting-edge technologies (range 84%-100%); DoD researchers solve real-world problems (range 88%-100%); and DoD research is valuable to society (range 87%-100%).

Table 24. AEOP Participants Agreeing with Various Statements about DoD STEM Research												
	Year	**CQL**	**eCM**	**eCM NJ&EE**	**GEMS**	**HSAP**	**JSHS**	**JSS**	**REAP**	**SEAP**	**Unite**	**URAP**
DoD researchers advance science and engineering fields*	2019	100%	46%	99%	83%	95%	79%	65%	84%	91%	74%	94%
	2020	***96%***	***84%***	***98%***	***97%***	***100%***	***96%***	***N/A***	***100%***	***100%***	***98%***	***100%***
DoD researchers develop new, cutting edge technologies*	2019	94%	47%	97%	83%	95%	80%	67%	87%	91%	75%	97%
	2020	***96%***	***84%***	***98%***	***96%***	***100%***	***97%***	***N/A***	***100%***	***100%***	***96%***	***100%***
DoD researchers solve real-world problems	2019	98%	52%	97%	86%	95%	81%	64%	94%	100%	78%	97%
	2020	***96%***	***88%***	***96%***	***96%***	***100%***	***96%***	***N/A***	***100%***	***100%***	***96%***	***100%***
DoD research is valuable to society/ Important to most people	2019	98%	52%	97%	84%	95%	77%	46%	87%	100%	77%	94%
	2020	***96%***	***87%***	***98%***	***91%***	***100%***	***96%***	***N/A***	***94%***	***100%***	***96%***	***100%***

* Items slightly modified for GEMS surveys to accommodate for younger participants completing the survey.

In past years, there was a visible pattern of agreement differences based on type of program (DoD sponsored vs. university sponsored or competition) with DoD sponsored program participants expressing greater levels of agreement. This year, however, such patterns are not as strong as all programs 95% or more of participants agreeing with these statements except for eCM overall. At the same time, eCM overall participants demonstrated a large positive jump from FY19 (range 46%-52%) to FY20 (range 84%-88%) in terms of their perspectives across these DoD STEM research items.

Research Question #3 - To what extent do participants and mentors report increased participant interest in STEM research and careers?

Participants reported increased interest in STEM research and careers after participation in FY20 AEOP. Overall, survey findings showed AEOP introduced participants to STEM careers, with most programs introducing their participants to Army and DoD STEM specific careers. Participating in AEOP increased interest in pursuing STEM careers for many participants in varying programs.

Students were asked to indicate the number of STEM careers in general that they learned about in their AEOP (Chart 7). Findings show that CQL, eCM NJ&EE, GEMS, and Unite participants reported 75% or higher agreement with learning about three or more STEM jobs or careers in the program. However, students in eCM, HSAP, and URAP did not have this same opportunity, as participants reported less than 50% agreement. Three programs experienced growth in this area since FY19 as CQL, HSAP, JSHS had an increase of percentage of students reporting learning about three or more STEM careers in FY20.

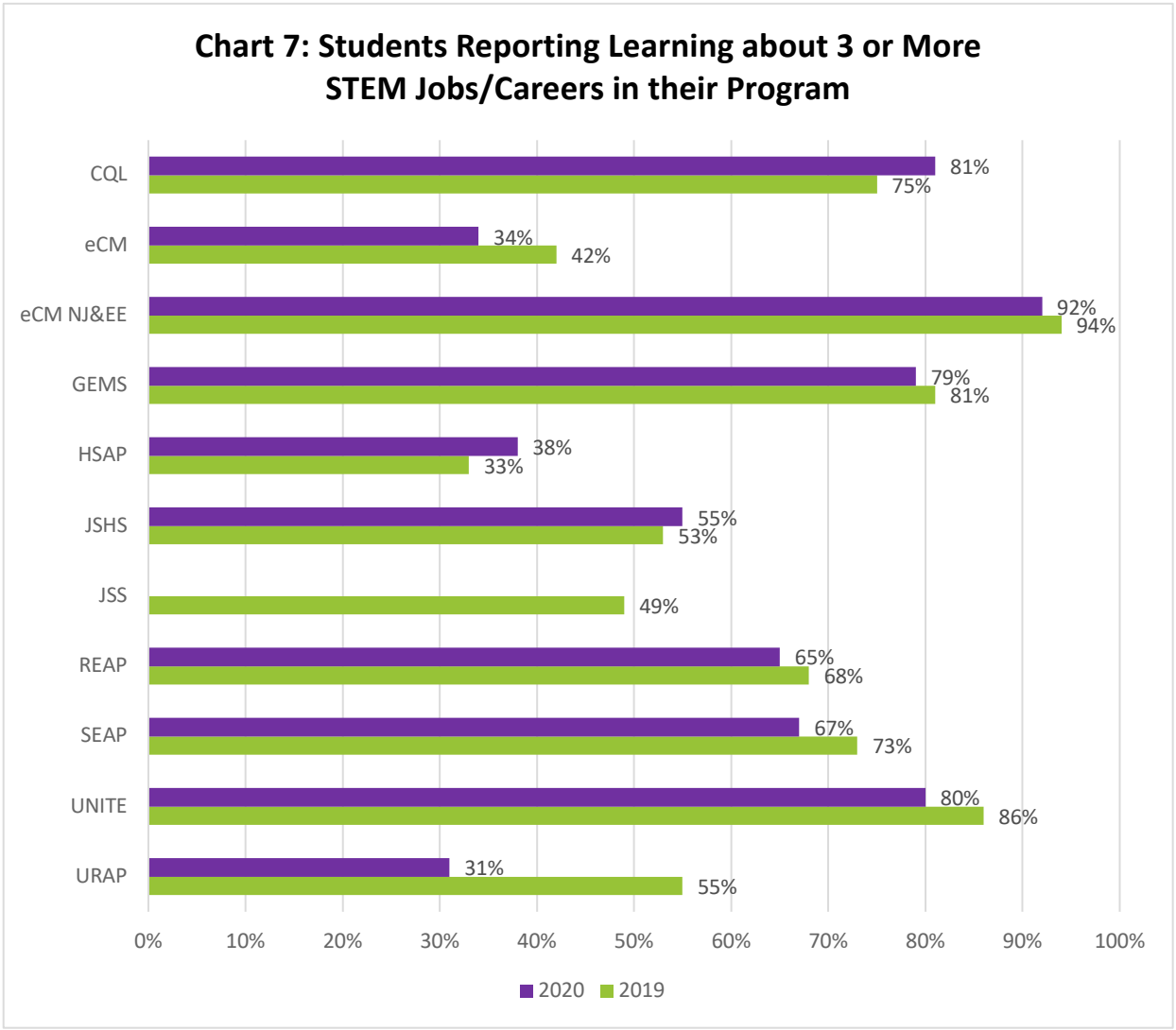
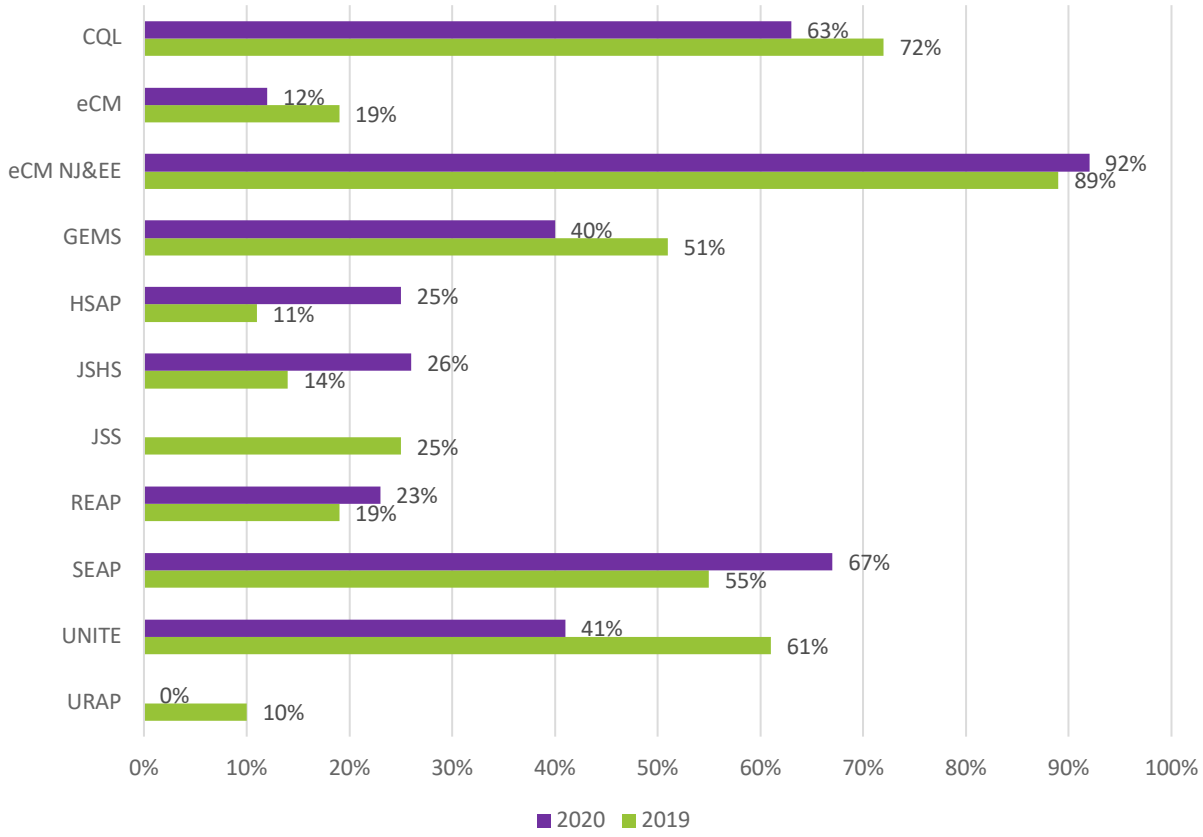


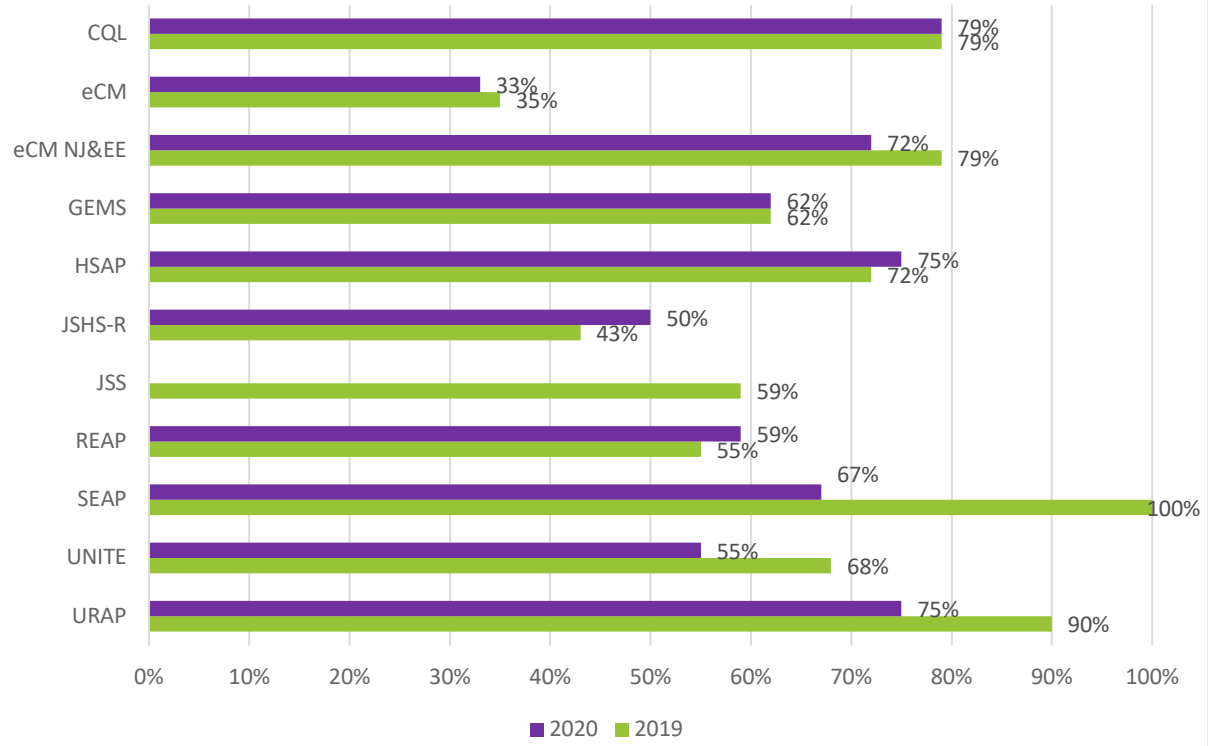
Chart 8 presents results for students who reported they learned about three or more STEM careers within the Army or DoD. Considerably fewer students (range 0%-92%) reported having learned about Army/DoD STEM careers compared to STEM careers in general. Three programs (CQL, eCM NJ&EE, SEAP) had approximately two-thirds or more of students (range 63%-92%) indicate they had learned about three or more DoD STEM careers. Five programs (eCM NJ&EE, HSAP, JSHS, REAP, SEAP) had larger proportions of students reported having learned about more of these jobs in FY20 than in FY19. When looking at results patterns by type of program and location, as with previous years' findings, AEOP participants in programs at Army laboratories and centers (CQL, GEMS, SEAP) or at Army-sponsored university labs (HSAP, URAP) reported knowing about more DoD STEM jobs compared to non-Army affiliated settings (eCM overall, JSHS, REAP, Unite) on average. It is important to mention that nearly all (92%) eCM NJ&EE participants indicated learning about three or more DoD STEM careers although these students participated in non-Army affiliated programs. As recommended in prior years, it may be useful to determine if practices used by eCM NJ&EE are suitable for implementation in other non-Army affiliated setting AEOP.

Chart 8: Students Reporting Learning about 3 or More DoD STEM Jobs/Careers in their Program



AEOP participants were asked to what extent their program impacted their interest in pursuing STEM careers in the Army or DoD (Chart 9). While only a third of participants from eCM overall (33%) indicated their AEOP impacted this interest, half or more (range 50%-79%) of all other programs reported similarly. As with prior years, participants from AEOP with greater exposure to Army/DoD STEM researchers and/or facilities during program activities were more likely to report higher levels of impacted interest in pursuing a STEM DoD career. Explicit engagement with STEM individuals from the DoD appears to be quite useful for teaching students about DoD jobs and sparking student interest in these positions.

Chart 9: Students Indicating AEOP Impacted their Interest in Pursuing a STEM Career with the DoD



AEOP participants were asked to indicate their agreement level with statements associating their interest in and awareness of STEM careers in general and more specifically within the DoD (Table 32). Except for eCM overall participants (41%), approximately half or more of AEOP student participants (range 63%-82%) indicated greater interest in pursuing STEM careers after participating in their program. On average, fewer students (range 33%-79%) reported that AEOP participation increased their interest in DoD STEM careers. However, programs such as CQL (79%) and HSAP (75%) reported larger proportions of participants with greater interest in DoD STEM careers after AEOP participation compared to general STEM careers.

Nearly half or more of participants (range 49%-100%) noted a greater appreciation of Army or DoD STEM research after their AEOP program. Comparing FY19 to FY20 findings, three programs (eCM overall, HSAP, REAP) had an increase in student perceptions on two of the three items presented in Table 25.

Table 25. Students Agreeing AEOP Affected Their Attitudes Toward STEM Careers

	Year	CQL	eCM	eCM NJ&EE	GEMS	HSAP	JSHS	JSS	REAP	SEAP	Unite	URAP
I am more interested in pursuing a career in STEM	2019	60%	40%	81%	70%	89%	58%	76%	68%	91%	81%	81%
	2020	***71%***	***41%***	***75%***	***72%***	***63%***	***69%***	***N/A***	***82%***	***67%***	***73%***	***81%***
I have a greater appreciation of Army or DoD STEM research	2019	94%	47%	97%	82%	89%	89%	73%	84%	100%	81%	94%
	2020	***90%***	***49%***	***91%***	***80%***	***100%***	***66%***	***N/A***	***82%***	***100%***	***74%***	***81%***
I am more interested in pursuing a STEM career with the DoD	2019	79%	35%	79%	62%	72%	59%	59%	55%	100%	68%	90%
	2020	***79%***	***33%***	***72%***	***62%***	***75%***	***50%***	***N/A***	***59%***	***67%***	***55%***	***75%***

Students and adults participating in all programs reported that AEOP participation provided opportunities for students to refine, explore, and/or advance their STEM education and career interests. In open-ended questionnaire responses and interviews, students and apprentices indicated that participating in AEOP affirmed or increased their interest in STEM careers. Mentors also noted that participating in AEOP provides students with valuable career information, both in STEM fields generally and in Army/DoD STEM careers more specifically. For example, participants said the following:

> *"Before I got this [CQL apprenticeship], I'd started thinking about working for the military as an engineer and this is the best taste, I could have got of it. And it really shows you how everything works. They're very welcoming and I remember at the beginning we had a meeting…I got to meet everyone in different branches and everything, and it was really cool and then throughout the [apprenticeship] you learn how everything works."* (CQL Apprentice)

> *"[The NJ&EE career workshop speakers] were really interesting to me because they showed me a lot of really interesting career paths that I had never really considered before. But after seeing all the amazing work that they had done, it was really something that I could consider for my future, and it was really helpful."* (eCM-N Student)

> *"eCYBERMISSION is an amazing opportunity that can truly change students' lives. My 9th grade son competed last year with his high school science teacher. He was not considering STEM as a career and didn't even want to go to college. Now he has goals to go to college and in planning on a lifelong STEM career. Amazing. Thank you for giving him the opportunity to feel a part of STEM and for increasing his self-confidence. Because of this amazing success, I mentored my own 9th grade team this year! They say it has changed their lives too!"* (eCM Team Advisor)

> *"I learned about…the way the military utilizes STEM and it's really intrigued me…I didn't want to be an engineer when I first started GEMS. I wanted to be a marine biologist. And when I first saw all the things that you could do with engineering, it made me think more about how the world works...and it inspired me to go into an engineering field."* (GEMS Student)

> *"We tell [GEMS participants] about our jobs. We show them videos about the different jobs in the military because there are so many - it's over a hundred and fifty jobs in the military. And then we also show them the food that we eat when we're in the field and they get to ask us questions about our deployments, and how the Army impacted our lives."* (GEMS S&E Mentor)

> *"[HSAP seminars included] actual researchers from the Navy lab or from different public-sector labs across the country. They would come to speak about their educational path and how they got into a Department of Defense position."* (HSAP Apprentice)

> "*One thing that I was previously unaware of [before JSHS] was how many career opportunities there were with the military."* (N-JSHS Student)

> *"I learned a lot about the field of study [in REAP] and was able to experience the education process required to pursue such a career. I also gained new skills that I can use in the future and an interest in stem careers."* (REAP Apprentice)

"[REAP] will help [apprentices] to understand how we do [research] in real-life circumstances…It might inspire them also to pursue this kind of research." (REAP Mentor)

"My [RESET] experience was awesome. It was a great experience ...having exposure to those different sciences and the different types of careers, which I can share with my students." (RESET Level I Participant)

"I heard from so many STEM professionals, and I learned about many different careers [in the RIT Apprenticeship Course]." (RIT Apprenticeship Course Participant)

'[In SEAP], we get to meet different people who are involved in the research. We meet active military who are studying and doing research. We meet contractors who are civilians who are also doing research. We meet students who are doing graduate studies here, pursuing other programs. It gives the students a great overview of the different ways you can get involved in the military here by being an active military member or just being a contractor and a civilian who works at bases. It does a great job of addressing the different paths and avenues in a very subtle way. We get to meet all these different people and talk to them about how they do their work and learn more about this." (SEAP Apprentice)

"[Unite] had two people from the Army talk to us about what they do, and we had to come up with questions to ask them their experience in the military and how they liked it, how did they get into doing the military and what their job…was and what it consists of." (Unite Student)

"[In URAP], I learned how to deal with conducting mostly independent work, while also collaborating with others...I also learned a lot of scientific presenting and writing skills…and certainly got more interested in a future career in this area." (URAP Apprentice)

Supporting mentors with resources to expose participants to DoD STEM jobs and careers has been a focus of AEOP since 2014. Because of this, mentors were asked to evaluate the usefulness of various AEOP resources for this explicit purpose (Table 26). The act of participating in an AEOP was selected most frequently as useful for exposing participants to DoD STEM careers (range 63%-100%) for all programs except HSAP which only had one mentor who responded to the survey. Mentor reports of other AEOP resource usefulness varied by program. For example, 93% of REAP mentors and 80% of URAP mentors said the AEOP website useful, but only 29% of JSHS mentors reported similarly. In addition, more than half of mentors from REAP (57%) noted AEOP printed materials were useful, and very few mentors from CQL (17%) believed printed materials helped them expose apprentices to DoD STEM careers. Half or more (range 50%-88%) or mentors from most AEOP (CQL, GEMS, JSHS, REAP, SEAP, Unite, URAP) indicated their program administrator or site coordinator was useful for introducing their students to DoD STEM careers.

Table 26. Resources that Mentors Found Useful for Exposing Apprentices and Students to DoD STEM Careers											
Resource	**Year**	**CQL**	**eCM**	**GEMS**	**HSAP**	**JSHS**	**JSS**	**REAP**	**SEAP**	**Unite**	**URAP**
AEOP website	2019	13%	44%	37%	50%	17%	60%	50%	18%	55%	61%
	2020	***67%***	***56%***	***63%***	***100%***	***29%***	***N/A***	***93%***	***67%***	***52%***	***80%***
AEOP social media	2019	0%	16%	30%	21%	4%	30%	35%	9%	40%	14%
	2020	***33%***	***24%***	***25%***	***0%***	***18%***	***N/A***	***29%***	***0%***	***40%***	***40%***
AEOP printed materials	2019	0%	30%	44%	29%	26%	60%	48%	9%	58%	25%
	2020	***17%***	***41%***	***29%***	***0%***	***36%***	***N/A***	***57%***	***0%***	***40%***	***50%***
Program administrator or site coordinator	2019	33%	26%	85%	36%	61%	40%	55%	9%	71%	43%
	2020	***50%***	***36%***	***88%***	***0%***	***74%***	***N/A***	***71%***	***67%***	***61%***	***70%***
Invited speakers or “career” events	2019	20%	17%	82%	14%	44%	10%	30%	18%	70%	22%
	2020	***50%***	***24%***	***54%***	***0%***	***56%***	***N/A***	***36%***	***33%***	***56%***	***30%***
Participation in program	2019	80%	74%	85%	64%	58%	70%	65%	82%	72%	79%
	2020	***83%***	***91%***	***92%***	***0%***	***63%***	***N/A***	***93%***	***100%***	***74%***	***80%***

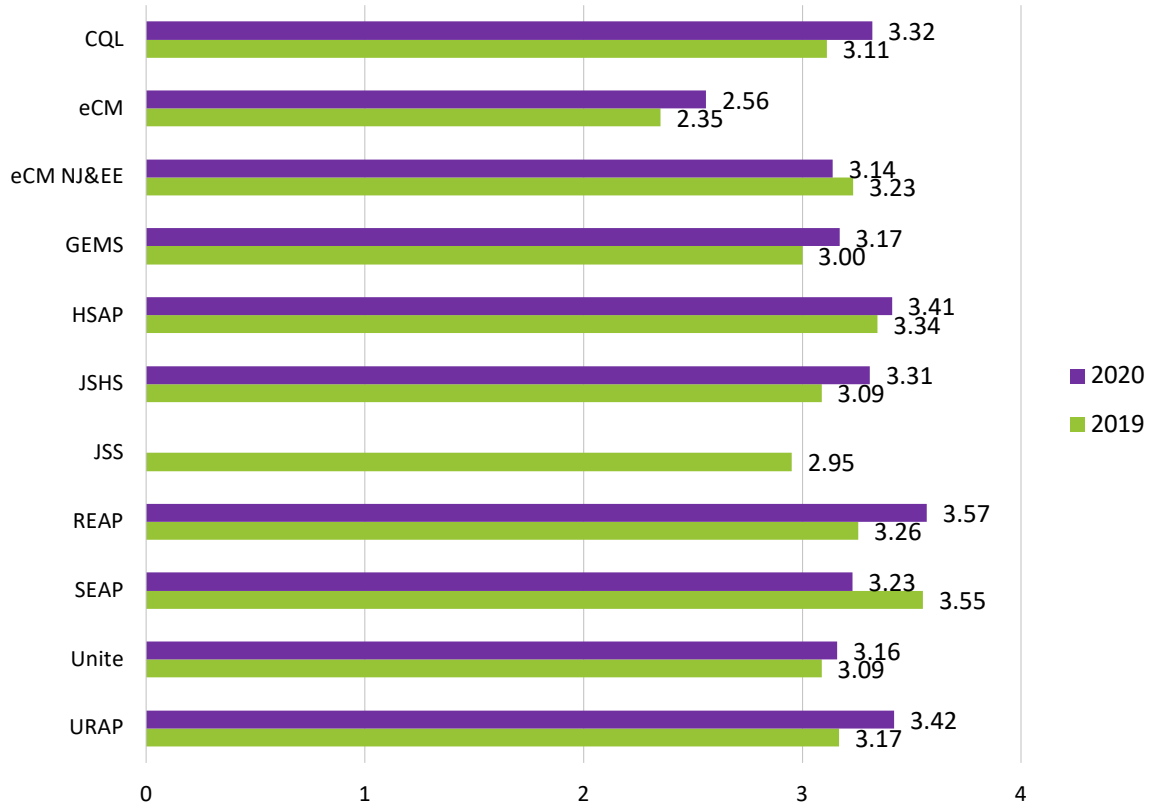
Research Question #5 - To what extent do participants report increased enrollment, achievement, and completion of STEM degree programs?

FY20 AEOP programs served to sustain existing STEM educational and career aspirations of participants and to inspire intentions to pursue post-baccalaureate education. Across programs, participants indicated interest gains in pursuing DoD STEM careers as a result of their AEOP participation. However, the extent of these effects varied by AEOP.

AEOP participants were asked to rate the likelihood that they would engage in STEM activities outside of AEOP or scheduled school classes to better understand how program participation influenced future STEM engagement. Survey items asked for this evaluation are provided in Table 27. Except for the overall eCM (2.56) program, students across all other programs averaged a response between "more likely" (3.00) and "much more likely" (4.00) to participate in STEM activities (Chart 10). Further, all programs saw a slight increase in this scale from FY19 to FY20 except for SEAP and eCM NJ&EE.

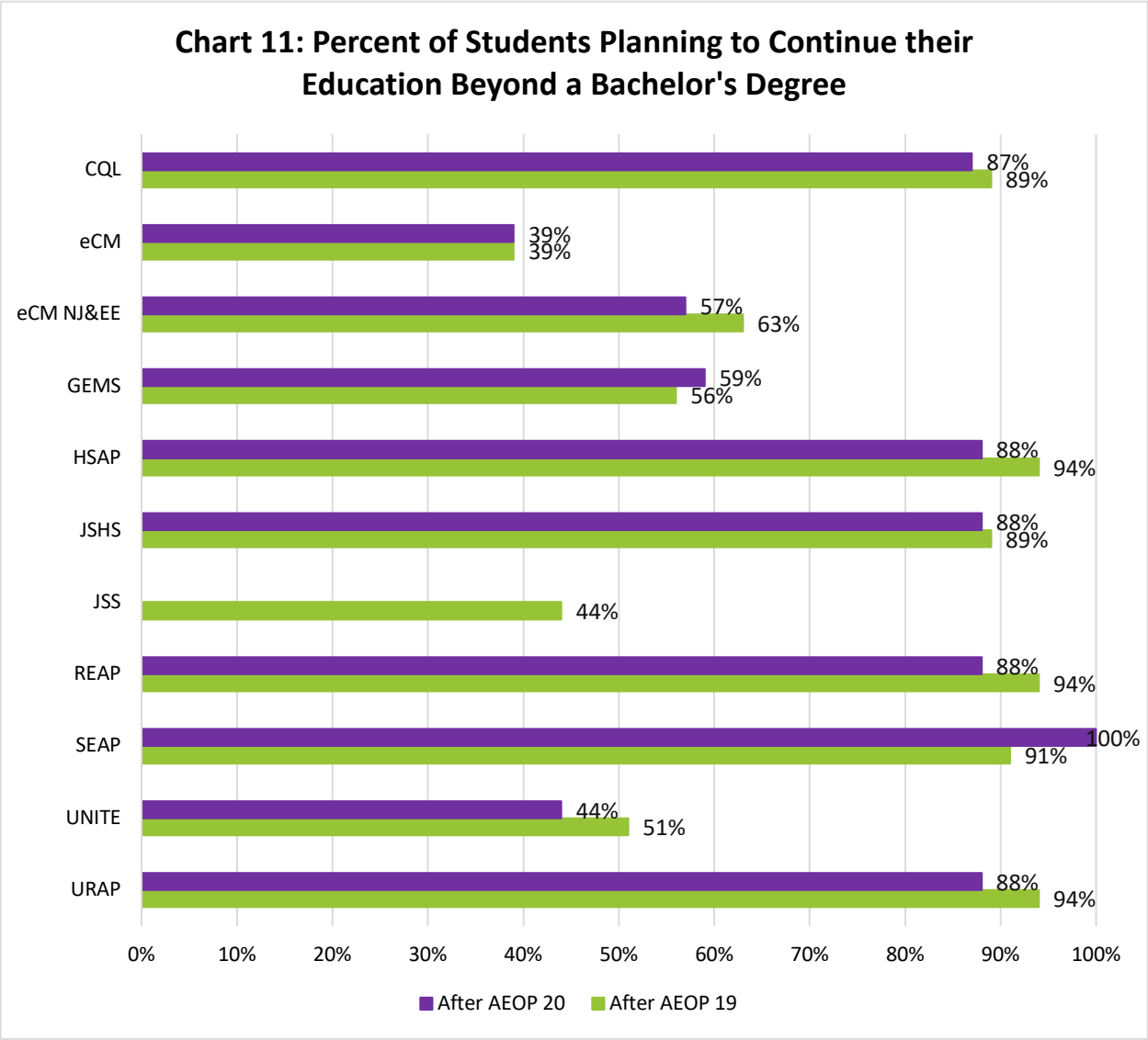
Table 27. Items that form the Intentions to Engage in STEM Activity Composite
1. Watch or read non-fiction STEM
2. Tinker (play) with a mechanical or electrical device
3. Work on solving mathematical or scientific puzzles
4. Use a computer to design or program something
5. Talk with friends or family about STEM
6. Mentor or teach other students about STEM
7. Help with a community service project that relates to STEM
8. Participate in a STEM camp, club, or competition
9. Take an elective (not required) STEM class
10. Work on a STEM project or experiment in a university or professional setting

Chart 10: Mean Composite Scores for Intentions to Engage in STEM Activities as a Result of AEOP†



† *Response options for the items forming this composite were: 1 – Much less likely, 2 – Less likely, 3 – More likely, 4 – Much more likely.*

AEOP students were asked to report on their educational aspirations after program participation. A comparison of responses from FY19 to FY20 are presented in Chart 11. With the exceptions of Unite (44%) and eCM overall (39%), half or more (range 53%-100%) of participants in all other AEOP reported wanting to continue their education beyond a bachelor's degree. Proportions of participants from AEOP indicating post-bachelor's educational aspirations slightly increased for two programs (GEMS, SEAP), and either remained stable or somewhat decreased for all others.



Priority Two: STEM Savvy Educators

Mentors play a crucial role in AEOP. They may design and facilitate learning activities, deliver content through instruction, supervise and support student collaboration and teamwork, provide one-on-one support, chaperone, advise students on educational and career paths, and generally serve as STEM role models. The FY20 AEOP evaluation assessed the extent to which AEOP mentors used research-based strategies for mentoring along with how satisfied AEOP student participants were with their mentors.

Research Question #6 - What is the impact of Scientists and Engineers (S&E) Mentors on AEOP participants?

Most AEOP mentors reported using a range of effective mentoring strategies in FY19, including establishing the relevance of learning activities, supporting the diverse needs of students as learners, supporting student development of interpersonal and collaboration skills, supporting student engagement in authentic STEM activities, and supporting student STEM educational and career pathways. While many mentors across AEOP reported using each mentoring strategy asked about, the

degree to which mentoring strategies were implemented varied by program. Regardless of AEOP, mentors most reported implementing strategies related to engaging students in authentic STEM activities (83% average use); supporting the development of collaboration and interpersonal skills (81% average use); and establishing relevance of learning activities (80% average use). However, mentors across AEOP were less likely to indicate they used strategies to support students' STEM educational and career pathways (60% average use).

Because mentors play a vital role in AEOP by stimulating and maintaining their students' interests in STEM and STEM careers, the quality and nature of mentoring provided is an important element in participants' AEOP experiences. As such, mentors were asked to report on their use of various mentoring strategies with participants in the FY20 evaluation survey. Strategies on the survey were made up of five research-based areas of effective mentoring:[6]

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

Mentor evaluation survey items composing the Establishing the Relevance of Learning Activities section are provided in Table 28 and average strategy use across items is depicted in Chart 12. More than two-thirds of mentors (range 71%-90%) across AEOP reported implementing these strategies. Table 29 reveals that slightly more mentors in CQL, HSAP, JSHS, and REAP reported using these strategies in FY20 compared to FY19.

Table 28. Items that form the Establishing the Relevance of Learning Activities Composite
1. Become familiar with my student(s) background and interests at the beginning of the program
2. Giving students real-life problems to investigate or solve
3. Selecting readings or activities that relate to students' backgrounds
4. Encouraging students to suggest new readings, activities, or projects
5. Helping students become aware of the role(s) STEM plays in their everyday lives
6. Helping students understand how STEM can help them improve their community
7. Asking students to relate real-life events or activities to topics covered in the program

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

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

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

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

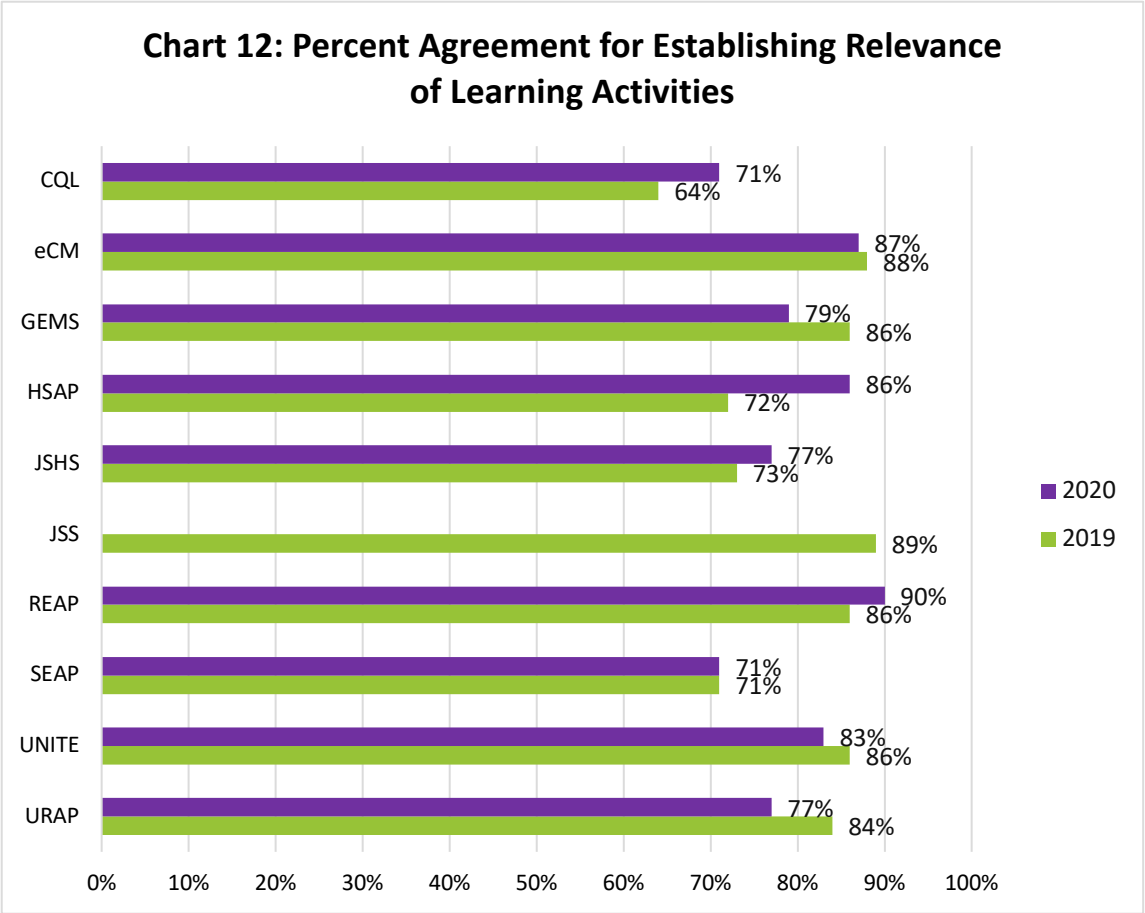


Table 29. Mentor Overall Percent Agreement for Establishing the Relevance of Learning Activities		
Program	**2019 Average % Agreement**	**2020 Average % Agreement**
CQL	64%	71%
eCM	88%	87%
GEMS	86%	79%
HSAP	72%	86%
JSHS	73%	77%
JSS	89%	N/A
REAP	86%	90%
SEAP	71%	71%
Unite	86%	83%
URAP	84%	77%

Items comprising the Supporting the Diverse Needs of Students as Learners section of the mentor evaluation survey are listed in Table 30. Average mentor strategy use across items by AEOP is presented in Chart 13 and Table 31. Nearly 60% or more of mentors (range 57%-84%) reported implementing these mentoring strategies. Only three AEOP (CQL, JSHS, REAP) had more mentors report using these strategies in FY20 compared to FY19.

Table 30. Items that form the Supporting the Diverse Needs of Students as Learners Composite
1. Identify the different learning styles that my student(s) may have at the beginning of their program
2. Interact with students and other personnel the same way regardless of their background
3. Use a variety of teaching and/or mentoring activities to meet the needs of all students
4. Integrating ideas from education literature to teach/mentor students from groups underserved in STEM
5. Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills
6. Directing students to other individuals or programs for additional support as needed
7. Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM

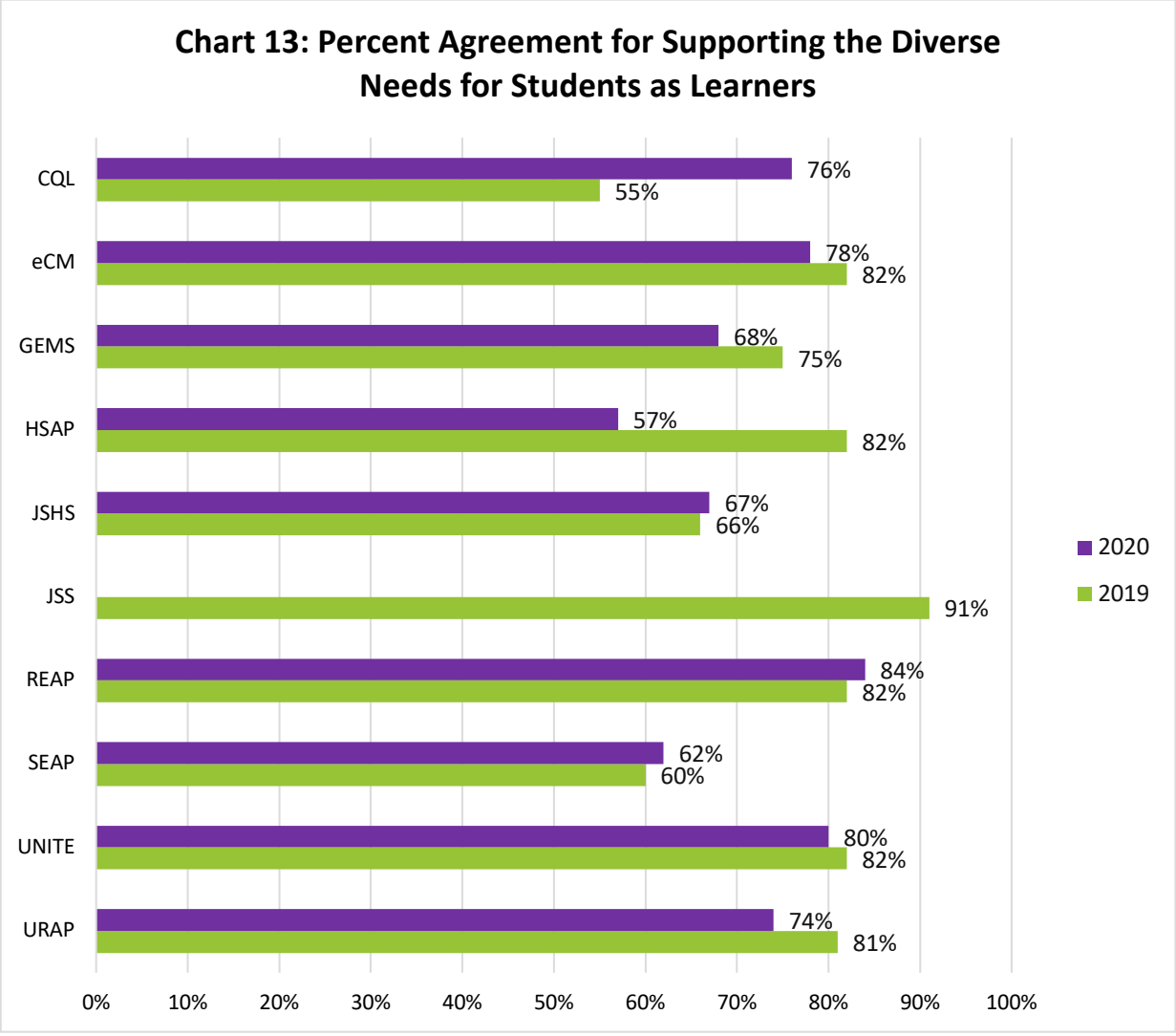


Table 31. Mentor Overall Percent Agreement for Supporting the Diverse Needs of Students as Learners		
Program	**2019 Average % Agreement**	**2020 Average % Agreement**
CQL	55%	76%
eCM	82%	78%
GEMS	75%	68%
HSAP	82%	57%
JSHS	66%	67%
JSS	91%	N/A
REAP	82%	84%
SEAP	60%	62%
Unite	82%	80%
URAP	81%	74%

Mentor questionnaire items for Supporting Student Development of Collaboration and Interpersonal Skills are presented in Table 32. Close to two-thirds or more (range 62%-10%) of mentors across programs said they used these strategies during their AEOP (Chart 14 and Table 33). Slight increases in mentor use of these strategies from FY19 to FY20 were found in the following programs: eCM overall, HSAP, JSHS, and REAP.

Table 32. Items that form the Supporting Student Development of Collaboration and Interpersonal Skills Composite
1. Having student(s) tell others about their backgrounds and interests
2. Having student(s) explain difficult ideas to others
3. Having student(s) listen to the ideas of others with an open mind
4. Having student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own
5. Having student(s) give and receive constructive feedback with others
6. Having my student(s) work on collaborative activities or projects as a member of a team[†]
7. Allowing my student(s) to resolve conflicts and reach agreement within their team[†]

[†] *These items were not included on the eCM and JSHS versions of the survey.*

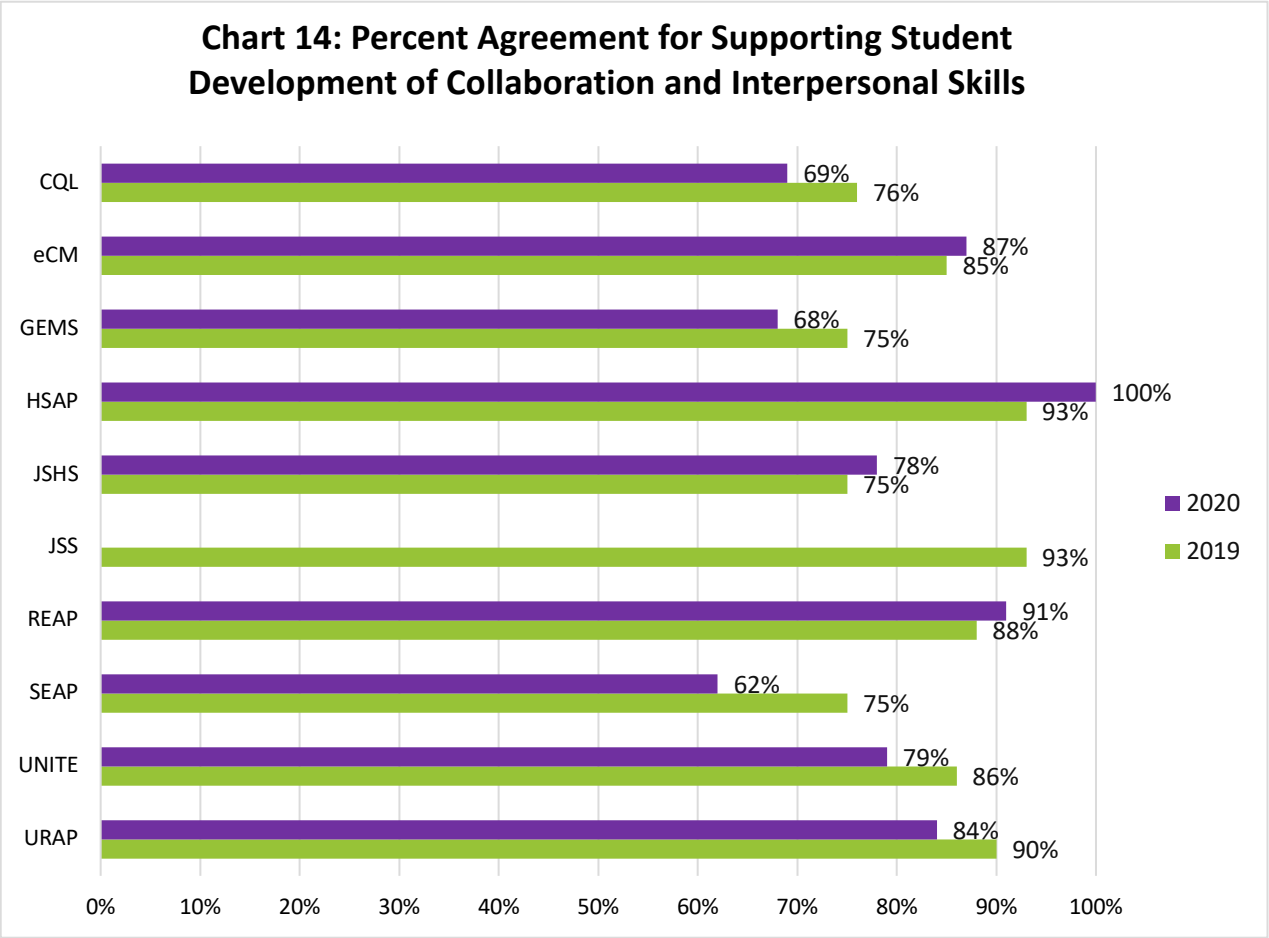


Table 33. Mentor Overall Percent Agreement for Supporting Student Development of Collaboration and Interpersonal Skills		
Program	**2019 Average % Agreement**	**2020 Average % Agreement**
CQL	76%	69%
eCM	85%	87%
GEMS	75%	68%
HSAP	93%	100%
JSHS	75%	78%
JSS	93%	N/A
REAP	88%	91%
SEAP	75%	62%
Unite	86%	79%
URAP	90%	84%

Table 34 shows mentor survey items focused on supporting student engagement in Authentic STEM Activities. Chart 15 and Table 35 provide a description of average strategy implementation across items with more than two-thirds of mentors (range 69%-93%) across AEOP reporting implementation of these strategies. Compared to FY19, no programs in FY20 reported greater strategy use in this area.

Table 34. Items that form the Supporting Student Engagement in Authentic STEM Activities Composite
1. Teaching (or assigning readings) about specific STEM subject matter
2. Having my student(s) search for and review technical research to support their work
3. Demonstrating laboratory/field techniques, procedures, and tools for my student(s)
4. Supervising my student(s) while they practice STEM research skills
5. Providing my student(s) with constructive feedback to improve their STEM competencies
6. Allowing students to work independently to improve their self-management abilities
7. Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.) †
8. Encouraging students to seek support from other team members†

† *These items were not included on the eCM and JSHS versions of the survey.*

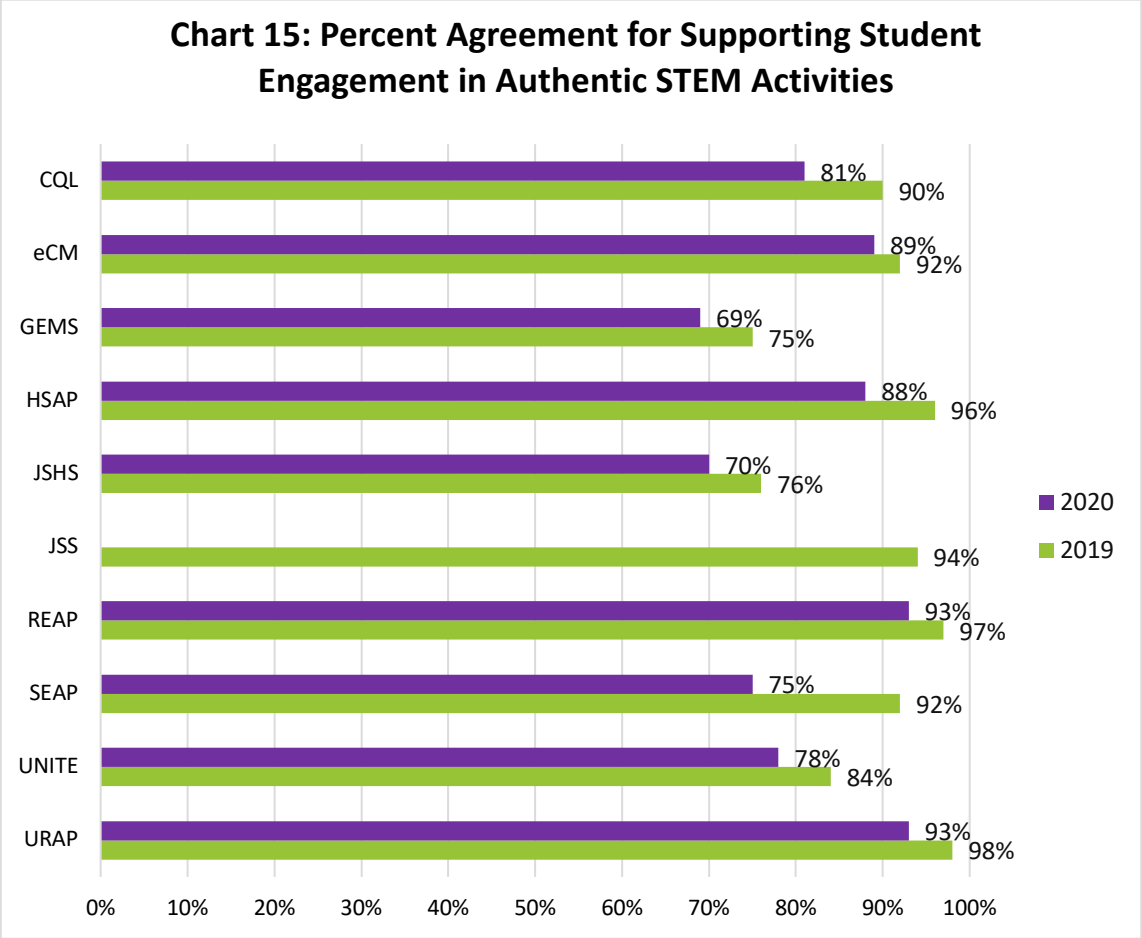


Table 35. Mentor Overall Percent Agreement for Supporting Student Engagement in Authentic STEM Activities		
Program	**2019 Average % Agreement**	**2020 Average % Agreement**
CQL	90%	81%
eCM	92%	89%
GEMS	75%	69%
HSAP	96%	88%
JSHS	76%	70%
JSS	94%	N/A
REAP	97%	93%
SEAP	92%	75%
Unite	84%	78%
URAP	98%	93%

Table 36 shares mentoring strategies used to support students' STEM Educational and Career Pathways from the evaluation survey. Average strategy implementation across items is presented in Chart 16 and Table 27. As mentioned in past years, these strategies were reportedly used less frequently by AEOP mentors compared to other mentoring strategies (range 30%-83%). Marginally more mentors in CQL and REAP, however, noted using these strategies more in FY20 than in FY19.

Table 36. Items that form the Supporting Student STEM Educational and Career Pathways Composite
1. Asking my student(s) about their educational and/or career goals
2. Recommending extracurricular programs that align with students' goals
3. Recommending Army Educational Outreach Programs that align with students' educational goals
4. Providing guidance about educational pathways that would prepare student(s) for a STEM career
5. Discussing STEM career opportunities within the DoD or other government agencies
6. Discussing STEM career opportunities in private industry or academia
7. Discussing the economic, political, ethical, and/or social context of a STEM career
8. Recommending student and professional organizations in STEM to my student(s)
9. Helping students build a professional network in a STEM field
10. Helping my student(s) with their resume, application, personal statement, and/or interview preparations

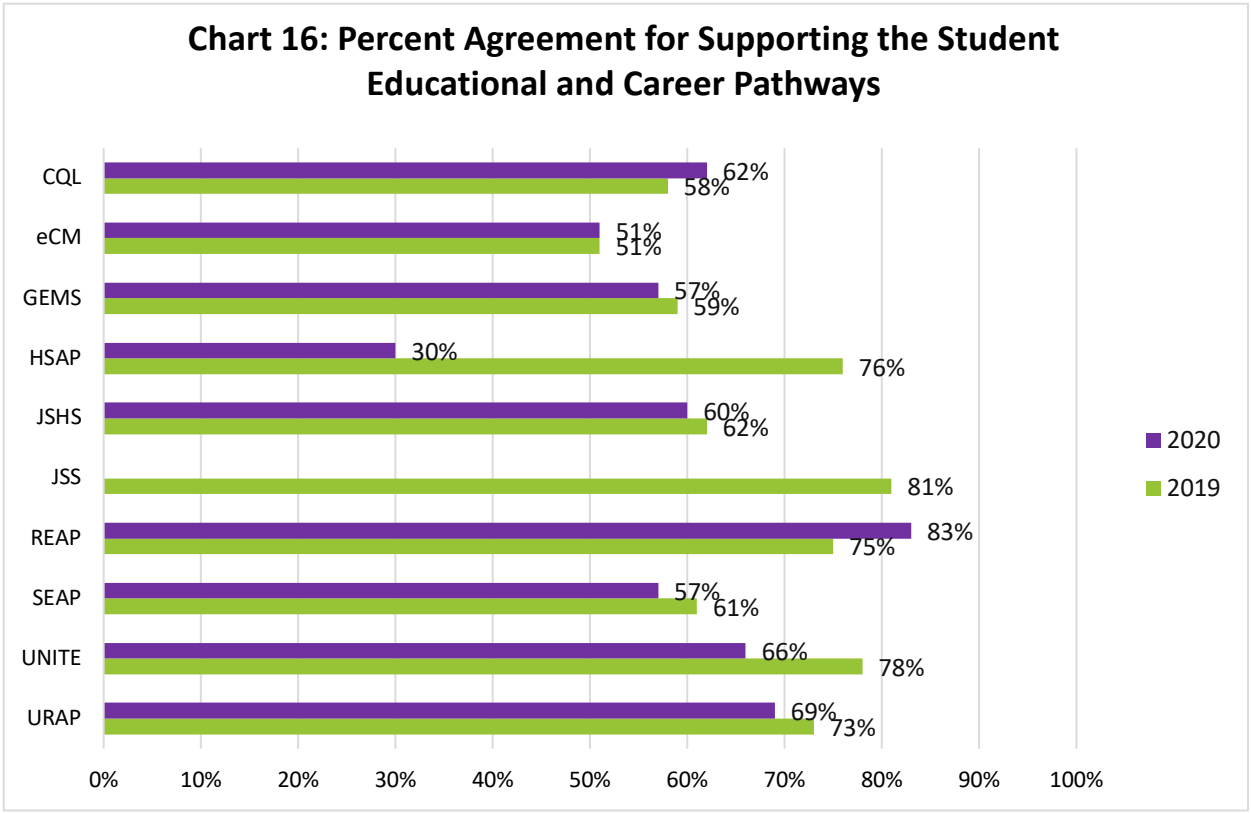
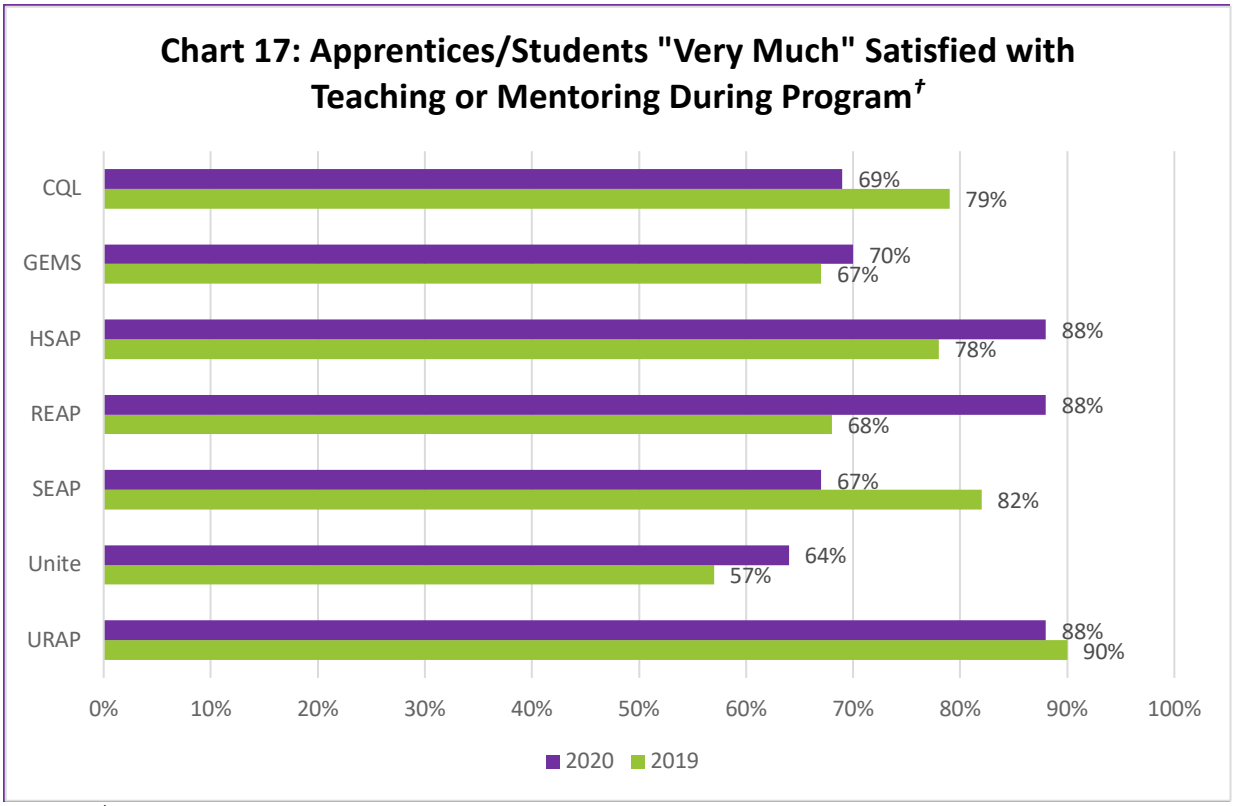


Table 37. Mentor Overall Percent Agreement for Supporting Student STEM Educational and Career Pathways		
Program	**2019 Average % Agreement**	**2020 Average % Agreement**
CQL	58%	62%
eCM	51%	51%
GEMS	59%	57%
HSAP	76%	30%
JSHS	62%	60%
JSS	81%	N/A
REAP	75%	83%
SEAP	61%	57%
Unite	78%	66%
URAP	73%	69%

In the AEOP evaluation, participant satisfaction with mentoring received represents student perceptions of mentoring quality, with quality mentoring theorized as a positive relationship that should result in a more meaningful, impactful, and sustainable program experience. Chart 17 and Table 38 provide student responses for those who indicated they were “very much” satisfied with the mentoring or teaching they received during their FY19 and FY20 AEOP. Nearly two-thirds of students or more (range 64%-88%) across AEOP indicated high levels of satisfaction with their program mentoring and instruction. Compared to FY19, student reported levels of mentoring satisfaction were higher in FY20 for GEMS, HSAP, REAP, and

Unite. However, student levels of mentoring satisfaction declined from FY19 to FY20 in CQL, SEAP, and URAP.



† *Only programs who work directly with a mentor (non-teacher) were asked this question.*

Table 38. Participants "Very Much" Satisfied with Teaching or Mentorship During Program		
Program	**2019**	**2020**
CQL	79%	69%
GEMS	67%	70%
HSAP	78%	88%
REAP	68%	88%
SEAP	82%	67%
Unite	57%	64%
URAP	90%	88%

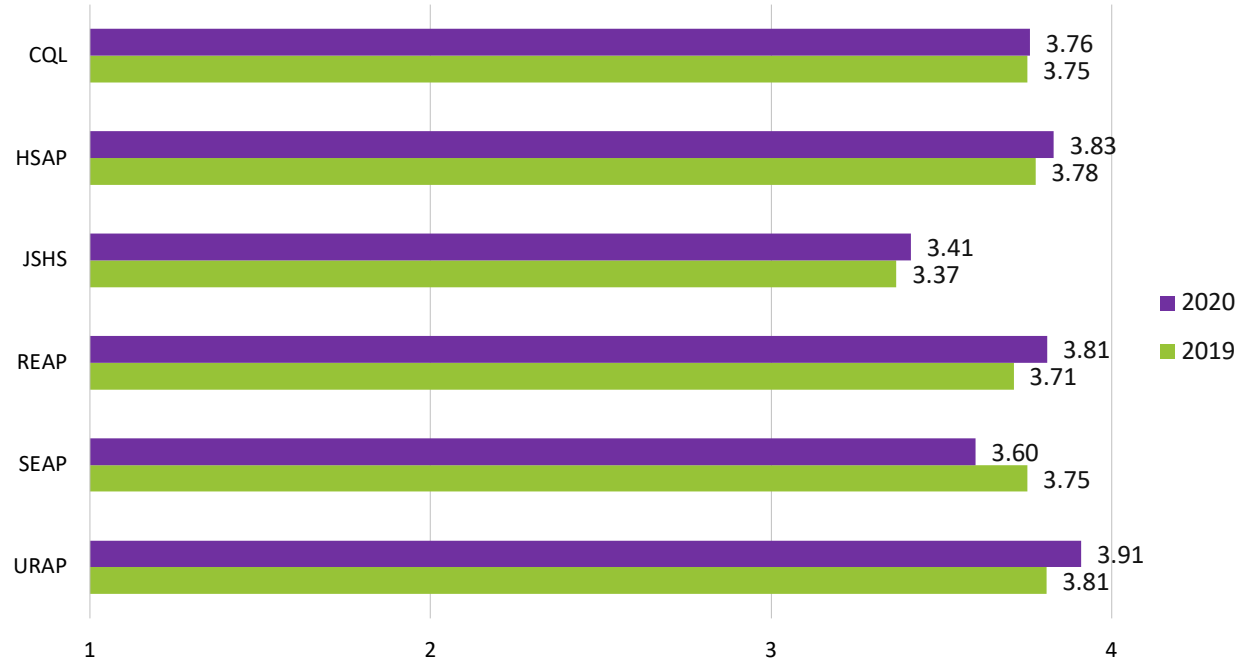
Mentoring satisfaction and overall research experiences were rated by AEOP participants in apprenticeship programs (CQL, HSAP, REAP, SEAP, URAP) and JSHS students (Table 39). Chart 18 shows average satisfaction across items remained consistently high across programs in FY20 and slightly rose for all programs except SEAP. Overall, these findings suggest AEOP apprentices and students responding were extremely pleased with their mentor-mentee relationship and overall research experiences in AEOP.

Table 39. Items that form the Mentor Satisfaction Composite for CQL, HSAP, JSHS, REAP, SEAP, and URAP
1. My working relationship with my mentor
2. My working relationship with the group or team†

3. The amount of time I spent doing meaningful research
4. The amount of time I spent with my research mentor
5. The research experience overall

† *This question was not included on the JSHS survey.*

Chart 18: Mean Composite Scores for Mentor Satisfaction†



† *Response options for the items forming this composite were: 1 – Did not experience, 2 – Not Satisfied, 3 – Somewhat Satisfied, 4 – Very Satisfied.*

Research Question #7 – To what extent do teacher participants report increased use of new approaches to teaching research concepts within STEM practices, and infusion of careers?

The AEOP Research Experiences for STEM Educators and Teachers (RESET) program has been in operation for five years in FY20. RESET was designed to specifically support STEM educators' content knowledge and provide them with DoD research experiences that they can translate into enhanced STEM curricula and learning experiences in their own classrooms.

Teachers who participated in RESET valued their exposure to Army/DoD research and the research skills and knowledge they gained. Participants particularly appreciated having opportunities to collaborate with other educators and learn about the scientific research process. RESET participants participating in interviews reflected on the value of their learning, both through the online course content and through interacting with Army S&Es and reflected and on ways that this learning could be incorporated into their classroom teaching practice. Participants said, for example:

> *"I learned a ton [about research], stuff I should've known years ago and didn't."* (RESET Level I Participant)

"[RESET is] a great program for teachers to learn something, and to interact with teachers from all over. That's the other great part about it, interacting with teachers from everywhere." (RESET Enhanced Level I Participant)

"On the first day of school I'm doing a lesson…from RESET." (Level I RESET Participant)

"I have trouble telling the kids what they will use math for. You know how kids always say, 'what am I going to use this [for]?' I can only list a couple of careers…but [in RESET] I was able to hear what all these gentlemen and ladies do for a living. It was incredible." (Level I RESET Participant)

"[The S&Es] talked about their background, their education, their present position - what they do. We were to write down questions that we would want to ask them, and we submitted those. Then we requested one or two individuals that we would like to interview virtually. They were all so interesting." (RESET Enhanced Level I Participant)

Priority Three: Sustainable Infrastructure

FY20 AEOP evaluation findings demonstrate progress toward attaining a viable infrastructure. Supporting evidence from evaluation data and trends are provided in this section by corresponding research question(s).

Research Question #8 - To what extent do participants report growth in awareness of and/or interest in AEOP opportunities?

As noted in FY19, personal connections, including friends, teachers and or professors, or someone who works at the university or school the participant attends continue to be the most frequently cited means of participant information about programs in FY20. A wide variety of personal connections were the most commonly reported ways participants indicated learning about their AEOP opportunities (Table 40). Multiple sources had approximately a quarter or more of participants in numerous programs endorsing them as where students learned about their AEOP: teacher or someone who works at the school they attend (CQL, eCM, HSAP, JSHS, Unite, URAP); someone who works with the program (CQL, SEAP, Unite, URAP); and a family member (GEMS, REAP, SEAP). While the AEOP website was reported as informative by participants in some programs (SEAP-67%, HSAP-50%, REAP-38%, GEMS-24%), nearly all participants did not choose AEOP on social media as a source that helped them learn about their AEOP program (range 0%-4%).

Table 40. How Students Learned About their Current AEOP Program											
	Year	**CQL**	**eCM**	**GEMS**	**HSAP**	**JSHS**	**JSS**	**REAP**	**SEAP**	**Unite**	**URAP**
Website: AEOP	2019	16%	1%	24%	28%	8%	0%	21%	25%	3%	13%
	2020	***16%***	***<1%***	***24%***	***50%***	***5%***	***N/A***	***38%***	***67%***	***3%***	***0%***
AEOP social media	2019	0%	1%	4%	0%	<1%	0%	0%	0%	0%	3%
	2020	***0%***	***2%***	***4%***	***0%***	***2%***	***N/A***	***0%***	***0%***	***<1%***	***0%***
School or university newsletter, email, or website	2019	9%	<1%	15%	22%	34%	35%	29%	13%	34%	40%
	2020	***11%***	***<1%***	***14%***	***25%***	***32%***	***N/A***	***25%***	***0%***	***34%***	***17%***
Past participant of program	2019	18%	<1%	45%	6%	30%	4%	21%	38%	12%	3%
	2020	***38%***	***16%***	***42%***	***0%***	***17%***	***N/A***	***31%***	***0%***	***11%***	***17%***
Friend	2019	23%	9%	37%	0%	22%	15%	7%	13%	18%	3%
	2020	***13%***	***8%***	***34%***	***0%***	***13%***	***N/A***	***19%***	***67%***	***8%***	***17%***
Family member	2019	27%	4%	37%	17%	10%	4%	7%	75%	16%	10%
	2020	***18%***	***5%***	***30%***	***0%***	***9%***	***N/A***	***31%***	***33%***	***7%***	***0%***
Teacher or someone who works at school/ university I attend	2019	25%	87%	9%	61%	66%	46%	39%	38%	28%	60%
	2020	***29%***	***90%***	***4%***	***50%***	***42%***	***N/A***	***13%***	***0%***	***25%***	***83%***
Someone who works with the program	2019	16%	N/A	4%	17%	4%	0%	25%	13%	20%	17%
	2020	***38%***	***N/A***	***3%***	***13%***	***3%***	***N/A***	***19%***	***33%***	***24%***	***25%***
Someone who works with the Department of Defense	2019	43%	<1%	13%	6%	2%	0%	4%	63%	0%	3%
	2020	***42%***	***<1%***	***9%***	***0%***	***0%***	***N/A***	***0%***	***33%***	***<1%***	***8%***
Community group or program	2019	0%	1%	5%	6%	4%	8%	4%	0%	11%	0%
	2020	***0%***	***2%***	***2%***	***0%***	***2%***	***N/A***	***0%***	***0%***	***21%***	***8%***
Choose not to report	2019	0%	8%	0%	0%	11%	15%	4%	0%	6%	0%
	2020	***0%***	***3%***	***<1%***	***0%***	***6%***	***N/A***	***0%***	***0%***	***<1%***	***0%***

Like AEOP participants, mentors were also asked how they had learned about AEOP (Table 41). Findings varied broadly across programs. However, a few sources stood out as the strongest influences for mentors with approximately 20% or more of mentors from several programs' reporting them as a way they learned about AEOP. These AEOP information sources were from: the act of being a past participant (CQL, eCM, GEMS, JSHS, SEAP); a colleague or friend (eCM, GEMS, JSHS, REAP, URAP); site host, director, or someone who works with the program (GEMS, HSAP, Unite, URAP); and AEOP website (GEMS, REAP, URAP).

Table 41. How Mentors Learned about AEOP

	Year	CQL	eCM	GEMS	HSAP	JSHS	JSS	REAP	SEAP	Unite	URAP
Website: AEOP	2019	18%	12%	17%	43%	6%	20%	28%	18%	14%	32%
	2020	***0%***	***10%***	***27%***	***0%***	***4%***	***N/A***	***50%***	***0%***	***8%***	***20%***
Social media	2019	0%	<1%	9%	0%	1%	0%	8%	0%	3%	0%
	2020	***0%***	***2%***	***7%***	***0%***	***0%***	***N/A***	***0%***	***0%***	***3%***	***0%***
School, university, or professional organization newsletter, email, or website	2019	0%	4%	26%	14%	15%	0%	13%	9%	31%	21%
	2020	***17%***	***5%***	***13%***	***0%***	***10%***	***N/A***	***14%***	***33%***	***25%***	***0%***
Past participant	2019	12%	32%	61%	21%	30%	40%	15%	36%	31%	14%
	2020	***50%***	***37%***	***40%***	***0%***	***36%***	***N/A***	***14%***	***100%***	***14%***	***20%***
A colleague or friend	2019	41%	34%	26%	0%	24%	20%	33%	18%	8%	18%
	2020	***17%***	***34%***	***27%***	***0%***	***28%***	***N/A***	***21%***	***0%***	***3%***	***20%***
Family member	2019	N/A	N/A	57%	N/A	N/A	N/A	N/A	N/A	3%	N/A
	2020	***N/A***	***N/A***	***33%***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***0%***	***N/A***
Site host, director, or someone who works with program	2019	6%	5%	22%	7%	23%	0%	23%	0%	28%	7%
	2020	***0%***	***3%***	***33%***	***100%***	***18%***	***N/A***	***0%***	***0%***	***22%***	***20%***
Someone who works with the Department of Defense	2019	0%	<1%	30%	36%	3%	10%	5%	0%	3%	25%
	2020	***0%***	***2%***	***20%***	***0%***	***2%***	***N/A***	***21%***	***33%***	***0%***	***30%***
Community group or program	2019	N/A	N/A	9%	N/A	N/A	N/A	N/A	N/A	6%	N/A
	2020	***N/A***	***N/A***	***0%***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***3%***	***N/A***
Choose Not to Report	2019	N/A	N/A	0%	N/A	N/A	N/A	N/A	N/A	3%	N/A
	2020	***N/A***	***N/A***	***0%***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***6%***	***N/A***

Building a pipeline of STEM opportunities for students beginning in the elementary grades and continuing across their high school and post-secondary studies is a growing focus of AEOP in FY20. Overall, very few participants at registration (Cvent) indicated they had engaged in a past AEOP aside from the program they were enrolled in in FY20. Table 42 shows the proportion of participants who reported previous AEOP participation by program. Several AEOP saw more than 20% of FY20 participants report being past participants of the same program (GEMS-48%, SEAP-29%, eCM-28%, Unite-28%, JSHS-22%). Outside of participants returning to the same program, 43% of FY20 SEAP participants reported past participation in GEMS; 26% of REAP participants reported past participation in Unite; and 14% of CQL participants reported past participation in GEMS. Overall, previous AEOP participation remained somewhat consistent between FY19 and FY20.

Table 42. Students Reporting Having Participated in Other AEOP*

Current Program	Year	eCM	JSS	JSHS	GEMS	Unite	HSAP	REAP	SEAP	URAP	CQL
CQL	2019	1%	0%	<1%	17%	0%	0%	0%	12%	0%	26%
	2020	***1%***	***0%***	***1%***	***14%***	***0%***	***0%***	***0%***	***8%***	***0%***	***19%***
eCM	2019	27%	2%	<1%	4%	0%	0%	0%	0%	0%	0%
	2020	***28%***	***1%***	***0%***	***2%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***
GEMS	2019	1%	1%	<1%	46%	0%	0%	0%	0%	0%	0%
	2020	***<1%***	***<1%***	***<1%***	***48%***	***<1%***	***0%***	***0%***	***0%***	***0%***	***0%***
HSAP	2019	0%	0%	3%	0%	0%	0%	3%	0%	0%	0%
	2020	***3%***	***0%***	***3%***	***0%***	***0%***	***3%***	***0%***	***0%***	***0%***	***0%***
JSHS	2019	2%	1%	22%	0%	0%	0%	0%	0%	N/A	N/A
	2020	***2%***	***0%***	***22%***	***1%***	***0%***	***0%***	***0%***	***0%***	***N/A***	***N/A***
JSS	2019	3%	24%	0%	2%	N/A	N/A	N/A	N/A	N/A	N/A
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
REAP	2019	2%	0%	0%	8%	16%	0%	9%	0%	0%	0%
	2020	***2%***	***1%***	***1%***	***7%***	***26%***	***2%***	***10%***	***0%***	***0%***	***0%***
SEAP	2019	5%	3%	2%	32%	0%	0%	1%	25%	0%	0%
	2020	***7%***	***4%***	***4%***	***43%***	***0%***	***0%***	***0%***	***29%***	***0%***	***0%***
Unite	2019	<1%	0%	1%	1%	28%	1%	1%	1%	0%	0%
	2020	***<1%***	***0%***	***0%***	***1%***	***28%***	***<1%***	***1%***	***<1%***	***0%***	***0%***
URAP	2019	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%
	2020	***4%***	***0%***	***4%***	***4%***	***0%***	***0%***	***0%***	***0%***	***2%***	***2%***

*Participants can report previous participation in more than one program. Therefore, percentages may not equal 100%.

Another method of examining the AEOP pipeline was by categorizing student past STEM program participation into three groups based on their self-report from Cvent enrollment data: 1) past AEOP participation; 2) past non-AEOP STEM program participation; and 3) no past STEM program participation of any type (Table 43). In FY20, two programs (GEMS, SEAP) had more than 50% of participants reporting previous AEOP involvement; four programs (CQL, eCM overall, REAP, Unite) saw between 30-50% of participants reporting previous AEOP involvement; and three programs (HSAP, JSHS, URAP) had less than 30% of participants note previous AEOP involvement. Proportions of previous AEOP participation for seven programs (GEMS, HSAP, JSHS, REAP, SEAP, URAP) increased or stayed consistent from FY19 to FY20.

Table 43. Student Past STEM Program Participation

Current Program	Year	Previously Participated in an AEOP	Previously Participated in Other STEM Program	No Past Participation in an AEOP or Other STEM Program
CQL	2019	45%	11%	44%
	2020	***35%***	***14%***	***51%***
eCM	2019	33%	28%	39%
	2020	***32%***	***21%***	***47%***
GEMS	2019	51%	10%	39%
	2020	***53%***	***9%***	***38%***
HSAP	2019	10%	24%	66%
	2020	***19%***	***9%***	***72%***
JSHS	2019	27%	13%	60%
	2020	***27%***	***12%***	***61%***
JSS	2019	29%	17%	54%
	2020	***N/A***	***N/A***	***N/A***
REAP	2019	34%	8%	58%
	2020	***44%***	***7%***	***49%***
SEAP	2019	54%	6%	40%
	2020	***61%***	***4%***	***35%***
Unite	2019	32%	23%	45%
	2020	***31%***	***16%***	***53%***
URAP	2019	6%	9%	85%
	2020	***14%***	***0%***	***86%***

AEOP consortium members are charged with promoting all AEOP to participants within their programs each year. As a result, programs have implemented strategies to assist their adults who run the programs at both local and national levels to focus program time on growing awareness of

other AEOP. Some progress across recent years has been made in this area. However, the majority of AEOP participants (more than 50%) in eCM, GEMS, JSHS, and URAP reported not having ever heard of many, if not all the other AEOP (Table 44). Part of the reason that many FY20 participants had little to no awareness of other AEOP may be attributed to the fact that only a very small percentage of AEOP adults (teachers, mentors, Team Advisors) reported discussing AEOP with their participants. Overall, for CQL, eCM, GEMS, HSAP, JSHS, SEAP, Unite, and URAP – much less than 50% of adults discussed any program with their students besides the actual program they were enrolled in for FY20 – except for REAP, where 30% or more adults did discuss other AEOP with participants (Table 45).

Table 44. AEOP Participants Reporting No Awareness of Other AEOP

Current Program	Year	eCM	JSS	JSHS	GEMS	Unite	HSAP	REAP	SEAP	URAP	CQL	SMART	NDSEG	GEMS-NPM
CQL	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	40%	0%	9%	34%	40%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	**35%**	***2%***	***21%***	***42%***	***42%***
eCM	2019	8%	58%	62%	56%	64%	60%	57%	55%	62%	61%	55%	59%	63%
	2020	***6%***	***65%***	***64%***	***58%***	***67%***	***64%***	***62%***	***62%***	***66%***	***63%***	***53%***	***63%***	***65%***
GEMS	2019	69%	64%	70%	16%	75%	65%	63%	60%	68%	68%	58%	67%	36%
	2020	***61%***	***62%***	**62%**	***15%***	***68%***	***56%***	***52%***	***49%***	***59%***	***59%***	***50%***	***59%***	***27%***
HSAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0%	61%	39%	44%	39%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***13%***	***63%***	***25%***	***50%***	***63%***
JSHS	2019	N/A	N/A	2%	N/A	73%	62%	61%	60%	63%	69%	58%	66%	69%
	2020	***N/A***	***N/A***	***5%***	***N/A***	***76%***	***66%***	***64%***	***65%***	***65%***	***70%***	***58%***	***67%***	***71%***
JSS	2019	56%	2%	60%	46%	65%	62%	62%	56%	64%	56%	64%	60%	56%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
REAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36%	58%	36%	52%	58%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***18%***	***41%***	***29%***	***35%***	***47%***
SEAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	18%	9%	0%	18%	18%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***33%***	***33%***	***33%***	***67%***	***67%***
Unite	2019	N/A	N/A	37%	33%	6%	33%	27%	32%	36%	36%	26%	37%	40%
	2020	***N/A***	***N/A***	***41%***	***33%***	***6%***	***35%***	***26%***	***30%***	***39%***	***43%***	***28%***	***43%***	***43%***
URAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0%	77%	36%	42%	71%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***0%***	***69%***	***50%***	***63%***	***63%***

Table 45. Mentors Explicitly Discussing AEOP with Participants														
Current Program	**Year**	**eCM**	**JSS**	**JSHS**	**GEMS**	**Unite**	**HSAP**	**REAP**	**SEAP**	**URAP**	**CQL**	**SMART**	**NDSEG**	**GEMS-NPM**
CQL	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0%	87%	53%	20%	7%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***0%***	***83%***	***50%***	***0%***	***0%***
eCM	2019	91%	8%	4%	6%	<1%	3%	4%	6%	1%	<1%	6%	<1%	1%
	2020	***90%***	***9%***	***12%***	***9%***	***3%***	***6%***	***6%***	***6%***	***2%***	***2%***	***8%***	***2%***	***4%***
GEMS	2019	22%	N/A	11%	100%	4%	7%	22%	19%	4%	11%	11%	15%	89%
	2020	***29%***	***21%***	***17%***	***88%***	***17%***	***17%***	***21%***	***25%***	***13%***	***17%***	***13%***	***13%***	***71%***
HSAP	2019	N/A	N/A	7%	N/A	N/A	93%	N/A	N/A	79%	7%	36%	36%	0%
	2020	***N/A***	***N/A***	***0%***	***0%***	***0%***	***100%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***	***0%***
JSHS	2019	7%	N/A	67%	N/A	26%	8%	10%	14%	5%	3%	11%	4%	3%
	2020	***11%***	***N/A***	***70%***	***N/A***	***22%***	***17%***	***19%***	***17%***	***13%***	***11%***	***17%***	***11%***	***9%***
JSS	2019	N/A	N/A	30%	30%	20%	10%	10%	20%	10%	20%	20%	10%	20%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
REAP	2019	N/A	N/A	23%	N/A	N/A	25%	N/A	N/A	33%	15%	28%	20%	15%
	2020	***N/A***	***N/A***	***43%***	***43%***	***36%***	***57%***	***N/A***	***43%***	***64%***	***36%***	***57%***	***57%***	***43%***
SEAP	2019	N/A	N/A	N/A	N/A	N/A	0%	N/A	N/A	0%	36%	55%	0%	0%
	2020	***N/A***	***N/A***	***N/A***	***0%***	***0%***	***0%***	***0%***	***N/A***	***0%***	***33%***	***33%***	***0%***	***0%***
Unite	2019	N/A	N/A	27%	37%	66%	25%	48%	28%	26%	22%	36%	24%	21%
	2020	***N/A***	***N/A***	***21%***	***27%***	***71%***	***23%***	***29%***	***21%***	***19%***	***18%***	***27%***	***21%***	***13%***
URAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	79%	11%	43%	29%	7%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***70%***	***0%***	***20%***	***20%***	***0%***

Students were also asked if they were interested in participating in future AEOP (Table 46). Future interest in AEOP was very evident across programs. Large proportions of students eligible for future participation in the same AEOP indicated they would be interested in doing so (range 70%-94%). Further, nearly half, or more of students reported interest in the SMART scholarship program across all programs except for JSHS.

Table 46. Current AEOP Participants Interest in Participating in Other AEOP in the Future														
Current Program	**Year**	**eCM**	**JSS**	**JSHS**	**GEMS**	**Unite**	**HSAP**	**REAP**	**SEAP**	**URAP**	**CQL**	**SMART**	**NDSEG**	**GEMS-NPM**
CQL	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	30%	85%	70%	47%	30%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***42%***	***85%***	***71%***	***50%***	***37%***
eCM	2019	50%	16%	15%	19%	12%	15%	19%	19%	16%	15%	22%	17%	13%
	2020	***70%***	***19%***	***22%***	***32%***	***19%***	***23%***	***24%***	***24%***	***20%***	***24%***	***33%***	***23%***	***20%***
GEMS	2019	24%	27%	24%	80%	20%	30%	32%	35%	26%	26%	38%	28%	57%
	2020	***32%***	***31%***	***32%***	***82%***	***27%***	***38%***	***41%***	***46%***	***35%***	***36%***	***46%***	***36%***	***68%***
HSAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	83%	39%	61%	50%	56%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***88%***	***38%***	***63%***	***50%***	***38%***
JSHS	2019	N/A	N/A	91%	N/A	N/A	33%	33%	35%	34%	26%	38%	28%	25%
	2020	***N/A***	***N/A***	***91%***	***N/A***	***N/A***	***30%***	***33%***	***32%***	***32%***	***27%***	***39%***	***28%***	***25%***
JSS	2019	21%	89%	16%	25%	14%	22%	18%	21%	16%	24%	24%	22%	22%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
REAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	61%	39%	58%	39%	29%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***82%***	***53%***	***71%***	***59%***	***53%***
SEAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	82%	91%	91%	73%	73%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***67%***	***67%***	***67%***	***33%***	***33%***
Unite	2019	N/A	N/A	40%	42%	77%	44%	49%	46%	35%	35%	46%	33%	32%
	2020	***N/A***	***N/A***	***46%***	***57%***	***90%***	***54%***	***62%***	***59%***	***49%***	***48%***	***67%***	***45%***	***43%***
URAP	2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	81%	13%	45%	45%	16%
	2020	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***94%***	***25%***	***44%***	***31%***	***25%***

Like findings from prior AEOP evaluations, FY20 results imply that student participants and mentors across AEOP possess limited knowledge of AEOP outside of the one they were in currently. However, AEOP participants noted considerable interest in future program participation. This suggests that developing and implementing strategic efforts to disseminate information about AEOP has potential to strengthen the program pipeline. AEOP administrators should continue to educate site and event coordinators, mentors, and other volunteers about all other AEOP opportunities so participants have a chance to gain a clear understanding of future AEOP available to them.

Mid to Long-Term Evaluation

As in past years, the FY20 AEOP evaluation included an alumni survey as a method of capturing near-term and mid-to long-term outcomes of AEOP participation.

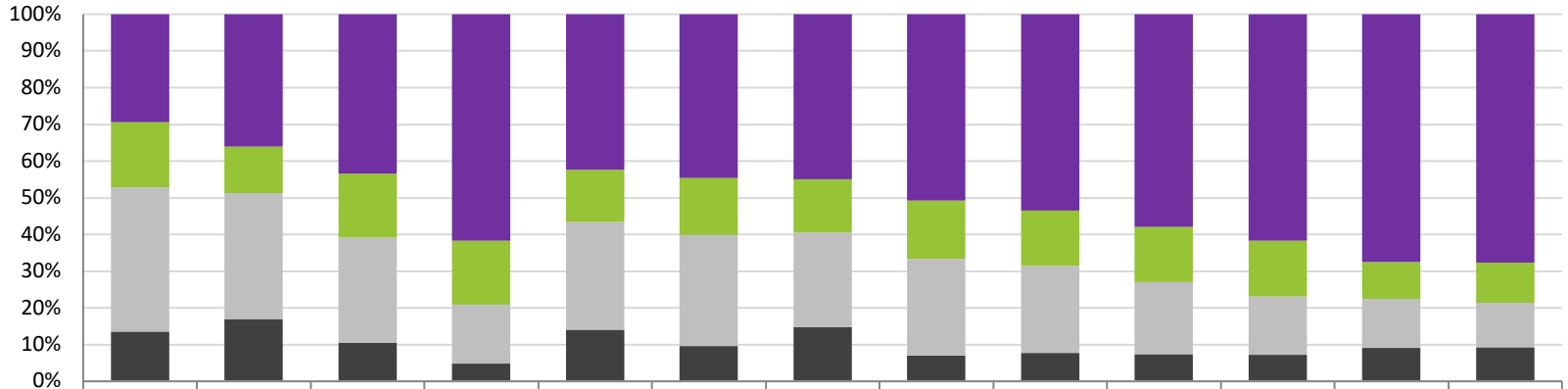
PRIORITY ONE: STEM Literate Citizenry

Research Question #1 - To what extent do alumni report positive, sustained interest and engagement in STEM?

Chart 19 displays AEOP alumni participant current interest in STEM activities which included a majority reporting they were at least somewhat interested in participating in all STEM activities listed on the survey. Specific activities with almost all (90% or more) reporting at least some interest were the following: learning about new STEM things (95%); talking with friends/family about STEM (90%); participating in STEM community service projects (93%); participating in STEM camps, clubs, or competitions (92%); participating in STEM projects at universities/professional settings (93%); taking STEM electives (93%); earning a STEM degree (91%); and pursuing a STEM career (91%).

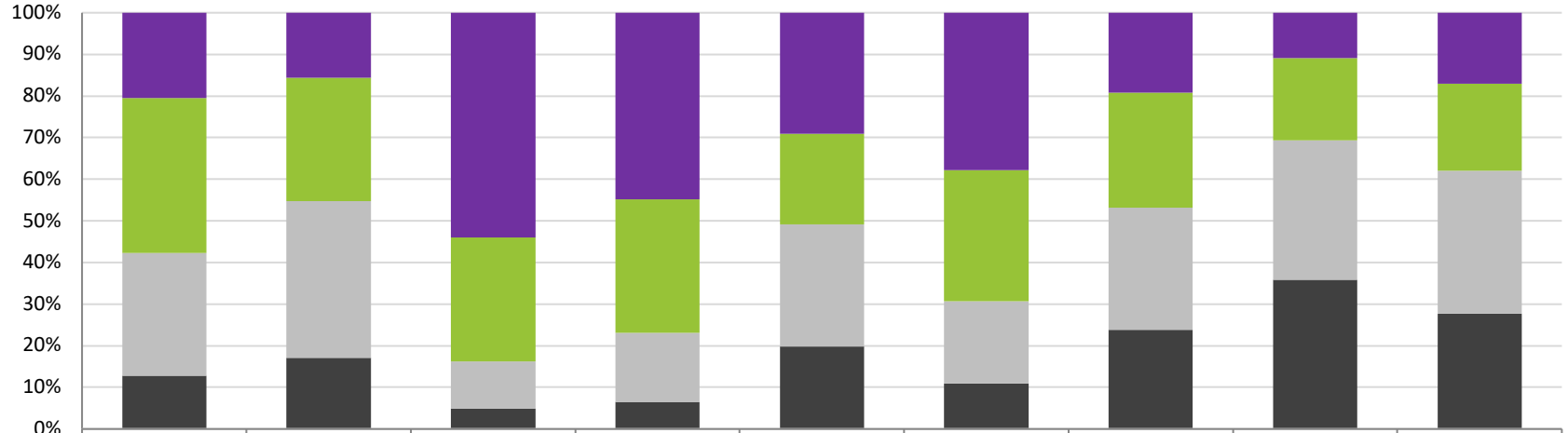
Data related to current AEOP alumni engagement in STEM activities is provided in Chart 20. Three-quarters or more of participating alumni noted sometimes or frequently engaging in activities such as learning about new things in STEM (84%) and solving math/science puzzles (78%). Further, more than half of alumni reported engaging in STEM sometimes or frequently by reading/watching STEM non-fiction (58%) and talking with friends/family about STEM (69%).

Chart 19: Alumni Interest in STEM Activities (*n* = 562-566)



	Reading/Watching STEM Non-Fiction	Tinkering with Mechanical/Electrical Device	Solving Math/Science Puzzles	Learning about New STEM Things	Computer Design/Programming	Talking with Friends/Family about STEM	Mentoring/Teaching Others about STEM	Participation in STEM Community Service Project	Participate/Volunteer STEM Camp, Club, or Competition	Taking STEM Electives	STEM Project/Experiment in University/Professional Setting	Earning a STEM degree	Pursuing STEM career
Very Interested	29%	36%	43%	62%	42%	45%	45%	51%	53%	58%	62%	68%	68%
Interested	18%	13%	17%	17%	14%	16%	14%	16%	15%	15%	15%	10%	11%
Somewhat Interested	39%	34%	29%	16%	29%	30%	26%	26%	24%	20%	16%	13%	12%
Not Interested	14%	17%	10%	5%	14%	10%	15%	7%	8%	7%	7%	9%	9%

Chart 20: Alumni Engagement in STEM Activities (*n* = 559 - 566)



	Reading/Watching STEM Non-Fiction	Tinkering with Mechanical/Electrical Device	Learning about New STEM Things	Solving Math/Science Puzzles	Computer Design/Programming	Talking with Friends/Family about STEM	Mentoring/Teaching Others about STEM	Participation in STEM Community Service Project	Participate/Volunteer STEM Camp, Club, or Competition
Frequently	21%	16%	54%	45%	29%	38%	19%	11%	17%
Sometimes	37%	30%	30%	32%	22%	31%	28%	20%	21%
Not Often	30%	38%	11%	17%	29%	20%	29%	34%	34%
Never	13%	17%	5%	7%	20%	11%	24%	36%	28%

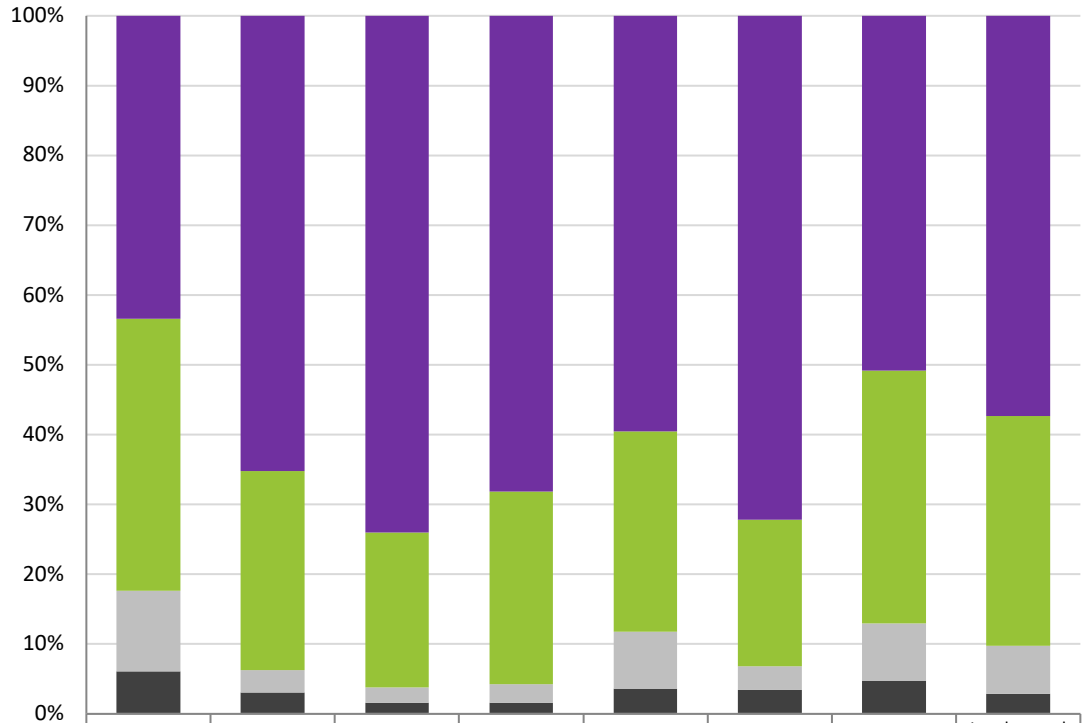
Findings in Table 47 reveal that AEOP alumni continue to be active in STEM activities with 57% reporting that they are taking a STEM elective course at the present time. Almost a third (29%) indicated they are in the process of pursuing a STEM degree, and 12% said that they are already working in a STEM career.

Table 47. Alumni Current STEM Activities (*n* = 577)	
Item	**Percentage**
Taking a STEM elective	57%
Working on STEM project/experiment in university/professional setting	24%
Pursuing a STEM degree	29%
Working in a STEM career	12%

Research Question #2 - To what extent do alumni report positive attitudes toward STEM, and particularly Army/DoD STEM?

A priority of AEOP is working to create a STEM literate society. Further, fostering positive student attitudes toward STEM is a critical component of this goal. Alumni respondents rated items about their attitudes toward STEM in general and specifically related to Army/DoD STEM (Chart 21). AEOP alumni reported very high perceptions toward STEM in general with more than three-quarters at least somewhat agreeing with all items. More than 90% of alumni responding agreed to some extent with the following items: enjoying solving real-world problems (96%); using STEM to help improve their community (95%); feeling successful in STEM classes (92%); understanding how scientists and engineers work on real problems in STEM (90%); and the belief that there are STEM careers that are a good fit with their interests (92%).

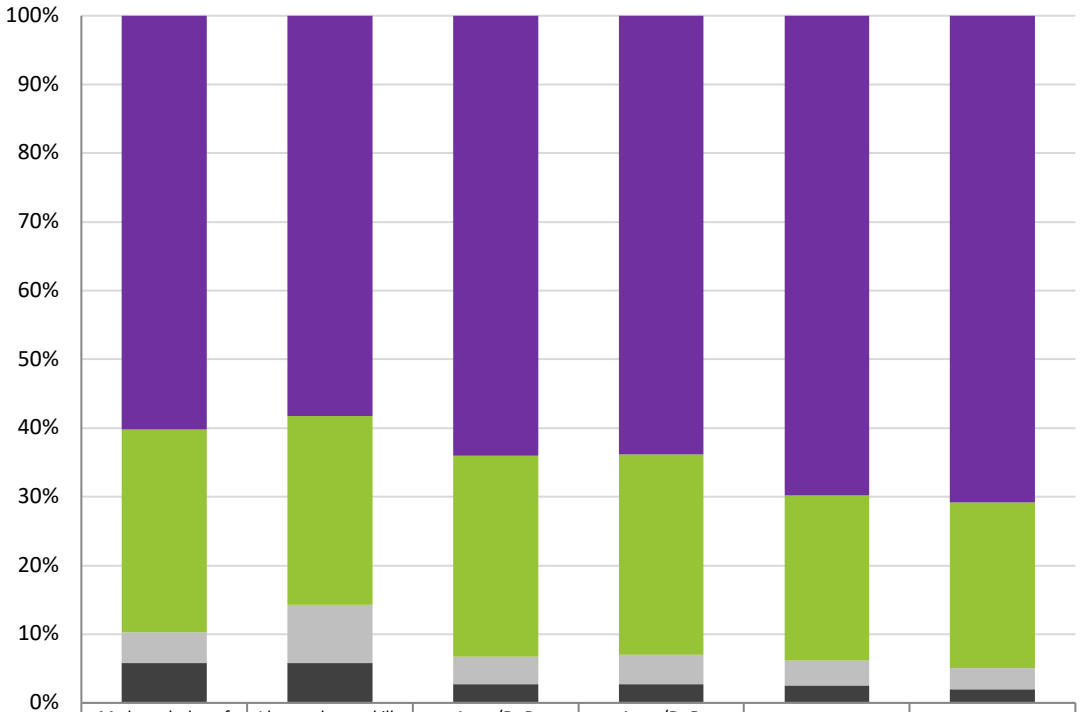
Chart 21: Alumni Attitudes Regarding STEM (*n* = 556 - 560)



	All people can be successful in STEM	I feel successful in STEM classes	I enjoy solving real-world problems	I can use STEM to help improve my community	I enjoy working on team projects and activities	There are STEM careers that are a good fit with my interests	I understand how STEM research is conducted	I understand how scientists and engineers work on real problems in STEM
Agree	43%	65%	74%	68%	60%	72%	51%	57%
Somewhat Agree	39%	29%	22%	28%	29%	21%	36%	33%
Somewhat Disagree	12%	3%	2%	3%	8%	3%	8%	7%
Disagree	6%	3%	2%	2%	4%	3%	5%	3%

Chart 22 shows that alumni respondents reported quite positive perceptions (more than 80%) regarding AEOP and Army/DoD STEM items. More than 90% of alumni reported believing Army/DoD research is valuable to society (95%), solves real-world problems (94%), advances STEM fields (93%), and develops new, cutting-edge technologies (93%).

Chart 22: Alumni Attitudes Regarding AEOP and Army/DoD STEM (*n* = 551 - 555)



	My knowledge of STEM increased through participating in AEOP	I learned new skills that I can use to solve STEM problems in my AEOP program	Army/DoD researchers advance science and engineering fields	Army/DoD researchers develop new, cutting edge technologies	Army/DoD researches solve real-world problems	Army/DoD research is valuable to society
Agree	60%	58%	64%	64%	70%	71%
Somewhat Agree	30%	27%	29%	29%	24%	24%
Somewhat Disagree	5%	8%	4%	4%	4%	3%
Disagree	6%	6%	3%	3%	3%	2%

Research Question #3 - To what extent do alumni report pursuit of and achievement in STEM courses in secondary school, post-secondary STEM degrees, STEM careers, and Army/DoD STEM careers?

Large proportions of responding alumni reported they completed high school STEM coursework in STEM (Table 48). A third to two-thirds of alumni indicated they completed higher level STEM classes such as AP Math (32%), Calculus (36%), AP Science (40%), Physics (51%), and Chemistry (72%).

Table 48. Alumni Reported STEM High School Coursework Completed (*n* = 577)	
HS STEM Course	**Percentage**
Algebra I	88%
Algebra II	80%
AP Math	34%
AP Science	47%
Biology	88%
Calculus	41%
Chemistry	75%
Computer Science	34%
Earth Science	26%
Engineering	24%
Environmental Science	25%
Geometry	80%
Human Anatomy	16%
Intro Chemistry and Physics	25%
Physics	54%
Pre-Calculus	60%

Table 49 reports AEOP alumni enrollment in post-secondary STEM degree programs. While more than half of alumni completing the survey were still in high school (57%), a third (33%) of responding alumni indicated that they were enrolled in STEM post-secondary education (Certificate – 5%, Associate – 7%, Bachelor's – 21%). Additionally, a small proportion (7%) said they were already post-secondary STEM degree graduates.

Table 49. STEM Degree at College or University	
Degree Level	**Percentage**
Associate (*n* = 569)	
Yes	6%
No	37%
Still in High School	57%
Bachelor's (*n* = 569)	
Yes	22%
No	20%
Still in High School	57%
Graduate (*n* = 572)	
Yes	6%
No	37%
Still in High School	57%

STEM Certificate/Training (*n* = 568)	
Yes	5%
No	39%
Still in High School	57%

Engineering-focused programs (12%) were the most frequently reported post-secondary focus of responding AEOP alumni (Table 50). This was followed by technology/computer science (6%), physical science (4%), life science (4%), and medicine (2%). Less than 1% of alumni indicated they were working toward a teaching degree. Among alumni reportedly enrolled in college, nearly all (91%) reported having completed credits toward a STEM degree (Table 51).

Table 50. STEM Degree Program Enrolled In (*n* = 577)	
STEM Degree Program	**Percentage**
Business	<1%
Engineering	12%
Environmental science	<1%
Life science	4%
Mathematics or statistics	<1%
Medicine	2%
Physical science	4%
Teaching	<1%
Technology/computer science	6%
Other	3%
Not enrolled	63%
Missing data	2%

Table 51. AEOP Alumni College Credit Hours Completed in STEM Degree Program (*n* = 577)	
STEM Credits	**Percentage**
0-30 credits	12%
31-60 credits	4%
61-90 credits	5%
91-120 credits	4%
121+ credits	5%
Not enrolled in classes	21%
Not enrolled in STEM	3%
Still in high school	44%
Missing data	2%

AEOP alumni-reported current grade point averages (GPAs) are provided in Table 52. Approximately a third of alumni (36%) reported holding a GPA of 4.0 or higher. More than three-quarters of alumni (81%) indicated they held a GPA of 3.0 or higher.

Table 52. AEOP Alumni College Student Current GPA (*n* = 577)	
GPA	**Percentage**
4.0 or better	36%
3.75 - 3.9	23%
3.50 - 3.74	11%
3.0 - 3.49	11%
2.5 - 2.9	3%
2.0 - 2.49	<1%
Lower than 2.0	<1%
Not enrolled	15%
Missing data	2%

Table 53 presents data demonstrating alumni STEM degree completion. Nearly a quarter of alumni (22%) indicated they have already earned some type of STEM certificate or training. Fewer indicated receiving a bachelor's degree (12%), associate degree (4%), or doctoral degree (4%).

Table 53. STEM Degree Program Completed	
Degree Level	**Percentage**
Associate (*n* = 577)	
Yes	4%
No	35%
Missing data	61%
Bachelor (*n* = 577)	
Yes	12%
No	31%
Missing data	57%
Master (*n* = 577)	
Yes	6%
No	27%
Missing data	67%
Doctoral (*n* = 577)	
Yes	4%
No	27%
Missing data	69%
STEM Certificate/Training (*n* = 577)	
Yes	22%
No	26%
Missing data	51%

There were 172 alumni survey respondents who provided a title for their degree program. Among these past participants, 146 (85%) identified their degree program as in a STEM field. Programs listed most frequently were engineering (44%), technology/computer science (18%), life science (14%), physical

science (10%), medicine (8%), mathematics or statistics (3%), environmental science (1%), and general Bachelor of Science (3%).

Eighty-one alumni survey participants reported their current employment is in a STEM-focused job. STEM positions indicated were K-12 teachers (28%), research scientists (21%), STEM-related positions within the DoD (16%), engineers (15%), technology-related (13%), university faculty (4%), and mathematics-oriented (3%).

Research Question #4 - To what extent do alumni report awareness of and interest in STEM research and careers overall and for the Army/DoD specifically?

Alumni evaluation participants were asked to identify general STEM research topics they had learned through AEOP and STEM research within the DoD. In addition, alumni were asked to list up to 3 Army/DoD STEM careers they had learned about during their AEOP.

A vast variety of STEM research topics they learned about during their AEOP were recorded. Some of these include:

- 3D Printing
- Actuarial Science
- Aerospace
- Agriculture Science
- Animal Testing/Dosing
- Antenna Positioning Systems
- Artificial Intelligence
- Autonomous Vehicles
- Bacterial Cellulose
- Biochemistry
- Biological Engineering
- Biology
- Biomedical Engineer
- Biostatistics
- Biotechnology
- Cancer research
- Chemical Engineering
- Chemistry
- Computer Engineering
- Coral Reefs
- Cybersecurity
- Defense Systems
- Earth Science
- Electrical Engineering
- Electronics
- Engineering
- Environmental Science
- Food Packaging Technologies
- Genomics
- Haptics
- Health
- Materials Science
- Mechanical Engineering
- Microbiology
- Multifunctional Materials
- Nanochemistry
- Nanotechnology
- Nanoscience
- Neurobiology
- Neuroscience
- Oceanography
- Parallel Programming with GPUs
- Particle Physics
- Pharmacy
- Robotics
- Technology
- Water Research
- Wind Turbine Research
- Wireless Communications

Further, alumni reported an equally large array of Army/DoD STEM research areas they learned about in their AEOP.

- Aerospace Research
- Applied Materials Science
- Biology
- Biomechanics
- Bioscience
- Cancer
- Chem Bio Defense
- Communications
- Computer Science
- Cybersecurity
- Defense Systems
- Detection Technology
- Developing Supercomputers
- Drug Discovery/Virology
- Electronics
- Engineering
- Entomology
- Environment
- Epidemiology
- Flood Control
- Fluid Dynamics
- Forensic Biology
- High Power Lasers
- Immunology and Virology
- Infectious Diseases
- Mechanical Engineering
- Microbiological Research
- Multifunctional Materials
- Nanoparticle Fabrication
- Neuroscience
- Particle Physics
- Prototype Building
- Robotics
- Two-Dimensional Materials
- Water Purification
- Weapons
- Wireless Communications

Alumni listed a wide variety of Army/DoD STEM careers they learned about in their AEOP. Some of these include:

- Actuarial Science
- Aeronautical Engineer
- Architect
- Behavioral Analysis Specialist
- Biochemist
- Biologist
- Biomedical Engineer
- Broadcast Engineer
- Chemical Engineer
- Chemist
- Civilian Scientists
- Combat Engineer
- Computer Engineering
- Computer Science and Information Technology
- Cryptologic Engineer
- Cybersecurity Specialist
- Doctor
- Drone Scientist
- Electronics Engineer
- Fire Protection Engineer
- Forensic Scientist
- General Engineer
- Geologist
- Histologist
- Industrial Engineer
- Marine Scientists
- Material Scientists
- Mechanical Engineering
- Mechanical Engineers
- Medical Scientists
- Missile Defense Contractor
- Molecular Biologist
- Nano chemist
- Neuroscientist
- Physicist
- Radar/SON/AR Engineers
- Research Scientists
- Resource Management
- Safety Engineer
- Structural Engineer

- Food Scientist
- Systems Engineers
- Urban Planner

Research Question #5 – To what extent do alumni report an increase in STEM career participation and success overall, as well as within the Army/DoD specifically?

Table 54 reveals alumni reported awareness and interest in STEM career participation within and outside of the DoD/Army. In general, nearly 90% of alumni were interested in pursuing a STEM career (88%). Approximately two-thirds indicated they were aware of Army/DoD STEM careers (65%), 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.

Table 54. Alumni Awareness and Interests (*n* = 533-577)	
Item	**Somewhat Agree/Agree**
I am aware of Army or DoD STEM careers	65%
I am interested in pursuing a career in STEM	88%
I am interested in pursuing a DoD/Army STEM career	59%
I am interested in learning more about Army/DoD careers focused on STEM research	73%

AEOP alumni STEM career plans are listed in Table 55. Over three-quarters (81%) of alumni said they plan to seek a STEM-focused career in the future. Some alumni (25%) have already applied for STEM-focused jobs or are presently working in a STEM-focused career (16%). Approximately one-third (36%) of AEOP alumni reported planning to seek an Army/DoD STEM-focused career in the future, and 4% are in such a position already.

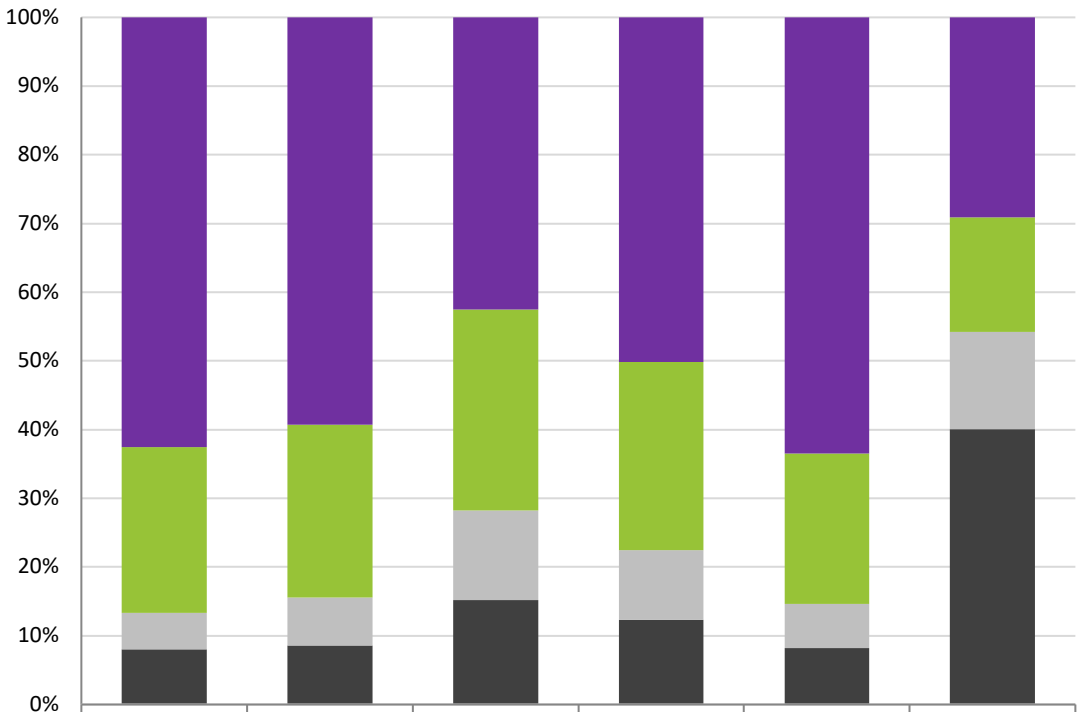
Table 55. Alumni STEM Career Focus (*n* = 544-555)	
Item	**Yes**
I have applied for STEM-focused job positions	25%
My current job is in a STEM-focused career	16%
I plan to seek a STEM-focused career position in the future	81%
My current position is an Army/DoD STEM focused position	4%
I plan to seek an Army/DoD STEM-focused career position in the future	36%

PRIORITY TWO: STEM Savvy Educators

Research Question #6 - What is the impact of Scientists and Engineers (S&E) Mentors on AEOP alumni?

AEOP alumni perceptions of mentoring they received during their program are provided in Chart 23. More than 80% agreed to some extent that their mentoring experience was very positive (87%), enhanced their learning (84%), and was a valuable aspect of their AEOP (85%). Large proportions of alumni also believed their AEOP mentor helped influence their future academic career decisions (78%) and helped them learn about Army/DoD careers (72%). While mentoring relationships appeared to be strong, less than half of alumni (46%) reported staying in touch with their AEOP mentor after their program was finished.

Chart 23: Alumni Perceptions of AEOP Mentoring Received (*n* = 525 - 527)



	Had very positive experience working with AEOP mentors	Learning enhanced with AEOP mentor	Learned more about Army/DoD careers & research from AEOP mentor	AEOP mentors helped influence/inform my future academic & career decisions	Mentoring aspect of AEOP programs is valuable	I stayed in touch with my mentor after the AEOP program
Agree	63%	59%	43%	50%	63%	29%
Somewhat Agree	24%	25%	29%	27%	22%	17%
Somewhat Disagree	5%	7%	13%	10%	6%	14%
Disagree	8%	9%	15%	12%	8%	40%

Research Question #7 – Are there measurable changes in teacher approaches to teaching research concepts within STEM practices, and careers after participation in AEOP (RESET)?

There are no findings to report on this research question in FY20. It is anticipated that data will begin to be collected for this research question in FY22 – when it is possible to gather videos of teachers in face-to-face classrooms of their practice prior to and following participation in RESET.

PRIORITY THREE: Sustainable Infrastructure

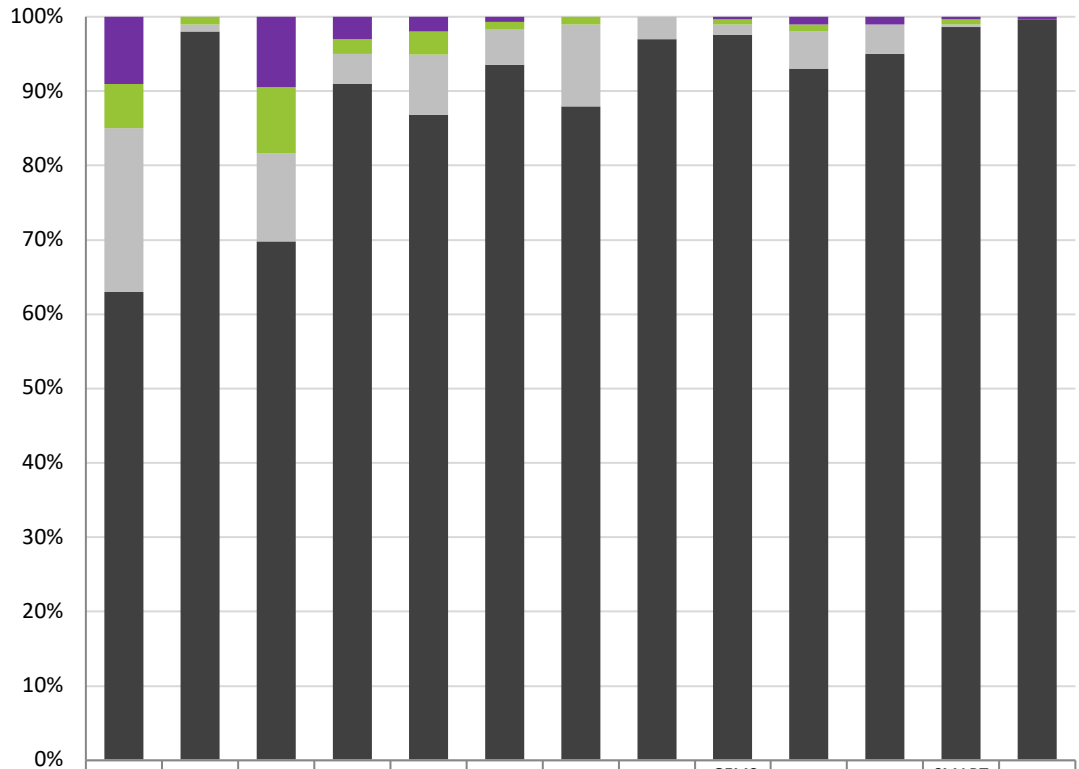
Research Question #8 - To what extent do alumni report increased awareness of and/or interest in AEOP opportunities?

More than half of alumni (60%) reported being familiar with other AEOP. And 79% said they were interested in participating in other AEOP in their future.

Research Question #9 - To what extent do alumni report participation in an AEOP program multiple times, in other AEOP elements, or in other DoD workforce development programs?

Chart 24 shows alumni survey respondents' past participation in AEOP. Alumni participants were representative of all programs. However, eCM had the largest proportion of past participants with 37% of survey respondents noting they had participated in this program at least once. GEMS (30%), JSHS (14%), and REAP (12%) also had strong representation among alumni survey participants. Further, alumni survey participants reported receiving each of the AEOP scholarships: SMART (1%) and NDSEG (<1%).

Chart 24: Alumni Participation in AEOP Programs (n = 505-543)



	eCybermission	JSS	GEMS	UNITE	JSHS	SEAP	REAP	HSAP	GEMS Near Peer Mentors	CQL	URAP	SMART College Scholarship	NDSEG
Three or more times	9%	0%	9%	3%	2%	1%	0%	0%	0%	1%	1%	0%	0%
Twice	6%	1%	9%	2%	3%	1%	1%	0%	1%	1%	0%	1%	0%
Once	22%	1%	12%	4%	8%	5%	11%	3%	1%	5%	4%	0%	0%
Never	63%	98%	70%	91%	86%	94%	88%	97%	98%	93%	95%	99%	100%

Alumni reported strong interest in participating in other AEOP, and most alumni are familiar with other AEOP (Table 56). More than half of alumni (60%) indicated that they were familiar with other AEOP (54% in FY19), and 79% reported being interested in participating in other AEOP (75% in FY19).

Table 56. AEOP Alumni Awareness of and Interest in Other AEOP	
Item	**Percentage**
I am aware of other AEOP that I have not participated in yet. (n=558)	
Agree	31%
Somewhat Agree	29%
Somewhat Disagree	16%
Disagree	24%
I am interested in participating in other AEOP programs. (n=556)	
Agree	45%
Somewhat Agree	34%
Somewhat Disagree	11%
Disagree	10%

7 | Summary of Findings

The 2020 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 57 and 58.

Table 57. 2020 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	**Slight decline in overall student participation.** There was an 19% decrease in student participants across the AEOP in FY20 (23,483 in FY20 compared to 28,947 in FY19). The timing of the COVID-19 pandemic created disruption for spring programming – some of which abruptly stopped and other AEOP paused to develop and implement a plan to move forward with virtual delivery or modified face-to-face opportunities. While enrollment for most programs was slightly less than in FY19 (CQL, -22%; eCM, -21%; GEMS, -26%; URAP, -9%) two programs were significantly impacted (REAP, -49%; SEAP, -74%). However, five programs experienced growth in FY20 despite challenges (HSAP, 10%; CII, 29%; Unite, 2%, RESET, 23%, JSHS, 31%).
	Slight decline in overall adult participation. A total of 5,066 adults, including K-12 teachers and Army and DoD S&Es, engaged in AEOP. Adult participation decreased by 19% as compared to FY19 (6,138) which was expected and aligned with the corresponding decrease of student participants due in part to the COVID-19 pandemic.
Finding #2	**Decline in participation for apprenticeship programs overall.** While participation in HSAP grew in FY20 by 10% compared to FY19, enrollment overall for apprenticeship programs decreased by 37%. Programs hosted at Army/DoD laboratories were significantly impacted as CQL declined 22% and SEAP participation was 74% less in FY20. REAP, a high school apprenticeship program hosted at university sites also experienced a 49% drop, and URAP had 9% fewer participants.
Finding #3	**Decline in number of applications to participate in AEOP while FY20 placement rates remained similar to FY19.** The number of applications that were received for the AEOP overall in FY20 from student participants was 31,347, which was considerably lower (18%) than FY19 (38,339) but expected due to COVID-19 challenges. However, the overall placement rate across AEOP for FY20 was similar to that of FY19 (75% in FY20 compared to 76% in FY19). Resulting placement rates by program (as applies) were as follows: • CQL placed 27% of applicants in FY20 (31% in FY19) • GEMS placed 48% of applicants in FY20 (56% in FY19)

	• HSAP placed 7% of applicants in FY20 (4% in FY19) • SEAP placed 3% of applicants in FY20 (8% in FY19) • Unite placed 61% of applicants in FY20 (54% in FY19) • URAP placed 19% of applicants in FY20 – (the same as FY19)
Finding #4	**AEOP continued to serve underserved populations and served a larger proportion of Underserved students in FY20 as compared to FY19.** The AEOP continued to prioritize the participation of students from traditionally underserved groups, per the AEOP definition of underserved (Underserved): *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, 52.5% of AEOP student participants in FY20 met the AEOP definition of Underserved, like FY19 when 56% of student participants met the definition of Underserved. As in FY19, REAP and Unite served a population of students that was comprised of over 90% Underserved participants (94% and 95% respectively). eCM had more than 50% Underserved participants. HSAP, JSHS, and GEMS had between 30% and 49% Underserved participation. Three apprenticeship programs included less than 30% Underserved students, CQL (26%), SEAP (21%), and URAP (29%).
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, student participants reported engaging in STEM practices significantly more frequently in their AEOP compared to in their typical school experiences, indicating that AEOP exposed participants to more intensive engagement in STEM than they typically experience in school. Significant differences ranged from medium to extremely large effect sizes.
Finding #6	**Participants reported increased STEM competencies, STEM skills, STEM knowledge, STEM practices, and confidence in STEM after participating in AEOP.** • Participants from all programs reported gains in their STEM knowledge after participating in AEOP. All programs averaged between "some" and "large" gains, with the exceptions of eCM which reported small to medium gains. • AEOP participants across all programs reported gains in their STEM competencies. CQL, eCM NJ&EE, JSHS, REAP, SEAP, Unite, and URAP all reported medium to large gains, while GEMS, and eCM reported small to medium gains. • Participants in each program reported gains in their 21st Century skills. Most programs reported slightly lower gains in FY20 compared to FY19 except for eCM NJ&EE and SEAP which reported slightly greater gains. • Participants in all FY20 AEOP reported some level of STEM identity gains which were at similar ranges to FY19 findings by program, with CQL, eCM NJ&EE, GEMS, HSAP, JSHS, REAP, SEAP, Unite, and URAP all reporting medium to large gains. eCM overall reported small to medium gains. • As in past years, students were most likely to agree strongly that AEOP impacted their confidence in their STEM knowledge, skills, and abilities, with

	CQL, eCM NJ&EE, GEMS, HSAP, JSHS, REAP, Unite, and URAP all reporting 80% or higher agreement.
Finding #7	**Participants reported positive attitudes toward Army/DoD STEM Research.** Most participants across programs agreed that Army/DoD research and researchers advance science and engineering fields. More than 80% participants across AEOP agreed that: Army/DoD research and researchers advance science and engineering fields (range 84%-100%); develop new cutting-edge technologies (range 84%-100%); DoD researchers solve real-world problems (range 88%-100%); and DoD research is valuable to society (range 87%-100%).
Finding #8	**Evaluation findings indicated that the AEOP exposed participants to STEM careers generally and to Army and DoD STEM careers and indicated that participating in AEOP increased participants' interest in pursuing STEM careers.** Findings revealed that CQL, eCM NJ&EE, GEMS, and Unite participants reported 75% or higher agreement with learning about three or more STEM jobs or careers in the program. However, students in eCM, HSAP, and URAP did not have this same opportunity, as participants reported less than 50% agreement. Three programs experienced growth in this area since FY19 as CQL, HSAP, JSHS had an increase of percentage of students reporting learning about three or more STEM careers in FY20. Regarding learning about DoD/Army STEM careers, AEOP participants reported this to be lower than for STEM careers overall during their programs. Participants in CQL, eCM NJ&EE, and SEAP had 50% of more agreement that they learned about three or more DoD/STEM careers. GEMS and Unite had less than 50% agreement, while URAP and eCM reported less than 20% agreement overall. Students reported 50% or more agreement that participation in their AEOP increased their interest in pursuing a STEM career for all programs in FY20 except for eCM. Similarly, students also reported 50% or more agreement that after their participation in AEOP they were more interested in a career in STEM with the DoD/Army in all programs except for eCM.
Priority 2: STEM Savvy Educators *Support and empower educators with unique Army research and technology resources.*	
Finding #1	**AEOP adult participants (i.e., mentors, S&E's, Team Advisors, teachers) reported use of effective mentoring strategies across the AEOP in FY20.** Mentors increased their agreement with reported use of effective mentoring strategies across the AEOP in FY20 for most programs despite many working with students at a distance. More than 70% of mentors reported establishing the relevance of learning activities, while 60% or more used strategies including: supporting the diverse needs of students, collaboration and interpersonal learning opportunities, and authentic STEM learning opportunities. Regarding introducing students to STEM academic and career pathways, there was slightly less agreement (50% or more) across programs with the lowest agreement coming from HSAP mentors at only 30%.
Finding #2	**AEOP participants continued to be satisfied with the support received from their mentors/S&Es/Team Advisors/teachers.** Nearly two-thirds of students or more (range 64%-88%) across AEOP indicated high levels of satisfaction with their program mentoring and instruction. Compared to FY19, student reported levels of

	mentoring satisfaction were higher in FY20 for GEMS, HSAP, REAP, and Unite. However, student levels of mentoring satisfaction declined from FY19 to FY20 in CQL, SEAP, and URAP.
Priority 3: Sustainable Infrastructure *Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.*	
Finding #1	**In FY20, AEOP participants shared the various ways they learned about programs indicating personal connections remain the predominant mode of communicating opportunities. However, some programs reported their main source was the AEOP website this year.** Participants from the various programs reported slightly different modes of learning about AEOP. HSAP and REAP indicated that the AEOP website was the primary way they learned about AEOP. Unite reported their school/university website, newsletter, or email messages were how they learned of about their programs. Teachers in K-12 or faculty at universities were the primary mode of connecting with AEOP for eCM, URAP, and JSHS. A person working with the DoD or Army was the main connection for CQL. For GEMS participants, a past GEMS student was how they learned about the program. Finally, SEAP participants reported friends were the main source of learning about AEOP. Social media was not a significant mode of learning about AEOP for any program, with less than 5% agreement across the AEOP.
Finding #2	**A percentage of FY20 participants have been retained in the AEOP pipeline through participation in some AEOP multiple times and other AEOP to some extent.** Several FY20 students reported participation in AEOP previously including repeat participation percentages by program of GEMS (48%), eCM (28%), and JSHS (22%). However, fewer numbers of AEOP students reported participation in other programs previously – with the highest percentages reported for GEMS to SEAP (43%), Unite to REAP (26%), and GEMS to CQL (14%).
Finding #3	**Few AEOP adults reported discussing other AEOP with student participants and as a result – only a small percentage of students reported awareness of other AEOP. AEOP students reported little awareness of other AEOP. However, many students expressed interest in participating in AEOP in the future.** In FY20, the majority of AEOP participants (more than 50%) in eCM, GEMS, JSHS, and URAP reported no awareness of many, if not all the other AEOP. Further, only a very small percentage of AEOP adults (teachers, mentors, Team Advisors) reported discussing AEOP with their participants in FY20. Less than 50% of adults in programs including CQL eCM, GEMS, HSAP, JSHS, SEAP, Unite, and URAP – discussed any AEOP with their students besides the actual program they were enrolled in for FY20 – except for REAP, where 30% or more adults did discuss other AEOP with participants. AEOP students expressed interest in participating in other AEOP programs in the future. Programs including GEMS, Unite, and eCM garnered the most future interest in multiple programs across the AEOP from FY20 participants. Additionally, HSAP students were interested in URAP (88%), REAP students in URAP (82%) and CQL (53%), SEAP students in URAP (67%) and CQL (67%), CQL students in URAP (42%), and URAP students in CQL (25%).
Finding #4	**Participation rates in the AEOP evaluation decreased slightly in FY20.** Participation in the evaluation questionnaire decreased slightly overall from 16%

	in FY19 to 13% in FY20. COVID-19 challenges including lack of face-to-face programming made evaluation recruitment and completion a more arduous task for AEOP. Percentage of student participation in the evaluation survey for FY20 was at an acceptable rate for eCM NJ&EE (72%), Unite (70%), GEMS (44%), URAP (33%), and CQL (33%). Other programs fell below desirable response rates in FY20 including HSAP (25%), REAP (20%), eCM (13%), SEAP (11%), and JSHS (9%). Adult participation in the FY20 evaluation survey was also lower than desired, with only eCM (32%) in the acceptable range. Other program response rates were as follows: URAP (26%), Unite (23%), REAP (21%), SEAP (14%), GEMS (11%), CQL (7%), JSHS (5%), and HSAP (4%).

Table 58. 2020 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 (83 to 95% agreement). Top areas of interest overall included: learning about new things in STEM (95%); participating in STEM community service projects (93%); participating in STEM camps, clubs, or competitions (%); participating in STEM projects at universities/professional settings (93%); taking STEM electives (93%); earning a STEM degree (91%); and pursuing a STEM career (91%). STEM Activities that AEOP Alumni reported engaging in most often included: learning about new STEM things (84%), solving math/science puzzles (77%), and talking with friends/family about STEM (69%).
Finding #2	**Alumni are engaged in pursuing STEM degrees and certifications.** 43% of AEOP alumni respondents in the longitudinal study reported they have graduated from high school. For those respondents that have graduated from high school, the post-secondary enrollment is as follows: STEM certificate program (5%), associate degree program (6%), bachelor's degree program (22%), and graduate degree program (6%). Additionally, some AEOP alumni have completed programs of post-secondary study. For those responding to the longitudinal study, there were individuals who had completed STEM certificate/training (22%), associate degree (4%), bachelor's degree (12%), master's degree (6%), doctoral degree (4%), and the remainder of AEOP alumni who had graduated high school did not indicate their progress toward pursuing post-secondary education (13%).
Finding #3	**Alumni hold positive views toward the AEOP and Army/DoD STEM.** In FY20, nearly all alumni indicated that they believe Army/DoD research is valuable to society (95%) and solves real-world problems (94%). Further, alumni understood the Army/DoD develops new, cutting-edge technologies (93%). Alumni reported their STEM knowledge had been increased because of participation in AEOP (90%).
Finding #4	**Alumni report awareness of and interest in STEM careers generally, as well as with the Army/DoD specifically.** Most alumni indicated that they were interested in pursuing a STEM career (88%). Approximately two-thirds indicated they were aware of Army/DoD STEM careers (65%), and 59% indicated they were interested in pursuing an Army/DoD STEM career.

Finding #5	**AEOP Alumni are actively working in STEM or seeking a STEM position for now or in the future.** The majority of AEOP alumni reportedly plan to seek a STEM career position in the future (81%) and some have already applied for STEM-focused job positions (25%). Interestingly, 16% of AEOP alumni are already working in a STEM career position and 4% are working for the Army/DoD 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 AEOP.** More than three-quarters of alumni reported that their AEOP mentoring experience was very positive (87%), enhanced their learning (84%), and was a valuable aspect of their AEOP (85%). Many alumni also believed their AEOP mentor helped influence their future academic career decisions (77%) and helped them learn about Army/DoD careers (72%). Significantly, nearly half of all AEOP alumni reported (46%) continuing to stay in touch with their mentors following participation in the program(s).
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 AEOP, and the majority of alumni are familiar with other AEOP.** More than half of alumni (60%) indicated that they were familiar with other AEOP (54% in FY19), and 79% reported being interested in participating in other AEOP (75% in FY19).

What AEOP Participants are saying……

*"I absolutely loved my experience with [**CQL**]! My mentor and my coworkers in the building went out of their way to make me feel like part of the team and helped me grow and learn as an engineer. I felt that I was a valuable resource to my branch and that I was helping my group meet our goals. I hope that I can continue to work with them in the future."* (CQL Apprentice)

*"I have had a very rewarding experience with [**CQL**] and I enjoy helping to develop young talent."* (CQL Mentor)

*"Participating in **eCYBERMISSION** was really fun. It helped me develop an interest in science and engineering, which I had never had before. I've always wanted to help the world, and …eCYBERMISSION made that dream come true. I also made some new friends along the way who shared my interests and helped the project become real.* (eCM-R Student)

*"The **eCYBERMISSION** experience has changed my students' lives for the better. They're are LOVING STEM and the project-based learning style. The day after submission deadline, the kids were already talking about next year's topic ideas. The kids grew leaps and bounds in their critical thinking, interest in solving problems, and ability to communicate. BEST. STEM. COMPETITION. EVER."* (eCM Team Advisor)

*"I had a great time in **GEMS**…I learned new things that school didn't teach us. I also learned more about STEM and STEM careers. I learned new skills that can help me in future STEM classes. I really enjoyed the labs that **GEMS** provided because it gave me something to do and it kept me occupied."* (GEMS Student)

*"The [Army lab] team was amazing in their ability to adapt quickly to multiple problems that nobody could have anticipated. I've worked with multiple STEM-related camps/competitions with students from high-school through undergrad/grad and [**GEMS**] was one of the most enjoyable camps of all of them. That's even more impressive given the virtual aspect of this one. "* (GEMS Mentor)

*"I enjoyed [**HSAP**] very much. I learned skills and information that I would not have learned otherwise."* (HSAP Apprentice)

*"**JSHS** has been one of my most enjoyable experiences in my high school STEM career. It has taught me the value of scientific research and the value of conferences and presenting one's research. JSHS has taught me the value of diversity in STEM and the importance of scientific research for shaping the future."* (R-JSHS Student)

*"**JSHS** has been giving opportunities for our students to excel in the field of STEM. As a teacher and mentor, I saw a lot of growth from my students since the time they were preparing until the day of presentation. JSHS enabled them to think beyond. Thank you **JSHS**!"* (JSHS Mentor)

*"I greatly enjoyed [**REAP**]. At first, I had reservations because I've never done research in general, but my mentor helped us all assimilate into the process and explained each step…I also got experience in research and connections with STEM mentors…. Overall, this program exceeded my expectations, and I would definitely say I was satisfied."* (REAP Apprentice)

*"[**REAP**] has a significant impact on students in my area, and by the program focusing on under-represented students, the impact is made even greater."* (REAP Mentor)

*"I learned so much [in the **RIT Apprenticeship Course]** about the aspects of STEM that I had never thought about, and skills that I need like communication or asking questions. I would recommend any STEM student to take the course."* (RIT Apprenticeship Course Student Participant)

*"I really enjoyed [**SEAP**]. It has been the best research experience I have ever had. I learned so much about a fascinating topic and had a great mentor who was always available to help. I got to present to and interact with several other researcher scientists. I am even going to continue my research during the school year because I had such a positive experience."* (SEAP Apprentice)

*"[**SEAP** is] all about developing and inspiring students to continue in STEM."* (SEAP Mentor)

*"I really love the **Unite** program! I love participating in research and classes with new friends. Doing research is fun, and all of the teachers are super nice. I like learning about college from this perspective."* (Unite Student)

*"I found the [**Unite**] experience to be phenomenal, despite the limitations imposed by the pandemic situation. Our administrative support was spectacular… It was an honor to be part of the program this summer. Thank you for the opportunity!"* (Unite Mentor)

*With [**URAP**], I was able to work with a knowledgeable mentor in the exciting field of machine learning and in a communicative team. Throughout my experience, I learned the joy and struggle of doing research, met several STEM researchers, and was ultimately inspired to further my education."* (URAP Apprentice)

*"[**URAP**] provided funds to work with talented students that helped further the broader research goals. The teaching and interaction with students helped hone our ideas, and we ended up learning from the students as well."* (URAP Mentor)

Recommendations for FY20 Program Improvement/Growth

FY20 was another successful year of program implementation for the AEOP. Thousands of students in K-12 schools were engaged in STEM programs, competitions, and apprenticeships including a majority percentage of underserved students (53% for FY20 compared to 56% in FY19). 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 (students and adults) and this is even more true for FY20 and challenges stemming from the global COVID-19 pandemic. Evidence-based recommendations for FY21 and beyond that will drive continuous program improvement are presented along with respective 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. Despite challenges of a global pandemic, AEOP engaged over 20,000 students in STEM programs, competitions, and apprenticeships in FY20 – experiencing only an 19% decrease overall (23,483, FY20; 28,947, FY19) though the population of underserved students engaged in AEOP was maintained at above 50% (53% for FY20; 56% for FY19). Most AEOP had between 9-25% fewer students (CQL, eCM, GEMS, URAP), while other programs experienced between 2-31% growth in participation for FY20 (CII, HSAP, JSHS, Unite, RESET,). However, some AEOP had greater drops in participation for FY20 (SEAP, 74% and REAP, 49%). It appears that COVID-19 is a pervasive challenge globally and will continue to require most AEOP, if not all, to operate in a virtual format for FY21. It is recommended that AEOP leverage what worked for program delivery and participant recruitment in FY20 and beyond to work toward maintaining participation rates and focus on new strategies for growing participation.

Examine means for increasing infrastructure to grow placement rates for AEOP. Placement rates in FY20 remained steady compared to FY19 at around 75% indicating that overall AEOP program capacity was not expanded this year. There remains a greater demand for AEOP programming than the present capacity of the consortium. The recommendation for FY21 and beyond is to consider new strategies, programming, and outreach plans that would support the growth in opportunity for students within the AEOP.

Examine AEOP social media efforts. AEOP participants in FY20 indicated that social media was the least frequent manner that individuals learned about the program (less than 5%). There is considerable effort that is invested into social media and branding of the AEOP. It is recommended that AEOP examine the goals of various communication outlets and potentially consider modifications that may make the outcome of these efforts yield more engagement of current and future participants.

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

Build out a strategic focus on supporting participants by introducing STEM educational and career pathways. AEOP participants are clearly interested in pursuing STEM careers in the future, and this is an area of focus and promotion that could be strengthened across the AEOP. In the mid-to-long term study of AEOP alumni, findings indicate that:

- 88% of alumni are interested in STEM careers;
- 65% of alumni are aware of DoD STEM;
- 59% of alumni are interested in DoD STEM careers;
- 25% of alumni have applied for STEM jobs.
- 16% of alumni are already working in STEM;
- and 4% of alumni are working in STEM for DoD.

As in FY19, mentors less frequently reported including activities that support students' STEM educational and career pathways within AEOP. Though progress has been made in other areas of important mentoring strategies, focus on STEM educational and career pathways has been a pervasive challenge, as only 30% of adults delivering high school apprenticeship programs reported discussing STEM post-secondary or career possibilities with students. This presents a great opportunity for AEOP to grow the value added for student participants. It is possible that the AEOP membership and communications teams could work to develop resources for AEOP to use, as the highlighting of STEM experts and alumni in webinars is already an activity that is in progress. As in FY19, 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.

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

Increase awareness of AEOP programs. As in previous years, participant awareness of other AEOP was evaluated in FY20. Findings indicated that more than half of eCM, GEMS, JSHS, and URAP students had not heard of any other program besides their current program. Additionally, less than 50% of adults in CQL, eCM, GEMS, HSAP, JSHS, SEAP, URAP, and Unite reported discussing any other AEOP with their students. Further, 60% of AEOP alumni had not hear of any other AEOP besides the program they had participated in. As in previous years, it is recommended that more effort be expended to provide resources to all current AEOP participants regarding AEOP programming opportunities.

AEOP Pipeline. One of the thrusts of the AEOP consortium is to have a vibrant pipeline of opportunities to engage students from underserved populations across their K-16 continuum. To this end, several

programs have had students participate in multiple years as reported in the FY20 evaluation (GEMS, 48%; SEAP 29%; eCM, 28%; Unite, 28%; JSHS, 22%). When looking at how many who reported in FY20 that they moved from one program to another in the progression from elementary to middle to high school to college, the percentages are much smaller (GEMS to SEAP, 43%; Unite to REAP, 26%; GEMS to CQL, 14%; all others 8% or less). Alumni who responded to the mid-to-long term evaluation survey reported 79% interest in participating in participating in another AEOP. It is recommended that AEOP examine current means of communicating pipeline opportunities and determine what other potential strategies could be employed to engage students in multiple AEOP.

Participation in AEOP evaluation. AEOP FY20 evaluation participation overall was much lower than desired (13%, FY20 compared to 16%, FY19). It is recommended that the AEOP programs continue to communicate the importance of participation in the evaluation early on, provide time within programming to complete the surveys if possible, and provide multiple reminders across the duration of their program of the importance of the evaluation. Adult participation in FY20 evaluation efforts was also much lower, with less than 30% response rate from all apprenticeship programs (URAP, REAP, SEAP, HSAP, and CQL), as well as Unite and JSHS. eCM was the only program with more than 30% of adults participating. Engaging local adults responsible for the program in the evaluation requirements is key to buy-in and it is recommended that the AEOP develop new strategies to grow participation.