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Army Educational Outreach Program

College Qualified Leaders (CQL)

2017 Annual Program Evaluation Report

PART 1: Executive Summary

February 2018

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ARMY EDUCATIONAL OUTREACH PROGRAM

1 | AEOP Consortium Contacts

U.S. Army Contacts

Matthew Willis, Ph.D.
Director, Laboratory Management
Office of the Assistant Secretary of the Army
Acquisition, Logistics, and Technology
matthew.p.willis.civ@mail.mil

Andrea Simmons
Army Educational Outreach Program (AEOP) Director
on behalf of the Office of the Deputy Secretary of the
Army for Research and Technology
andrea.e.simmons.ctr@mail.mil

AEOP Cooperative Agreement Manager

Louie Lopez
AEOP Cooperative Agreement Manager
U.S. Army Research, Development, and
Engineering Command (RDECOM)
louie.r.lopez.civ@mail.mil

Battelle Memorial Institute – Lead Organization

David Burns
Project Director, AEOP CA
Director of STEM Innovation Networks
burnsd@battelle.org

CQL Program Administrators

Pamela Hampton
Apprenticeships Lead
Academy of Applied Science
phampton@aas-world.org

Evaluation Team Contacts – Purdue University

Carla C. Johnson, Ed.D.
Evaluation Director, AEOP CA
carlacjohnson@purdue.edu

Toni A. Sondergeld, Ph.D.
Assistant Director, AEOP CA
tonisondergeld@metriks.com

Janet B. Walton, Ph.D.
Assistant Director, AEOP CA
walton25@purdue.edu

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2 | Executive Summary

The Army Educational Outreach Program (AEOP) vision is to develop a diverse, agile, and highly competent STEM talent pool. AEOP seeks to fulfill this mission by providing students and teachers nationwide a collaborative and cohesive portfolio of Army-sponsored science, technology, engineering and mathematics (STEM) programs that effectively engage, inspire, and attract the next generation of STEM talent through K-college programs and expose participants to Department of Defense (DoD) STEM careers. AEOP provides this portfolio of programs via a consortium, formed by the Army Educational Outreach Program Cooperative Agreement (AEOP CA), that engages non-profit, industry, and academic partners with aligned interests. The consortium provides a management structure that collectively markets the portfolio among members, leverages available resources, and provides expertise to ensure the programs provide the greatest return on investment in achieving the Army's STEM goals and objectives.

The College Qualified Leaders (CQL) program, managed by the Academy of Applied Science (AAS), is a program that matches talented college students (herein referred to as apprentices) with practicing Army Scientists and Engineers (Army S&Es, herein referred to as mentors), creating a direct apprentice-mentor relationship that provides apprentice training that is unparalleled at most colleges. CQL allows alumni from Gains in the Education of Mathematics and Science (GEMS) and Science and Research Apprentice Program (SEAP) to continue their relationships with mentors and/or laboratories, and also allows new college students to enter the program. CQL offers apprentices the provision of summer, partial year, or year-round research at Army laboratories, depending on class schedules and school location. CQL apprentices receive firsthand research experience and exposure to Army research laboratories. CQL fosters desire in its participants to pursue further training and careers in STEM while specifically highlighting and encouraging careers in Army research.

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

2017 CQL Fast Facts	
Description of program	STEM Apprenticeship Program – Summer, at Army laboratories with Army S&E mentors
Participant Population (who is eligible for program)	college students
Number of Applicants	565
Number of Registered Participants	229

Percent Underserved registered participants	22%
Placement Rate	41%
Number of Army S&Es	206
Number of Army/DoD Research Laboratories	12
Number of Colleges/Universities	102 (4 HBCU/MSI)
No. of DoDEA Students	NA
No. of DoDEA Schools	NA
Total Cost	$1,874,600
Stipend Cost (paid by participating labs)	$1,745,018
Administrative Cost to AAS	$120,154
Cost Per Student Participant	$ 8,186

Summary of Findings

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

2017 CQL Evaluation Findings	
Participant Profiles	
CQL enrollment declined slightly in FY17; participation by females increased while participation from underserved racial/ethnic groups declined slightly.	Overall enrollment for CQL decreased by 3% in FY17 (229 participants), falling short of the program goal of 246 participants, although 17% more individuals applied to the program (565), exceeding the program goal of 517 applicants, as well as number of overall applications by 8%.
	The proportion of female participants —a population that is historically underserved in engineering fields – increased to 54% in FY17 (compared to 46% in FY16).
	CQL continued to serve students from historically underserved race/ethnicity groups, however the majority of enrolled apprentices (81%) identified themselves as "White" or "Asian" (85% in FY16). The percentage of Black or African American decreased to 7% in FY17 (11% in FY16) although the percentage of Hispanic or Latino participants increased slightly to 5% (3% in FY16). Only about 12% of enrolled participants identified themselves as being from underserved racial or ethnic groups (13% in FY16), indicating that growing the diversity of CQL participants is an area for continued investment. Over a fifth of

	participants (22%), however, fell into the category of "underserved" using the AEOP definition of underserved students.[1]
Most CQL participants had not previously participated in other AEOPs and many had not heard of other AEOPs for which they may be eligible suggesting that strengthening the pipeline of AEOPs is an area with potential for growth.	Nearly two-thirds of apprentices (65%) reported having never participated in AEOPs in the past. Apprentices who had participated in AEOPs were most likely to have participated in CQL (15%), SEAP (13%), and GEMS (9%). This represents a decline in previous AEOP participation compared to FY16 when 32% had previously participated in CQL, 14% in SEAP, and 19% in GEMS and fell short of the program goal of 35% of participants being GEMS or SEAP alumni.
	Nearly a third or more of apprentices had never heard of the NDSEG fellowship (38%), URAP (29%) and the GEMS Near Peer Mentor Program (41%), and 20% had not heard of the SMART Scholarship.
Actionable Program Evaluation	
CQL participants continued to learn about AEOP largely through personal connections.	The most frequently cited sources of information about AEOP for apprentices were someone who works with the DoD (33%), someone who works with the program (28%), and someone who works at the school/university apprentice attends (25%).
	Approximately half (52%) of mentors reported learning about AEOP through someone who works with the DoD. Other sources of information (cited by 16% of participants) included the AEOP website and past participants of the program.
CQL apprentices were motivated to participate in CQL primarily for the learning opportunities presented by the program	Apprentices were motivated to participate in CQL by a variety of factors, however the most frequently cited motivators for participating in CQL related to apprentices' educational interests and learning. More than 80% of apprentices indicated that a desire to learn something new or interesting (91%), interest in STEM (90%), desire to expand laboratory or research skills (89%), learning in ways that are not possible in school (81%), and opportunity to use advanced laboratory technology (80%) motivated them to participate in CQL.
CQL apprentices were engaged in STEM practices more intensely than they are in their typical school experiences	Apprentices reported consistently engaging in STEM practices. The STEM practices apprentices reported being engaged in most frequently (weekly or every day) during CQL were interacting with STEM researchers (94%) and working with a STEM researcher or company on a real world STEM research project (89%).
	Apprentices' engagement in STEM practices in CQL were significantly more intense than their engagement in the same practices in school (effect size is extremely large with d = 2.61).

[1] 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 with disabilities; students with English as a second language; first-generation college students; students in rural, frontier, or other Federal targeted outreach schools; females in certain STEM field.

Mentors used strategies associated with all areas of effective mentoring	Mentors helped make learning activities relevant to students by using strategies such as becoming familiar with their students' backgrounds and interests (98%) and giving students real-life problems to investigate or solve (91%).
	Mentors supported students as learners by using strategies such as a variety of teaching and/or mentoring activities to meet the needs of all students (83%) and directing students to other individuals or programs for additional support as needed (80%).
	Mentors supported students' development of collaboration and interpersonal skills by using strategies such as having students listen to the ideas of others with an open mind (96%) and having students work on collaborative activities or projects as members of teams (87%).
	Mentors supported students' engagement in authentic STEM activities by using strategies such as allowing students to work independently to improve their time management skills (100%) and providing students with constructive feedback to improve their STEM competencies (98%).
	Mentors supported students' STEM educational and career pathways by using strategies such as asking students about their educational and career interests (96%) and discussing STEM career opportunities within the DoD or other government agencies (89%).
CQL promoted apprentice awareness of DoD STEM careers; besides simply participating in CQL, mentors and program administrators or site coordinators were the most impactful resources to promote this awareness.	A large majority of apprentices (94%) reported learning about at least one STEM job/career, and most (72%) reported learning about 3 or more general STEM careers. Similarly, a large majority of apprentices (92%) reported learning about at least one DoD STEM job/career, although somewhat fewer (66%) reported learning about 3 or more Army or DoD STEM jobs during CQL.
	Apprentices most frequently (88%) selected their mentors as being somewhat or very much impactful on their awareness of DoD STEM careers. The vast majority of apprentices reported that they either had not experienced AEOP resources such as the AEOP brochure and AEOP on social media or found them not impactful on their awareness of DoD STEM careers.
	The program administrator or site coordinator was perceived to be somewhat or very much useful for exposing students to DoD STEM careers by 46% of responding mentors. Most mentors had not experienced AEOP materials such as AEOP on social media (91%), and the AEOP brochure (85%) as resources for exposing students to DoD STEM careers.
Apprentices' awareness of other AEOPs increased as a result of their CQL participation; besides CQL participation, mentors and program administrators or site coordinators were the	Over three-quarters (77%) of apprentices reported that CQL influenced their awareness of AEOPs and 80% reported that participating in CQL resulted in an increased interest in participating in other AEOPs.
	Apprentices indicated that participation in CQL (81%) and their CQL mentors (73%) were at least somewhat impactful on their awareness of other AEOPs. Approximately two-thirds or more of responding apprentices had not experienced AEOP resources such as AEOP on social media (72%) and the AEOP brochure (65%).

most impactful resources to promote this awareness.	Mentors indicated that participation in CQL (78%) and program administrators or site coordinators (48%) were at least somewhat useful (78%) for exposing students to AEOPs. Most mentors reported they did not experience materials provided by AEOP such as social media (91%), the AEOP brochure (78%), and the AEOP website (61%) as resources for exposing students to AEOPs.
Apprentices and mentors were highly satisfied with their CQL experiences, although in-processing and computer access continue to be areas of concern.	CQL features apprentices reported being most satisfied with included the teaching/mentoring provided during CQL (92%), the physical location of program activities (90%), and the amount of the stipend (89%). Few apprentices expressed dissatisfaction with most CQL program features although 17% of students were not satisfied with administrative tasks such as in-processing and networking and 8% were not satisfied with the timeliness of stipend payments.
	More than two-thirds of apprentices indicated being "very much" satisfied with all elements of their research experience (ranging from 67% - 84%). The vast majority of apprentices reported being at least "somewhat" satisfied with each experience (ranging from 80%-94%).
	The program improvements most frequently mentioned by CQL apprentices related to improvements in in-processing and CAC access followed by improvements to mentor communication with apprentices and improvements to the research experience such as providing more or more diverse work for apprentices and providing workshops or seminars.
	More than half of mentors reported being somewhat or very much satisfied with all program features. For example, 67% of mentors were at least somewhat satisfied with research abstract requirements and 63% with communications with CQL coordinators. Few mentors expressed dissatisfaction with program features although 17% reported being "not at all" satisfied with administrative tasks such as in-processing and network access.
	The program improvements most frequently mentioned by CQL mentors related to improvements in in-processing and CAC access, providing more information to mentors, improving communication with program organizers, providing mentors with more information about AEOP, and increasing the marketing and/or outreach activities for CQL.
Outcomes Evaluation	
CQL apprentices reported substantial gains in their STEM knowledge and competencies.	A large majority of apprentices reported gains in their STEM knowledge as a result of participating in CQL, with more than 80% indicating some gains or large gains in each area. For example, 90% of apprentices reported at least some gain in their in-depth knowledge of STEM topics and 91% in knowledge of research conducted in STEM fields. Apprentices' reports of CQL's impact on their STEM knowledge was shared by their mentors who reported similarly on a parallel item on the mentor questionnaire.
	Three-quarters or more of apprentices reported at least some gains on all STEM competencies. For example, a large majority of apprentices reported some gains or high gains in areas such as communicating about their experiments and explanations in different ways (92%), supporting an explanation with relevant STEM knowledge

	(84%), and considering different interpretations of data when deciding how the data answer a question (83%).
CQL apprentices experienced substantial gains in their 21st Century Skills.	Apprentices reported impressive 21st Century Skills gains as a result of participating in CQL. More than 85% reported that participation in CQL was responsible for some gains or large gains on each item associated with 21st Century Skills - skills such as problem solving and communication that are necessary across a wide variety of fields. For example, over 90% of apprentices reported some gains or large gains in making changes when things do not go as planned (94%) and communicating effectively with others (92%).
CQL apprentices aspire to continue their education after earning a Bachelor's degree.	Over three-quarters (82%) of apprentices reported that after participating in CQL they aspired to earn either a master's degree or a terminal degree (Ph.D. or terminal medical degree).
CQL apprentices have positive opinions about DoD researchers and research.	Apprentice's opinions about DoD researchers and research were overwhelmingly positively with more than 90% agreeing or strongly agreeing to statements such as: "DoD research is valuable to society" (95%) and "DoD researchers advance science and engineering fields" (94%).
CQL participants reported increased interest in engaging in STEM activities in the future.	Approximately 50% or more of apprentices indicated they were more likely or much more likely to engage in all STEM activities after CQL. For example, about three-quarter of apprentices indicated being more likely or much more likely to engage in working on STEM projects in a university setting (77%) and mentoring or teaching other students about STEM (73%).
CQL participants reported gains in their STEM identities.	More than three-quarters of apprentices reported some gains or large gains on all items associated with STEM identity (seeing oneself as capable of succeeding in STEM). For example, large majorities of apprentices reported at least some gain in their desire to build relationships with mentors who work in STEM (90%) and feeling prepared for more challenging STEM activities (88%).
CQL impacted apprentices' confidence in STEM, their career aspirations, and their awareness of and interest in other AEOPs.	Approximately two-thirds or more agreed that CQL contributed to their increased confidence in STEM, their interest in pursuing STEM in the future, their awareness of and interest in DoD STEM careers, and awareness of and interest in other AEOPs. For example, apprentices reported that CQL contributed to them having a greater appreciation about the Army or DoD research (93%); more awareness of Army or DoD research and careers (92%); increased confidence in their STEM knowledge, skills, and abilities (90%); and increased interest in participating in AEOPs in the future (80%).

Responsiveness to FY17 Evaluation Recommendations

The primary purpose of the AEOP program evaluation is to serve as a vehicle to inform future programming and continuous improvement efforts with the goal of making progress toward the AEOP priorities. In previous years the timing of the delivery of the annual program evaluation reports has precluded the ability of programs to use the data as a formative assessment tool. However, beginning

with the FY16 evaluation, the goal is for programs to be able to leverage the evaluation reports as a means to target specific areas for improvement and growth.

In this report, we will highlight recommendations made in FY16 to programs and summarize efforts and outcomes reflected in the FY17 APR toward these areas.

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

FY16 Finding: CQL should focus on growing the pool of applicants overall as well as for underserved groups. The significant decline in participation this year (60%) indicates that much more effort should go into recruiting potential apprentices – outside of the personal connections that are most frequently reported as the primary means of learning about and participating in CQL. Further, though percentages of underserved groups held steady at 13% in FY16, there should be continued focus on growing the representation of these groups in the CQL program. A suggestion for doing this may be to connect with more HBCUs/MSIs, as well as implementing other new methods to actively recruit students nationwide.

CQL FY17 Efforts and Outcomes: In FY17, AAS contacted 122 HBCU's to request a listing on career sites. Program opportunities were listed on 300 university career sites. Program opportunities were also listed on Internships.com which generated interest from all over the US. CQL student participation for AEOP's underserved population increased by 8% in FY17, which is significant since DoD labs have a unique process when selecting student applicants. DoD lab coordinators, not AAS, review applications. AAS will continue to target more HBCUs/MSIs in close proximity to DoD labs, and provide further guidance to lab coordinators that may assist in student selection process.

FY16 Finding: Personal relationships continue to play a key role in how students are recruited into CQL. In order to broaden and diversify the pool of applicants, the program may wish to revise recruitment and selection practices. In particular, AAS may want to consider how the CQL program is publicized to students. In addition, selection processes that ensure applicants are selected based on their qualifications and aptitudes rather than on their personal connections should be considered. These activities should be undertaken with mindfulness of the program goal of recruiting former AEOP participants into CQL, however. Since it is a goal of the program to recruit SEAP students into CQL, the program may wish to work with the SEAP program to ensure that the pool of applicants is broadened and diversified at that level as well.

CQL FY17 Efforts and Outcomes: In FY17, AAS contacted 122 HBCU's to request a listing on career sites. Program opportunities were listed on 300 university career sites. Program opportunities were also listed on Internships.com which generated interest from all over the US. Although, there was in increase in applications in FY17, due to the lack of mentors and decreased funding at the labs, there was not enough capacity for these students. Despite the challenges, the U2 participation increased by 8% in FY17. Similar to SEAP, selection of CQL applicants is at the discretion of the DoD labs. 53% (or 121) CQL participants

indicated that they had no prior AEOP experience, including SEAP. 15% (or 34) CQL participants indicated that they, did in fact, participate in SEAP. While the goal of the program is to recruit SEAP students into CQL, it appears that a high percentage of students are being selected with no prior AEOP experience. Since this percentage is so high, AAS will work with lab coordinators to determine if mentors are aware of the SEAP to CQL progression. In addition, further review shows that only 10% of the total CQL applicants in FY17 had participated in SEAP. AAS will continue to reach out to past SEAP participants to ensure that they are aware of the CQL program, as well as NDSEG and the SMART Program.

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

FY16 Finding: Since the number of available mentors places a limit on the number of apprentices the CQL program can accommodate, the program may want to consider what incentives it can provide for mentor participation. Mentors in focus groups suggested increased program outreach to potential mentors, program recognition of mentor efforts, and support in the form of overhead funding for mentors as means to increase the pool of CQL mentors. Other mentor recruitment strategies the program may wish to consider include highlighting potential benefits of apprentice involvement in mentors' projects, publicizing the work of apprentice-mentor teams, publicizing the professional accomplishments of former CQL apprentices, and recognizing mentors who exemplify outstanding mentorship practices.

CQL FY17 Efforts and Outcomes: AAS worked with lab coordinators to confirm the importance of CVENT application/registration. Throughout FY17, as an incentive and to increase mentor awareness and recognition, AAS worked with Metriks to profile CQL mentors. Several Alumni spotlights and blogs highlighted mentors throughout FY17. In addition, AAS provided Metriks with CQL apprentice/mentor teams for interviewing purposes. Mentors were also provided with CQL Certificates of Appreciation which were presented by lab coordinators.

FY16 Finding: In light of the program goal to have SEAP apprentices progress into CQL apprentice positions, the low percentage of CQL apprentices who had participated in SEAP is an area with room for growth. The program may wish to work with the SEAP program to ensure that the pipeline between the two programs is clear to both apprentices and mentors. Apprentice responses indicated that mentors are key resources in learning about other AEOPs and therefore efforts should be made to ensure that mentors are informed about the range of AEOPs and that GEMS and SEAP mentors are equipped with information about CQL. Because of the time constraints mentors face in working with students, however, the program should also consider ways to educate participants about AEOP opportunities that do not rely on mentors. Given the limited use of the AEOP website, print materials, and social media, the program should consider how these materials could be more effectively utilized to provide students with targeted program information.

CQL FY17 Efforts and Outcomes: Extensive marketing efforts were conducted to AEOP alumni, which resulted in more AEOP alumni participation in apprenticeships. AAS successfully assisted the RESET program in recruiting laboratory mentors to work with teachers in that program. AAS also helped to recruit volunteer judges for eCM this past year by reaching out to DoD lab coordinators and

university directors. Summer weekly AEOP news items were sent directly to the students regarding other AEOP program information, including the DoD STEM Career Guide. Cross promotion/marketing with GEMS is imperative to ensure a smooth transition to SEAP, and ultimately CQL. AAS will seek GEMS assistance with promoting SEAP, as a next step into the pipeline. AAS will continue to specifically target previous SEAP participants to ensure that they are aware of CQL. Information regarding NDSEG and the SMART program has also been added to FY18 promotional materials. Additional effort will be made regarding year-round or non-summer CQL students to ensure that they are included in the exchange of information.

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

FY16 Finding: The administrative difficulties noted in both FY14 and FY15 continued in FY16. While students indicated that their CQL experiences were mostly positive, problems with receiving stipends in a timely fashion and lack of computer access continued to color apprentice experiences. Likewise, some mentors reported considerable frustration with apprentice pay issues and computer access. The AAS should be mindful of these issues and leverage its past experience with administering apprenticeship programs to streamline processes and improve communication with apprentices.

CQL FY17 Efforts and Outcomes: Stipends were issued on time this year. AAS assisted lab coordinators with tracking stipends and funding. In FY17, applications opened earlier, and lab coordinators were encouraged to make selections earlier to allow more time for processing CAC cards and security clearances.

FY16 Finding: The continued decline in response rates for both the student and mentor questionnaires raises questions about the representativeness of the results. The program may want to consider emphasizing the importance of these evaluations with individual program sites and communicating expectations for evaluation activities. In addition, the evaluation instruments may need to be streamlined to reduce the time commitment of respondents.

CQL FY17 Efforts and Outcomes: Weekly emails were sent to lab coordinators, students, and mentors regarding survey completion. AEOP encouraged evaluation completion during calls with lab coordinators. Again, as with SEAP, mentors see little value in the survey because it offers them no feedback for improvements at the lab. The survey is only of value to AEOP. Perhaps the evaluation could be updated to offer relevant input for the lab and mentor which will still be of value to AEOP. Several mentors had previously reported that it would be helpful to receive useful feedback, by lab, to encourage program evaluation participation. In FY17, several outcome points were distributed to university directors, with positive feedback received. Therefore, in FY18, AAS will provide similar outcome data to DoD lab coordinators (for distribution to mentors) to show that mentors are making a difference. To assist in streamlining the evaluation process for students and mentors, following the FY17 APR, AAS sent the assessment team several evaluation updates for FY18.

Recommendations for FY18 Program Improvement/Growth

Evaluation findings indicate that FY17 was a successful year overall for the CQL program, as there continues to be increased interest in CQL, noted by 17% growth in applicants for FY17. Notable successes for the year include high levels of mentor and apprentice satisfaction with program features; evidence of strong apprentice gains in STEM knowledge, skills, and competencies; and apprentice interest in participating in AEOPs in the future. Apprentices and mentors continue to report high levels of satisfaction with mentor-apprentice relationships, and both groups likewise report strong apprentice gains in 21st Century skills. While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY18 and beyond:

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

1. As recommended in FY17, CQL should continue in FY18 to focus on growing the pool of applicants overall as well as for underserved groups. There were some gains in participation of females (54% compared to 46% in FY16) and Hispanic or Latino apprentices (5% compared to 3% in FY16). However, it is warranted to invest more focus and effort on broadening the participation of ethnic/racial groups including Hispanic or Latinos (beyond 5% overall) and Black or African American (only 7% of FY17 CQL group).

2. As in FY16, personal relationships continued to play a major role in FY17 in how students were recruited into CQL. AAS should continue investments that were started in FY17 to recruit more broadly and also follow up to provide expectations to labs that students outside of those mentors know of are included in program participation in FY18.

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

CQL should continue to recruit and grow the pool of available mentors to support apprentices. The CQL program goal of one-to-one mentoring provides deep and meaningful experiences for apprentices. However, without growing the number of adults to serve as mentors, the program will continue to have

unmet need.

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

As in FY16, mentor FY17 participation in the CQL evaluation is still below the desirable level (20% of population). Apprentice participation improved in FY17 to 47%. It is recommended that CQL continue to

strongly emphasize the importance of both mentor and apprentice participation in the CQL evaluation.