Army Educational Outreach Program

College Qualified Leaders

2014 Annual Program Evaluation Report

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Executive Summary

The College Qualified Leaders (CQL) program, managed by the American Society for Engineering Education (ASEE), is an Army Educational Outreach Program (AEOP) that matches talented college students and recent graduates (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 relationship with the mentor and/or laboratory, and also allows new college students to enter the program. CQL offers apprentices the provision of summer, partial year, or year-round research at the Army laboratory, 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 FY14 CQL program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The assessment strategy for CQL included questionnaires for students and mentors, three focus groups with students and one with mentors, and an annual program report compiled by ASEE.

2014 CQL sites included the US Army Research Laboratory – Aberdeen Proving Ground (ARL-APG), the US Army Research Laboratory – Adelphi (ARL-A), the Walter Reed Army Institute of Research (WRAIR), the US Army Medical Research Institute for Infectious Diseases (USAMRIID), the US Army Aviation & Missile Research Development and Engineering Center – Redstone Arsenal (AMRDEC), the Engineering Research and Development Center Construction Engineering Research Laboratory (ERDC-CERL), the US Army Medical Research Institute of Chemical Defense (USAMRICD), the US Army Center for Environmental Health Research (USACEHR), the Defense Forensic Science Center (DFSC), and the Engineering Research and Development Center in Vicksburg, MS (ERDC-MS).

2014 CQL Fast Facts	
Description	STEM Apprenticeship Program – Summer or school year, at Army laboratories with Army S&E mentors
Participant Population	College undergraduate and graduate students
No. of Applicants	550
No. of Students (Apprentices)	307
Placement Rate	56%
No. of Adults (Mentors)	288
No. of Army S&Es	288
No. of Army Research Laboratories	10
No. of Colleges/Universities	104
No. of HBCU/MSIs	13
Total Cost	$3,663,463

Stipend Cost (paid by participating labs)	$3,534,144
Administrative Cost to ASEE	$129,319
Cost Per Student Participant	$11,933

Summary of Findings

The FY14 evaluation of CQL collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in the following table.

2014 CQL Evaluation Findings	
Participant Profiles	
CQL had limited success at serving students of historically underrepresented and underserved populations.	• CQL attracted some participation of female students—a population that is historically underrepresented in engineering fields. However, enrollment data suggests that participation of female students was limited: 75% of enrolled apprentices were male, 25% were female.
	• CQL served some students from historically underrepresented and underserved race/ethnicity groups, however that involvement was limited. The vast majority of enrolled apprentices identified themselves as "White" or "Asian"; only 8% identified themselves as being from an underrepresented or underserved minority group (5% Black or African American & 3% Hispanic or Latino).
CQL had limited success in recruiting past AEOP program participants.	• Questionnaire data indicate that the vast majority of responding apprentices had participated in CQL at least once (although it's not clear whether the one time was including or in addition to current participation), and 30% had participated more than once. In addition, just over 30% of students had participated in SEAP at least once. However, for other AEOP programs, the vast majority of responding apprentices have never participated (ranging from 87% to 98%).
Actionable Program Evaluation	
CQL recruitment was largely the result of pre-existing relationships	• Mentor questionnaire data indicate that recruitment of students was most commonly done through colleagues, personal acquaintances, and contact from the student.
	• Apprentice questionnaire data indicate that apprentices most commonly learned about CQL from someone who works at an Army laboratory, teachers or professors, immediate family members, university resources, friends, mentors, or past CQL participants. In addition, apprentice focus group data support the idea that pre-existing relationships were instrumental in making students aware of CQL.
CQL apprentices were motivated to participate in CQL by a variety of factors.	• Apprentices were motivated to participate in CQL, according to questionnaire data, by an interest in STEM, the desire to expand laboratory and research skills, and the opportunity to learn in ways that are not possible in school. Other highly motivating factors included building a college application or résumé, earning a stipend or award while doing STEM, networking opportunities, and opportunities to use advanced laboratory technology. Focus group data also suggest that

	apprentices were motivated by the opportunity to gain job and research experience.
CQL engages apprentices in meaningful STEM learning.	• Most apprentices (67-93%) report learning about STEM topics, applications of STEM to real-life situations, STEM careers, and cutting-edge STEM research on most days or every day of their CQL experience.
	• Most apprentices had opportunities to engage in a variety of STEM practices during their CQL experience. For example, 93% reported participating in hands-on STEM activities; 88% practicing using laboratory or field techniques, procedures, and tools; 81% working as part of a team; 77% carrying out an investigation; and 76% analyzing and interpreting data or information on most days or every day.
	• Apprentices reported greater opportunities to learn about STEM and greater engagement in STEM practices in their CQL experience than they typically have in school.
	• A clear majority of mentors report using strategies to help make learning activities relevant to apprentices, support the needs of diverse learners, develop apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
CQL promotes DoD STEM research and careers but can improve marketing of other AEOP opportunities.	• Most mentor interviewees and questionnaire respondents reported limited awareness of AEOP initiatives. Subsequently, mentors did not consistently educate their apprentices about AEOPs or encourage apprentices to participate in them. The majority of responding mentors (61-89%) mentioned never experiencing AEOP informational resources including the AEOP website, AEOP instructional supplies, the AEOP brochures, and AEOP social media.
	• Nearly all CQL participants reported learning about at least one STEM career, and about half (51%) reported learning about 4 or more. Similarly, 86% of students reported learning about at least one DoD STEM job, with 54% reporting they learned about 3 or more. Mentors and the CQL experience contributed the most to this impact.
The CQL experience is valued by apprentices and mentors, although program administration is an area for improvement.	• Responding apprentices reported satisfaction with their mentor and working experience during the CQL program. For example, over 90% of responding apprentices reported being at least "somewhat" satisfied with their mentor, the time they spent with their mentor, and the research experience overall.
	• In an open-ended item on the questionnaire, almost all of the responding participants had something positive to say about the program. However, about 30% described frustration with administrative aspects of the program including a lack of communication, payment problems, and delays in getting clearance and access that limited their ability to do meaningful work. Perhaps more notably, when asked how the program could be improved, the most common theme by far (86% of students responding to the question) was logistical issues including payment, communication, and obtaining clearance and access. In addition, in focus groups, apprentices described difficulties associated with late notification of acceptance

	(e.g., having to decide on other job opportunities before being notified of CQL acceptance, having to find housing on short notice).
Outcomes Evaluation	
CQL had positive impacts on apprentices' STEM knowledge and competencies.	• A majority of apprentices reported large or extreme gains in their knowledge of what everyday research work is like in STEM, how professionals work on real problems in STEM, research conducted in a STEM topic or field, a STEM topic or field in depth, and the research processes, ethics, and rules for conduct in STEM. These impacts were identified across all apprentice groups.
	• Many apprentices also reported impacts on their abilities to do STEM, including such things as carrying out procedures for an investigation and recording data accurately; supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge; using mathematics or computers to analyze numeric data; reading technical or scientific tests, or using other media, to learn about the natural or designed worlds; deciding what type of data to collect in order to answer a question; identifying the limitations of data collected in an investigation; asking a question that can be answered with one or more investigations; designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected; and using data or interpretations from other researchers or investigations to improve a solution.
CQL had positive impacts on apprentices' 21st Century Skills.	• A large majority of apprentices reported large or extreme gains in the areas of making changes when things do not go as planned, building relationships with professionals in the field, learning to work independently, patience for the slow pace of research, sticking with a task until it is complete, and sense of being part of a learning community.
CQL positively impacted apprentices' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many apprentices reported a large or extreme gains on items related to STEM identify including feeling prepared for more challenging STEM activities, building academic or professional credentials in STEM, confidence to do well in future STEM courses, feeling responsible for a STEM project or activity, confidence to contribute in STEM, feeling like part of a STEM community, and feeling like a STEM professional.
	• Apprentices also reported positively on the likelihood that they would engage in additional STEM activities outside of school. A majority of apprentices indicated that as a result of CQL they were more likely to talk with friends or family about STEM, mentor or teach other students about STEM, work on a STEM project or experiment in a university or professional setting, receive an award or special recognition for STEM accomplishments, and look up STEM information at a library or on the internet.
CQL succeeded in raising apprentices' education aspirations, but did not	• After participating in CQL, apprentices indicated being more likely to go further in their schooling than they would have before CQL, with the greatest change being in the proportion of apprentices who wanted to get a Ph.D. (19% before CQL, 35% after).

change their career aspirations.	• Apprentices were asked to indicate what kind of work they expected to be doing at age 30, and the data were coded as STEM-related or non-STEM-related. Although the vast majority of apprentices indicated interest in a STEM-related career, there was not a statistically significant difference from before CQL to after.
CQL apprentices are largely unaware of AEOP initiatives, but apprentices show interest in future AEOP opportunities.	• Apprentice and mentors were largely unaware of other AEOP initiatives, but 73% of responding apprentices were at least somewhat interested in participating in CQL in the future, 54% in SMART, 40% in NDSEG, and 34% in URAP. Apprentices reported that their CQL participation and their mentors had the most impact on their awareness of AEOPs.
CQL apprentices have positive opinions about DoD researchers and research.	• The vast majority of apprentices reported that they agreed or strongly agreed that DoD researchers solve real-world problems (95%), DoD researchers advance science and engineering fields (95%), DoD research is valuable to society (94%), DoD researchers develop new, cutting edge technologies (92%), and DoD researchers support non-defense related advancements in science and technology (86%).

Recommendations

1. The CQL program has the goal of broadening the talent pool in STEM fields. Overall, the program has had limited success in attracting students from groups historically underrepresented and underserved in these fields. In addition, personal relationships continue to factor highly into how students learn about and are recruited to CQL. The program may want to consider doing more to increase the number and diversity of students who participate in CQL. In particular, the program may consider how to more actively recruit students nationwide. Given that the program involves college students and includes a stipend to help with housing expenses, recruitment does not need to be limited to locations near CQL sites. By more actively recruiting, and broadening recruitment efforts beyond local sites, the program is likely to receive more applications, including more from groups that are historically underrepresented and underserved. Mentor focus groups elicited some suggestions for changes to recruitment strategies. These suggestions include having a centralized CQL recruitment and application process (rather than site specific) as well as advertising more with high schools (so that future college students are aware of the program) and with colleges, including working with college job placement services and posting fliers prominently where students will see them. In addition, the program may want to consider how students are recruited and subsequently selected to serve as apprentices. Although some mentors did not know how students were recruited, others reported that there were no targeted recruitment strategies for students from underrepresented and underserved groups. In order to meet the goal of serving more students from underrepresented or underserved groups, the program could develop guidance to balance selecting the strongest candidates (e.g. best match between apprentice interest and mentor work), regardless of race or gender, and providing more opportunities for students from underrepresented and underserved groups to participate.

2. Similarly, efforts to recruit mentors should be considered. The number of apprentices who can participate in CQL is limited by the number of mentors available. In order to broaden participation and provide more opportunities to qualified candidates, the program needs to recruit more mentors. One potential factor impacting mentor participation – time – came out in a focus group; mentors noted that colleagues were not interested in serving as mentors because of the time it takes them to work with apprentices, which can detract from other responsibilities. In addition, on the questionnaire, some responding mentors suggested providing more support for mentors. As a result, it may be productive to consider what supports can be put in place to help mentors efficiently and effectively utilize their apprentices. For example, mentors may benefit from ideas for ways in which apprentices can productively contribute to ongoing research. In addition, potential mentors should be made aware of these supports as well as potential benefits to their project from involving apprentices in their work.

3. Given the goal of having students progress from other AEOP programs into CQL, and from CQL into other programs, the program may want to consider implementing marketing and recruitment efforts targeting past AEOP participants and to work with sites to increase both mentors' and students' exposure to AEOP. Apprentice questionnaire data indicate that few apprentices had previously participated in other AEOPs. Implementing marketing and recruitment efforts targeted at past AEOP participants may increase the number of participants in other AEOP programs who progress into CQL and may broaden CQL participation of students from underrepresented and underserved groups as several other AEOP programs specifically target these students. In addition, responding CQL mentors and apprentices tended to lack knowledge of AEOP programs beyond CQL. In focus groups, mentors indicated that they would be willing to educate students about other AEOP programs if they knew more about those programs themselves, suggesting that improving mentor awareness of programs would also improve student awareness. Alternatively, given that CQL participants are completing internships on active research, and potential mentors may already be hesitant to participate due to time considerations, the program may want to consider ways to educate apprentices about AEOP opportunities that do not rely on the mentor (e.g., presentations during an orientation; information provided during the student symposium). In addition, given the limited use of the AEOP website, print materials, and social media, the program should consider how these materials could be adjusted to provide students with more information and facilitate their enrollment in other AEOPs, or what alternative strategies may be more effective.

4. Efforts should be made to address administrative difficulties. Although participants were pleased with their experience, frustration with administrative and logistical aspects was quite evident in responses, and in some cases detracted from program goals. In particular, students reported difficulties due to late notification of acceptance, including missing out on participating in the past, and late payment. Students also reported negative impacts on their ability to do meaningful work because of delays in getting clearance and computer access. In addition, some students indicated that they, and their mentors, expended considerable time and effort to remedy these administrative issues. Although some students indicated that these issues would not keep them from participating again, other students indicated that they would not participate again, may work at the lab again but would do so through other channels, or were discouraged from participating in CQL or working for the DoD in the

future. Given that one AEOP goal is to “broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base,” efforts should be made to remedy these administrative issues so as not to detract from apprentices’ or mentors’ experience with the program. One suggestion that came out of apprentice questionnaire and focus group data is to begin the process for students to obtain clearance and computer access early, so that they have computer access when they begin the internship and can begin doing meaningful work.

5. Additional efforts should be undertaken to improve participation in evaluation activities, as the low response rates for both the student and mentor questionnaires raise questions about the representativeness of the results. Improved communication with the individual program sites about expectations for the evaluation may help. In addition, the evaluation instruments may need to be streamlined as perceived response burden can affect participation. In particular, consideration should be given to better tailoring questionnaires to particular programs and whether the parallel nature of the student and mentor questionnaires is necessary, with items being asked only of the most appropriate data source. Given that CQL apprentices are career age, as well as the significant investment that Army research installations make in each apprentice, it may prove important to conduct a CQL alumni study in the near future. The purpose of which would serve to establish the extent to which CQL apprentices subsequently become employed in the Army or DoD.

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-college programs and expose them to Department of Defense (DoD) STEM careers. The consortium, formed by the Army Educational Outreach Program Cooperative Agreement (AEOP CA), supports the AEOP in this mission by engaging non-profit, industry, and academic partners with aligned interests, as well as a management structure that collectively markets the portfolio among members, leverages available resources, and provides expertise to ensure the programs provide the greatest return on investment in achieving the Army's STEM goals and objectives.

This report documents the evaluation study of one of the AEOP elements, the College Qualified Leaders (CQL) program. CQL is managed by the American Society for Engineering Education (ASEE). The evaluation study was performed by Virginia Tech, the Lead Organization (LO) in the AEOP CA consortium. Data analyses and reports were prepared in collaboration with Horizon Research, Inc.

AEOP Goals

Goal 1: STEM Literate Citizenry.

- Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.

Goal 2: STEM Savvy Educators.

- Support and empower educators with unique Army research and technology resources.

Goal 3: Sustainable Infrastructure.

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

Program Overview

The College Qualified Leaders (CQL) program, managed by the American Society for Engineering Education (ASEE), is an Army Educational Outreach Program (AEOP) that matches talented college students and recent graduates (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 of Gains in the Education of Mathematics and Science (GEMS) and/or Science and Engineering Apprentice Program (SEAP) to continue their relationship with the mentor and/or laboratory, and also allows new college students to enter the program. CQL offers apprentices the provision of summer, partial year, or year-round research at the Army laboratory, 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.

In 2014, CQL was guided by the following objectives:

1. To nurture interest and provide STEM research experience for college students and recent graduates contemplating further studies;
2. To provide opportunities for continued association with the DoD laboratories and STEM enrichment for previous SEAP, GEMS, and other AEOP participants as well as allow new college students the opportunity to engage with DoD laboratories;
3. To outreach to participants inclusive of youth from groups historically underrepresented and underserved in STEM;
4. To increase participant knowledge in targeted STEM areas and develop their research and laboratory skills as evidenced by mentor evaluation and the completion of a presentation of research;
5. To educate participants about careers in STEM fields with a particular focus on STEM careers in DoD laboratories;
6. To acquaint participants with the activities of DoD laboratories in a way that encourages a positive image and supportive attitude towards our defense community; and
7. 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.

Apprenticeships were completed at 10 Army research laboratories in 5 states, summarized in Table 1.

Table 1. 2014 CQL Sites

2014 CQL Site	Command†	Location
US Army Research Laboratory – Aberdeen Proving Ground (ARL-APG)	RDECOM	Aberdeen, MD
US Army Research Laboratory – Adelphi (ARL-A)	RDECOM	Adelphi, MD
Walter Reed Army Institute of Research (WRAIR)	MRMC	Silver Spring, MD
US Army Medical Research Institute for Infectious Diseases (USAMRIID)	MRMC	Fort Detrick, MD
US Army Aviation & Missile Research Development and Engineering Center – Redstone Arsenal (AMRDEC)	RDECOM	Huntsville, AL
Engineer Research & Development Center Construction Engineering Research Laboratory (ERDC-CERL)	USACE	Champaign, IL
US Army Medical Research Institute of Chemical Defense (USAMRICD)	MRMC	Aberdeen, MD
US Army Center for Environmental Health Research (USACEHR)	MRMC	Fort Detrick, MD
Defense Forensic Science Center (DFSC)	USACIDC	Forest Park, GA
Engineer Research and Development Center – Vicksburg, MS (ERDC-MS)	USACE	Vicksburg, MS

† Commands: "MRMC" is the Medical Research and Material Command, "RDECOM" is the Research, Development and Engineering Command, and "USACE" is the U.S. Army Corps of Engineers

The 10 host sites received applications from substantially more qualified students than they had positions for the 2014 CQL program: 550 students applied and 307 enrolled, which represents a slightly larger enrollment from slightly fewer applicants compared to FY13 (588 students applied and 260 enrolled). Table 2 summarizes interest and final enrollment by site.

Table 2. 2014 CQL Site Applicant and Enrollment Numbers				
2014 CQL Site	FY2013		FY2014	
	No. of Applicants	No. of Enrolled Participants	No. of Applicants	No. of Enrolled Participants
US Army Research Laboratory – Aberdeen Proving Ground (ARL-APG)	133	59	161	79
US Army Research Laboratory – Adelphi (ARL-A)	93	48	118	75
Walter Reed Army Institute of Research (WRAIR)	184	97	94	76
US Army Medical Research Institute for Infectious Diseases (USAMRIID)	32	14	40	18
US Army Aviation & Missile Research Development and Engineering Center – Redstone Arsenal (AMRDEC)	32	2	69	16
Engineer Research & Development Center Construction Engineering Research Laboratory (ERDC-CERL)	24	8	27	12
US Army Medical Research Institute of Chemical Defense (USAMRICD)	22	9	20	9
US Army Center for Environmental Health Research (USACEHR)	19	8	8	12
Defense Forensic Science Center (DFSC)	11	11	13	8
Engineer Research and Development Center – Vicksburg, MS (ERDC-MS)	4	4	NA	2
Total	**588**[†]	**260**	**550**	**307**

[†] Twenty-one individuals applied at The US Army Criminal Investigation Laboratory (USACIL) but did not enroll there as there was no CQL program at USACIL in 2014.

The total cost of the 2014 CQL program was $3,666,463. This includes administrative costs to ASEE of $129,319 and $3,534,144 for participant stipends (including cost of required eye exams for apprentices in laser labs and work boots when required). The average cost per 2014 CQL participant taken across all CQL sites was $11,933. Table 3 summarizes these expenditures.

Table 3. 2014 CQL Program Costs	
2014 CQL - Cost Per Participant	
Total Participants	307
Total Cost	$3,666,463
Cost Per Participant	**$11,933**
2014 CQL - Cost Breakdown Per Participant	
Average Administrative Cost to ASEE Per Participant	$421
Average Participant Stipend (including eye exam and/or work boots if required)	$11,512
Cost Per Participant	**$11,933**

Evidence-Based Program Change

Based on recommendations from the FY13 summative evaluation report, the AEOP identified three key priorities for programs in FY14: 1) Increase outreach to populations that are historically underserved and underrepresented in STEM; 2) Increase participants' awareness of Army/DoD STEM careers; and 3) Increase participants' awareness of other AEOP opportunities. ASEE initiated the following program changes/additions to the FY14 administration of the CQL program in light of the key AEOP priorities, the FY13 CQL evaluation study, and site visits conducted by ASEE and the LO.

I. Increase outreach to populations that are historically underserved and underrepresented in STEM.

- a. ASEE wrote and implemented a 2014 Outreach Plan for CQL that included:
  - i. Outreach efforts at conferences/expos that serve diverse audiences
    1. Event it. Build it. Career Expo at the Society of Women Engineers Conference
    2. Hispanic Association for Colleges and Universities Conference
    3. University of Maryland Career Fair
    4. George Mason University Career Fair
    5. Howard University Career Fair
    6. Columbia University Career Fair
  - ii. Bi-Weekly meetings with LPCs to identify new targets and strategies for outreach

II. Increase participant's awareness of other AEOP opportunities.

- a. ASEE emailed previous CQL participants with links to AEOP social media.

FY14 Evaluation At-A-Glance

Virginia Tech, in collaboration with ASEE, conducted a comprehensive evaluation study of the CQL program. The CQL logic model below presents a summary of the expected outputs and outcomes for the CQL program in relation to the AEOP and CQL-specific priorities. This logic model provided guidance for the overall CQL evaluation strategy.

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• Army sponsorship • ASEE providing oversight of site programming • Operations conducted by 10 Army Labs • 307 students participating in CQL apprenticeships • 288 Army S&Es serving as CQL mentors • Stipends for apprentices to support meals and travel • Centralized branding and comprehensive marketing • Centralized evaluation	• Apprentices engage in authentic STEM research experiences through hands-on summer, partial year, and year-round apprenticeships at Army labs • Army S&Es supervise and mentor apprentices' research • Program activities that expose apprentices to AEOP programs and/or STEM careers in the Army or DoD	• Number and diversity of student participants engaged in CQL • Number and diversity of Army S&Es engaged in CQL • Apprentices, Army S&Es, site coordinators, and ASEE contributing to evaluation	• Increased apprentice STEM competencies (confidence, knowledge, skills, and/or abilities to do STEM) • Increased apprentice interest in future STEM engagement • Increased apprentice awareness of and interest in other AEOP opportunities • Increased apprentice awareness of and interest in STEM research and careers • Increased apprentice awareness of and interest in Army/DoD STEM research and careers • Implementation of evidence-based recommendations to improve CQL programs	• Increased apprentice participation in other AEOP opportunities and Army/DoD-sponsored scholarship/ fellowship programs • Increased apprentice pursuit of STEM degrees • Increased apprentice pursuit of STEM careers • Increased apprentice pursuit of Army/DoD STEM careers • Continuous improvement and sustainability of CQL

The CQL evaluation study gathered information from apprentice and mentor participants about CQL processes, resources, activities, and their potential effects in order to address key evaluation questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and CQL program objectives.

Key Evaluation Questions

- What aspects of CQL motivate participation?
- What aspects of CQL structure and processes are working well?
- What aspects of CQL could be improved?
- Did participation in CQL:
  - Increase apprentices' STEM competencies?
  - Increase apprentices' interest in future STEM engagement?
  - Increase apprentices' awareness of and interest in other AEOP opportunities?
  - Increase apprentices' awareness of and interest in Army/DoD STEM research and careers?

The assessment strategy for CQL included on-site focus groups with apprentices and mentors at 4 CQL sites, a post-program apprentice questionnaire, a post-program mentor questionnaire, and one Annual Program Report (APR) prepared by ASEE using data from all CQL sites. Tables 4-8 outline the information collected in apprentice and mentor questionnaires and focus groups, as well as information from the APR that is relevant to this evaluation report.

Table 4. 2014 Apprentice Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, grade level, and race/ethnicity
	Education Intentions: Degree level, confidence to achieve educational goals, field sought
AEOP Goal 1	**Capturing the Apprentice Experience:** In-school vs. In-program experience; mentored research experience and products
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21^{st} Century Skills
	STEM Identity: Gains in STEM identity, intentions to participate in STEM, and STEM-oriented education and career aspirations; contribution of AEOP
	AEOP Opportunities: Past participation, awareness of, and interest in participating in other AEOP programs; contribution of AEOP, impact of AEOP resources
	Army/DoD STEM: Exposure to Army/DoD STEM jobs, attitudes toward Army/DoD STEM research and careers, change in interest for STEM and Army/DoD STEM jobs; contribution of AEOP, impact of AEOP resources
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies (apprentices respond to a subset)
	Comprehensive Marketing Strategy: How apprentices learn about AEOP, motivating factors for participation, impact of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers
Satisfaction & Suggestions	Benefits to participants, suggestions for improving programs, overall satisfaction

Table 5. 2014 Mentor Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, race/ethnicity, occupation, past participation
Satisfaction & Suggestions	Awareness of CQL, motivating factors for participation, satisfaction with and suggestions for improving CQL programs, benefits to participants
AEOP Goal 1	**Capturing the Apprentice Experience:** In-program experience
	STEM Competencies: Gains in their apprentices' Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in their apprentices' 21^{st} Century Skills
	AEOP Opportunities: Past participation, awareness of other AEOP programs; efforts to expose apprentices to AEOPs, impact of AEOP resources on efforts; contribution of AEOP in changing apprentice AEOP metrics

	Army/DoD STEM: Attitudes toward Army/DoD STEM research and careers, efforts to expose apprentices to Army/DoD STEM research/careers, impact of AEOP resources on efforts; contribution of AEOP in changing apprentice Army/DoD career metrics
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies
	Comprehensive Marketing Strategy: How mentors learn about AEOP, usefulness of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers

Table 6. 2014 Apprentice Focus Groups

Category	Description
Profile	Gender, race/ethnicity, grade level, past participation in CQL, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of CQL, motivating factors for participation, satisfaction with and suggestions for improving CQL programs, benefits to participants
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Extent to which apprentices were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Extent to which apprentices were exposed to STEM and Army/DoD STEM jobs

Table 7. 2014 Mentor Focus Groups

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

Table 8. 2014 Annual Program Report

Category	Description
Program	Description of course content, activities, and academic level (high school or college)
AEOP Goal 1 and 2 Program Efforts	**Underserved Populations:** Mechanisms for marketing to and recruitment of apprentices from underserved populations
	Army STEM: Army/DoD STEM Careers – Career day exposure to Army STEM research and careers; Participation of Army engineers and/or Army research facilities in career day activities
	Mentor Capacity: Local Educators - University faculty and apprentice involvement

Detailed information about methods and instrumentation, sampling and data collection, and analysis are described in Appendix A, the evaluation plan. The reader is strongly encouraged to review Appendix A to clarify how data are summarized, analyzed, and reported in this document. Findings of statistical and/or practical significance are noted in the report narrative, with tables and footnotes providing results from tests for significance. Questionnaires and respective data summaries are provided in Appendix B (apprentice) and Appendix C (mentor). Focus group protocols are provided in Appendix D (apprentices) and Appendix E (mentors); the APR template is located in Appendix F. Major trends in data and analyses are reported herein.

Study Sample

Apprentices from 9 of 10 CQL sites responded to questionnaires, as did mentors from 5 of the 10 sites. Table 9 shows the number of apprentice and mentor respondents by site.

Table 9. 2014 CQL Site Survey Respondent Numbers				
2014 CQL Site	**Apprentices**		**Mentors**	
	No. of Participants	**No. of Survey Respondents**	**No. of Participants**	**No. of Survey Respondents**
US Army Research Laboratory – Aberdeen Proving Ground (ARL-APG)	79	37	54	0
US Army Research Laboratory – Adelphi (ARL-A)	75	36	109	0
Walter Reed Army Institute of Research (WRAIR)	76	26	59	3
US Army Medical Research Institute for Infectious Diseases (USAMRIID)	18	16	32	9
US Army Aviation & Missile Research Development and Engineering Center – Redstone Arsenal (AMRDEC)	16	7	9	0
Engineer Research & Development Center Construction Engineering Research Laboratory (ERDC-CERL)	12	7	9	3
US Army Medical Research Institute of Chemical Defense (USAMRICD)	9	6	4	2
US Army Center for Environmental Health Research (USACEHR)	12	3	3	2
Defense Forensic Science Center (DFSC)	8	1	6	0
Engineer Research & Development Center – Vicksburg, MS (ERDC-MS)	2	0	3	0
Total	**307**	**139**	**288**	**19**

Table 10 provides an analysis of apprentice and mentor participation in the CQL questionnaires, the response rate, and the margin of error at the 95% confidence level (a measure of how representative the sample is of the population). The margin of error for both the apprentice and mentor surveys is larger than generally considered acceptable, indicating that the samples may not be representative of their respective populations. Note that the apprentice response rate is higher than in 2013 (which had a response rate of 36%).

Table 10. 2014 CQL Questionnaire Participation				
Participant Group	**Respondents (Sample)**	**Total Participants (Population)**	**Participation Rate**	**Margin of Error @ 95% Confidence[1]**
Apprentices	139	307	45%	±6.2%
Mentors	19	288	7%	±21.8%

A total of four apprentice focus groups were conducted at 4 of the 10 CQL sites. Apprentice focus groups included 17 apprentices, 11 female and 6 male. It should be noted that the gender proportion in the focus group sample (35% male) was not representative of that in the population of CQL apprentices at large (75% male), suggesting that females may have been oversampled in focus groups. Apprentices in focus groups ranged from college sophomores to recent graduates and graduate-school students. A total of four mentor focus groups were also conducted at the same 4 sites. Mentor focus groups included 13 mentors (7 females, 6 males). Mentors were predominately STEM professionals, but also included an architect and a teacher. Focus groups were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of questionnaire data. They add to the overall narrative of CQL's efforts and impact, and highlight areas for future exploration in programming and evaluation.

Respondent Profiles

Apprentice Demographics

Demographic information collected from questionnaire respondents is summarized in Table 11. More males (56%) than females (43%) completed the questionnaire. More apprentices responding to the questionnaire identified with the race/ethnicity category of White (55%) than any other single race/ethnicity category, though there is substantial representation of the category of Asian (21%). The majority of respondents (64%) were in the 2nd to 4th year of college. The APR included demographic data for a larger proportion of the enrolled participants (n = 185). Those data were similar to the questionnaire data for race/ethnicity and grade-level; however, were quite different for gender (75% male, 25% female).

[1] "Margin of error @ 95% confidence" means that 95% of the time, the true percentage of the population who would select an answer lies within the stated margin of error. For example, if 47% of the sample selects a response and the margin of error at 95% confidence is calculated to be 5%, if you had asked the question to the entire population, there is a 95% likelihood that between 42% and 52% would have selected that answer. A 2-5% margin of error is generally acceptable at the 95% confidence level.

FY14 evaluation data and enrollment data reveals that CQL had limited success in engaging female students (43% of questionnaire respondents, 25% of enrollment survey respondents). The same data suggest CQL had limited success in providing outreach to students from historically underrepresented and underserved race/ethnicity groups (13% of questionnaire respondents, 8% of enrollment survey respondents). This remains an area for growth, one that is dependent upon other AEOPs for appropriately preparing a diverse body of students (e.g., in GEMS and/or SEAP) and encouraging them to pursue CQL as a more competitive apprenticeship. Growth in this area is also dependent upon the success of the marketing and outreach of the program administrator in recruiting applicants and upon mentors for initiating a balanced applicant selection process.

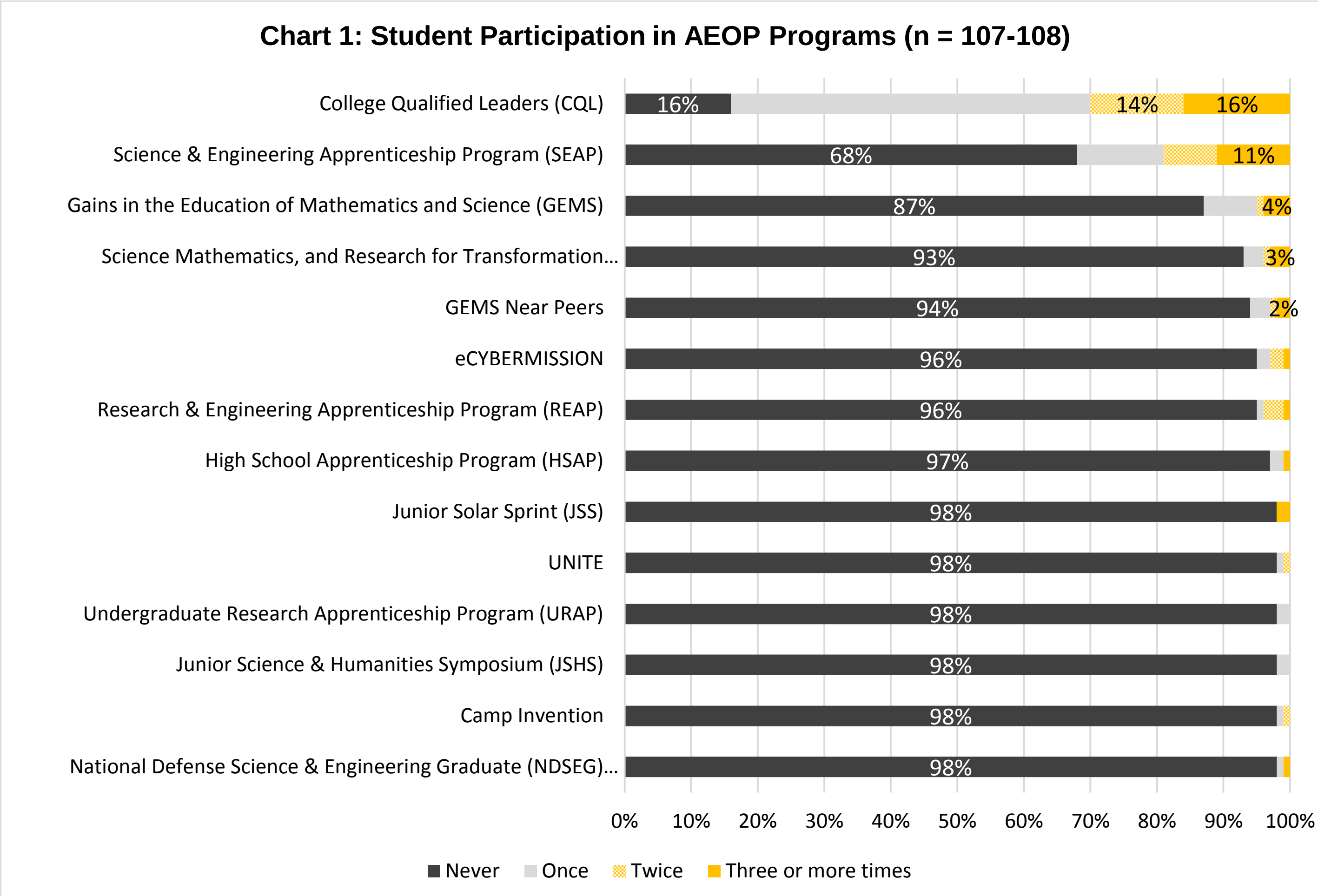
Table 11. 2014 CQL Apprentice Respondent Profile (n = 139)

Demographic Category	Questionnaire Respondents	
Respondent Gender		
Male	78	56%
Female	60	43%
Choose not to report	1	1%
Respondent Race/Ethnicity		
Asian	29	21%
Black or African American	9	6%
Hispanic or Latino	7	5%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	2	1%
White	77	55%
Other race or ethnicity, (specify):†	5	4%
Choose not to report	10	7%
Respondent Grade Level		
College freshman	1	1%
College sophomore	27	19%
College junior	32	23%
College senior	30	22%
Graduate program	35	25%
Other, (specify)	8	6%
Choose not to report	6	4%

† Other = "Bi-racial," "Iranian," "Middle Eastern," "White-Asian," and "Korean, White."

‡ Other = "Graduated" (n = 3), "Applying to Graduate Program," "College Super Senior," "Continued internship," "I will have graduated at the end of this term and will take a class as a non-degree seeking student in the fall," and "Research Technician at the WRAIR and NIH."

Apprentices were asked how many times they participated in each of the AEOP programs. As can be seen in Chart 1, 30% of responding apprentices reported participating in CQL two times or more; 32% reported participating in SEAP at least once. Few apprentices (13% or less) reported participating in any of the other AEOP programs. Compared to 2013, a higher percentage of 2014 responding apprentices had previously participated in SEAP, but for all other AEOP programs, the percentage was lower for 2014.



Mentor Demographics

The 2014 Mentor Questionnaire collected more extensive demographic information on the mentors than past years, FY14 data is summarized in Table 12. The number of male responding mentors was approximately equal to the number of female responding mentors (9 males vs. 10 females or 47% vs 53%). Nearly three-fourths of the responding mentors identified themselves as White (74%). All responding mentors were scientist, engineer, or mathematics professionals; the majority (74%) identified their primary area of research as biological science. Additional characteristics of the mentors are included in Appendix C.

Table 12. 2014 CQL Mentor Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 19)		
Female	10	53%
Male	9	47%
Respondent Race/Ethnicity (n = 19)		
Asian	3	16%
Black or African American	0	0%
Hispanic or Latino	1	5%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	14	74%
Other race or ethnicity, (specify):	0	0%
Choose not to report	1	5%
Respondent Occupation (n = 19)		
Scientist, Engineer, or Mathematics professional	19	100%
Teacher	0	0%
Other school staff	0	0%
University educator	0	0%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	0	0%
Other, (specify):	0	0%
Respondent Primary Area of Research (n = 19)		
Biological Science	14	74%
Physical science (physics, chemistry, astronomy, materials science)	2	11%
Engineering	2	11%
Medical, health, or behavioral science	1	5%
Earth, atmospheric, or oceanic science	0	0%
Agricultural science	0	0%
Environmental science	0	0%
Computer science	0	0%
Technology	0	0%
Mathematics or statistics	0	0%
Social science (psychology, sociology, anthropology, etc.)	0	0%
Other, (specify)	0	0%

Actionable Program Evaluation

Actionable Program Evaluation is intended to provide assessment and evaluation of program processes, resources, and activities for the purpose of recommending improvements as the program moves forward. This section highlights information outlined in the Satisfaction & Suggestions sections of Tables 4-8.

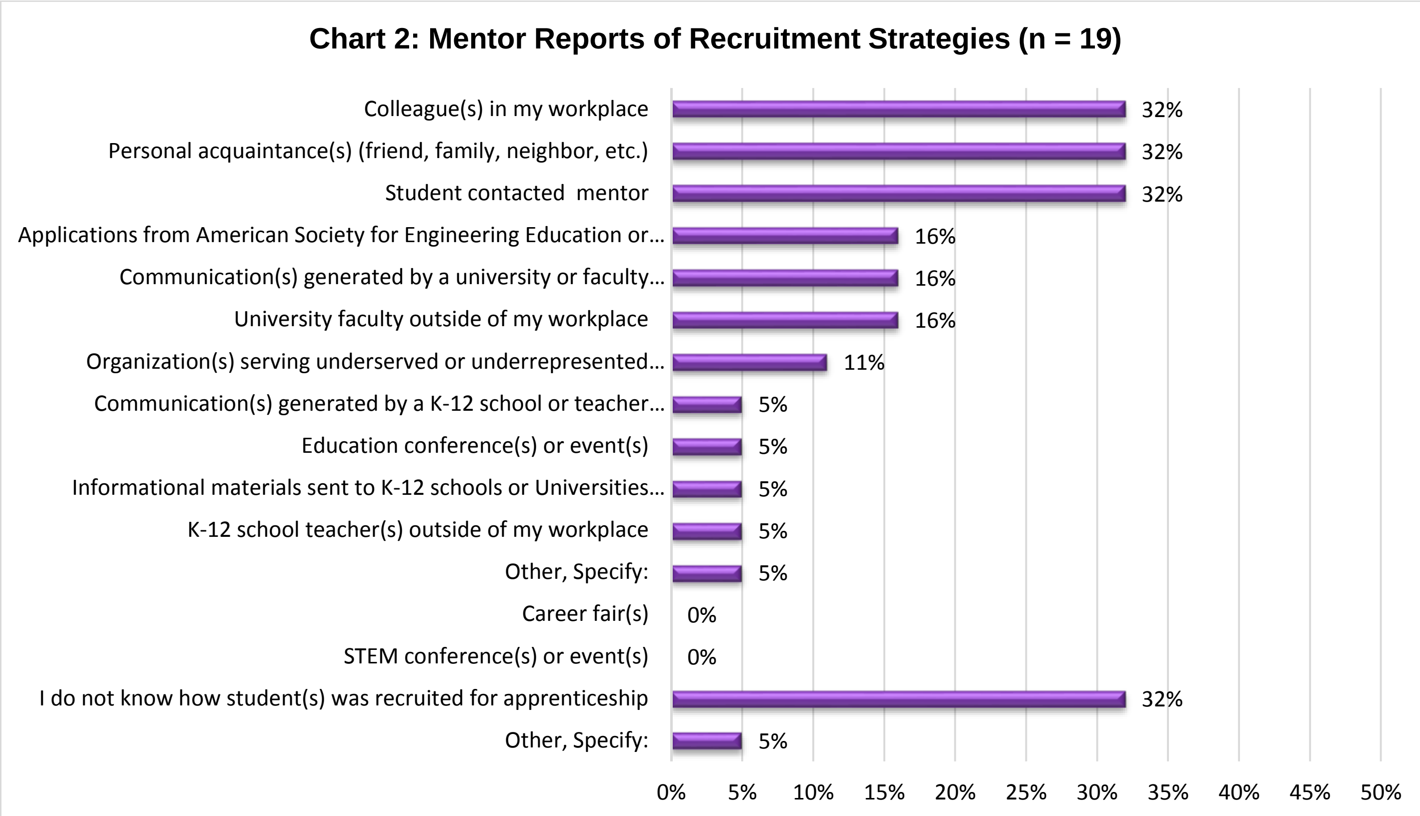
A focus of the Actionable Program Evaluation is efforts toward the long-term goal of CQL and all of the AEOP to increase and diversify the future pool of talent capable of contributing to the nation's scientific and technology progress. Thus, it is important to consider how CQL is marketed and ultimately recruits participants, the factors that motivate them to participate in CQL, participants' perceptions of and satisfaction with activities, what value participants place on program activities, and what recommendations participants have for program improvement. The following sections report perceptions of apprentices and mentors that pertain to current programmatic efforts and recommend evidence-based improvements to help CQL achieve outcomes related to AEOP programs and objects.

Marketing and Recruiting Underrepresented and Underserved Populations

The CQL manager, ASEE reported marketing to and recruiting students for CQL in a variety of ways. ASEE marketed CQL at the following FY14 outreach events:

- Event it. Build it. Career Expo at the Society of Women Engineers Conference
- Hispanic Association for Colleges and Universities Conference
- University of Maryland Career Fair
- George Mason University Career Fair
- Howard University Career Fair
- Columbia University Career Fair

The mentor questionnaire included an item asking how students were recruited for apprenticeships. As can be seen in Chart 2, mentors most often indicated recruiting their apprentices through a personal network such as workplace colleagues (32%), personal acquaintances (32%), and direct contact from the student (32%). Interestingly, 32% reported that they had no knowledge of how their apprentices were recruited.



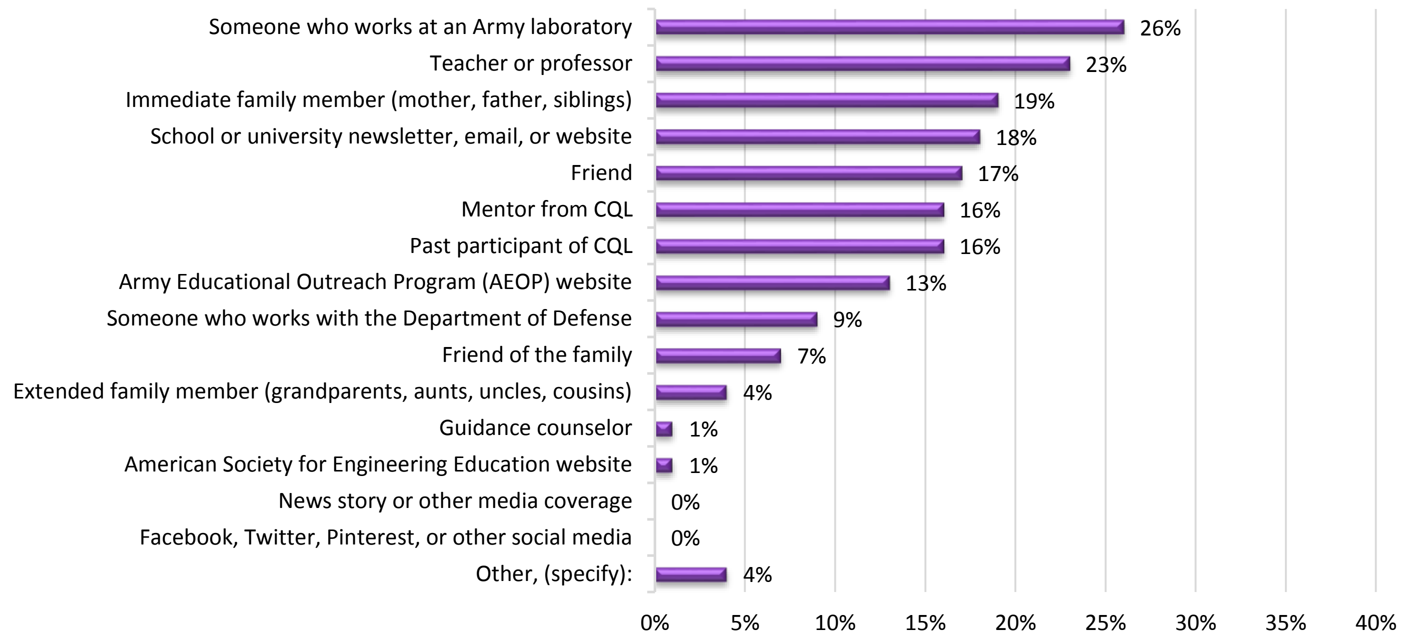
In focus groups, mentors were asked what strategies had been used that year to recruit students from underrepresented and underserved populations. Most commonly mentors indicated that they recruited through university contacts, they were not involved in selecting apprentices, or there was no targeted recruitment strategy. One said:

> *We did not look for any specific gender or race or anything, we had a billet that we put out to several universities, and we were indiscriminate, as far as looking at their resumes, we didn't take the brightest, I mean we just took the student that seemed to have the most interest in what we were doing. And we interviewed several people, and the student that we picked has worked well. We didn't have any goal in mind for, you know, minority, you know, gender. (CQL mentor)*

In order to understand which recruitment methods are most effective, the questionnaire asked apprentices to select all of the different ways they heard about CQL. Chart 3 summarizes apprentices' responses. The most frequently mentioned source of information about CQL was someone who works at an Army laboratory (26%). Other sources mentioned relatively frequently were teachers or professors (23%); immediate family members (19%); school or university newsletter, email, or website (18%); friends (17%), CQL mentors (16%), and past CQL participants (16%). The "Other" category typically included references to finding out about CQL indirectly through interest in another program (e.g., a co-op job, the SMART program).

These data were analyzed by apprentice gender and race/ethnicity to determine if different groups of apprentices learned about CQL in a different manner. No meaningful differences were found in how apprentices learned about CQL by either factor. Taken together, these findings suggest that responding apprentices were most likely to learn about CQL through personal contacts or university media resources rather than other media sources.

Chart 3: How Students Learned about CQL (n = 137)



Apprentice focus group data reflect the importance of personal contacts in making apprentices aware of CQL. Most apprentice focus group participants indicated that they learned about CQL through a pre-existing relationship with either a mentor or the site (e.g., they had worked at the site before; their parents work at the site). For example:

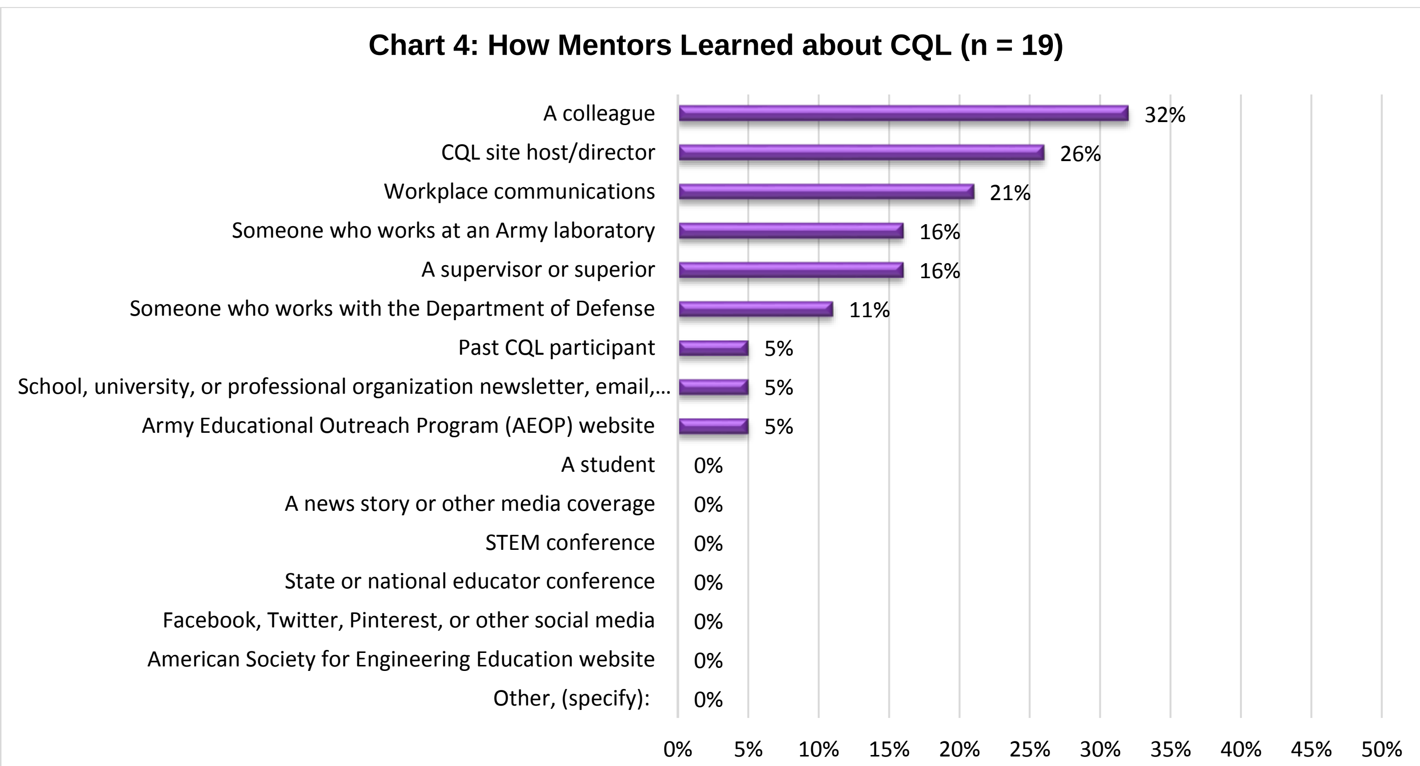
> *Both my parents work out here on the [site name] and there was an email sent around saying, "SEAP and CQL people…apply now". So I applied. My mom was actually working to get me into her office but that fell through, really badly fell through at the last minute, so my dad stepped up and said, "hey, do you think you have a spot?" and they said, "yes we always want new people." (CQL apprentice)*
>
> *I knew [Mentor's name], my supervisor. I've known his family for a long time. (CQL apprentice)*

The reason I chose CQL is because the program I was under was unavailable for a period of time so then I chose to be under this program...I was a student contractor, undergraduate and graduate. When that ended, I needed a new program to work here. (CQL apprentice)

My previous mentor recommended me to my mentor here and he advised me to apply to CQL in order to intern for him. (CQL apprentice)

Friends who had previously participated in CQL, college professors, and neighbors were also cited as sources of information about the program.

Mentors were also asked how they learned about CQL (see Chart 4). Almost all of the responding mentors learned about CQL through work and/or Army/DoD personnel, indicating the source as a colleague (32%), the CQL site host/director (26%), workplace communications (21%), someone who works at an Army laboratory (16%), a supervisor/superior (16%), or someone who works with the Department of Defense (11%).



To examine whether mentors are expanding their participation in AEOP programs, the questionnaire asked how many times they participated in each of the AEOP programs. Approximately half of the responding mentors (53%) reported participating in an AEOP program between one and three times (32% participated once, 0% participated twice, and 21%

participated three times). Thirty-seven percent indicated participating 4 or more times (11% indicated never participating in any AEOP program, perhaps because they were not including their current participation in CQL when answering the question). Despite responding mentors' continued participation in at least one AEOP program, for nearly half of the AEOP programs (6 of 14), including URAP and NDSEG in which their apprentices were eligible to participate, the majority indicated having never heard of the program.

Factors Motivating Apprentice Participation

Apprentice questionnaires and focus groups included questions to explore what motivated apprentices to participate in CQL. Specifically, the questionnaire asked how motivating a number of factors were in apprentices' decision to participate. As can be seen in Table 13, more than 7 in 10 responding apprentices indicated that interest in STEM (81%), the desire to expand laboratory or research skills (81%), learning in ways that are not possible in school (80%), the desire to learn something new and interesting (76%), and building a college application or résumé (73%) were "very much" motivating to them. Earning a stipend or award while doing STEM (61%), networking opportunities (61%), the opportunity to use advanced laboratory techniques (59%), and exploring a unique work environment (53%) were each indicated by a majority of respondents as motivating them very much.

Table 13. Factors Motivating Apprentices "Very Much" to Participate in CQL (n = 136-137)

Item	Questionnaire Respondents
Interest in science, technology, engineering, or mathematics (STEM)	81%
Desire to expand laboratory or research skills	81%
Learning in ways that are not possible in school	80%
Desire to learn something new or interesting	76%
Building college application or résumé	73%
Earning stipend or award while doing STEM	61%
Networking opportunities	61%
Opportunity to use advanced laboratory technology	59%
Exploring a unique work environment	53%
Interest in STEM careers with the Army	40%
The program mentor(s)	38%
Serving the community or country	36%
Having fun	31%
Teacher or professor encouragement	26%
Parent encouragement	22%
Opportunity to do something with friends	14%
An academic requirement or school grade	6%

In focus groups, apprentices were also asked why they chose to participate in CQL. The majority of apprentices indicated that they wanted to participate in order to gain job experience, a category that is not included on the questionnaire, but may be related to some of the motivations commonly indicated on the questionnaire (e.g., desire to expand laboratory or research skills; building a college application or résumé). As two apprentices said when asked why they chose to participate in CQL:

> *Honestly, the experience, just being able to work in the lab, see how everything functions, and just getting all of that experience is what made me interested in it, because it will give me a leg up when searching for jobs. (CQL apprentice)*

> *Well I did this program because I've actually been debating between going to med school or getting my masters or Ph.D. in a biotech laboratory related field, and I really wanted this experience to see what it would be like working in a lab every day, just to kind of give me a vision of what my career would be like. And these internships certainly give me great experience. (CQL apprentice)*

For each item in Table 14, differences between females and males as well as minority apprentices and non-minority apprentices were tested to identify whether different factors were more or less motivating for different apprentice groups. Overall, there were few significant differences. Males were somewhat more likely than females to indicate being motivated by an academic requirement or school grade[2] (effect size,[3] d=0.41 standard deviations); females were somewhat more likely than males to be motivated by exploring a unique work environment[4] (d=0.46 standard deviations). Minority apprentices were much more likely than non-minority apprentices to be motivated by teacher or professor encouragement[5] (d = 0.99 standard deviations).

The CQL Experience

The apprentice questionnaire included several items asking about the nature of apprentices' experience in CQL, and how that experience compared to their STEM learning opportunities in school. When asked what field their CQL experience focused on, 50% of responding apprentices selected science, 37% engineering, 11% technology, and 3% mathematics. As can be seen in Chart 5, over half of the responding apprentices indicated that they had at least some input in their project, either through working with their mentor to design the project (18%), working with their mentor and other research team members to design the project (18%), choosing from project options suggested by the mentor (17%), or designing the project on their own (4%). The remaining apprentices reported being assigned a project by their mentor (44%) or not having a project at all (1%).

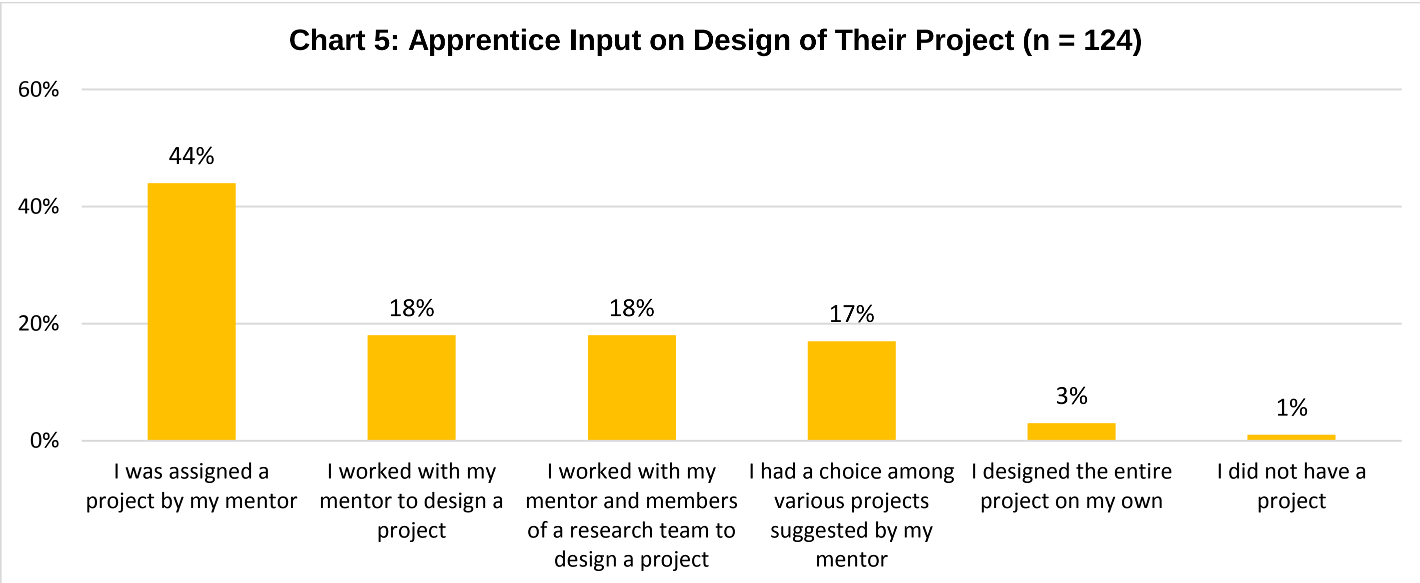
---

[2] Two-tailed independent samples t-test, $t(134) = 2.43$, $p = 0.017$

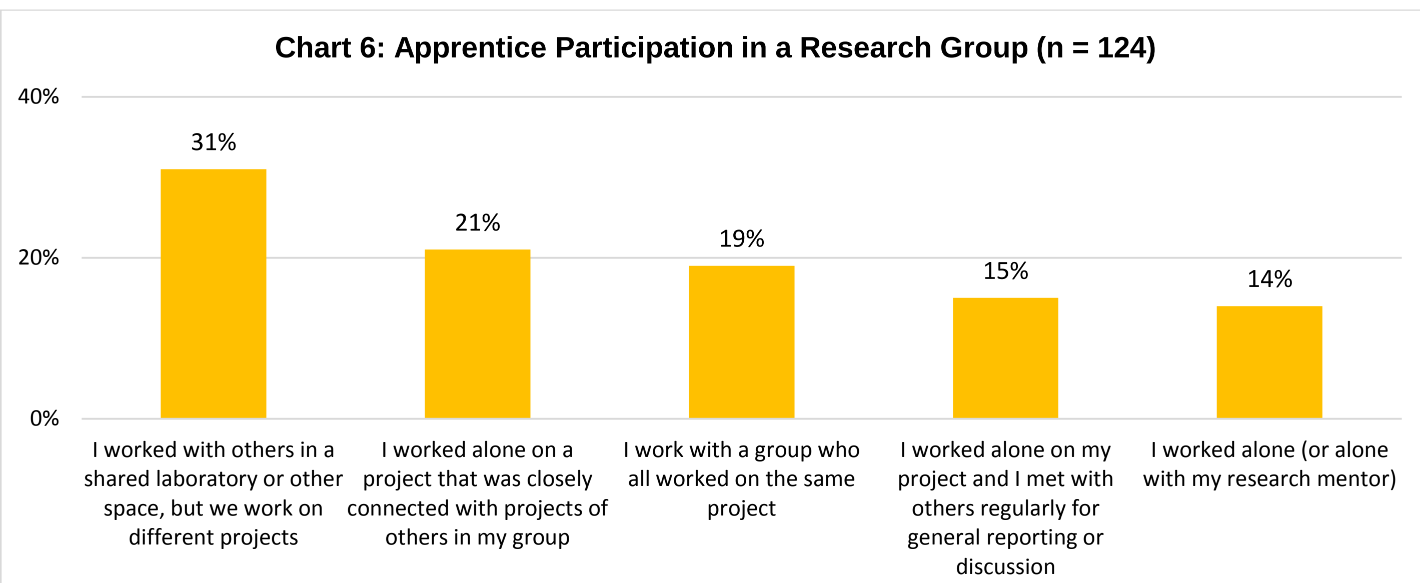
[3] Effect size calculated as Cohen's d: the difference in means of the two groups divided by the pooled standard deviation. Effect sizes of about 0.20 are typically considered small, 0.50 medium, and 0.80 large. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

[4] Two-tailed independent samples t-test, $t(134) = 2.61$, $p = 0.010$

[5] Two-tailed independent samples t-test, $t(135) = 3.90$, $p < 0.001$



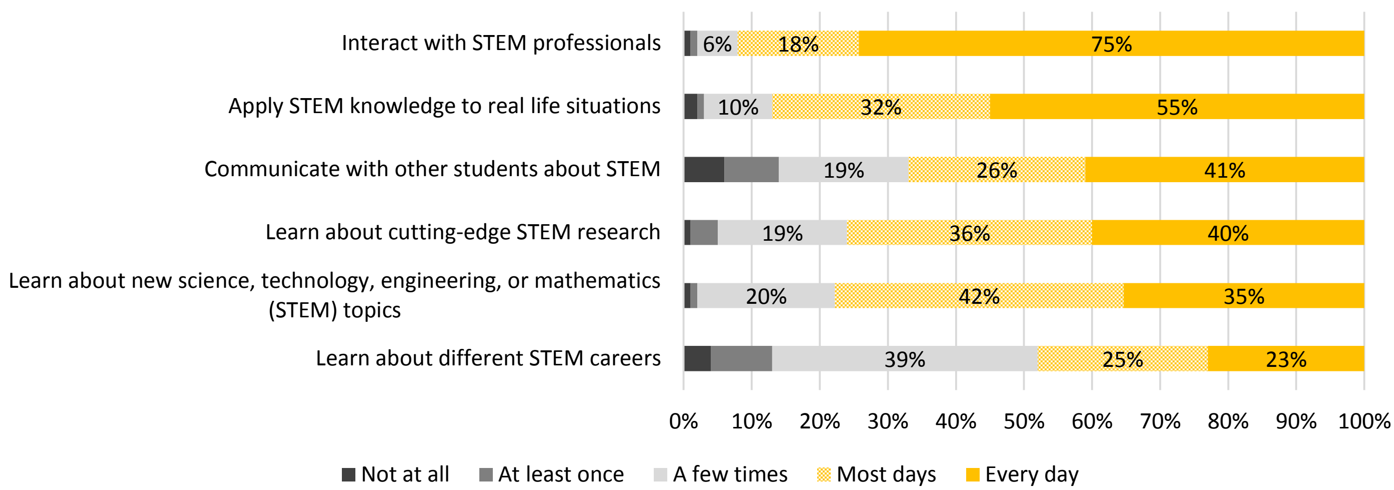
Although most apprentices worked in close proximity with others during their experience (see Chart 6), they tended to work independently on their projects. For example, 31% reported working in a shared laboratory/space with others, but on different projects. Similarly, 21% indicated working alone on a project closely connected to other projects in their group, while 14% reported working alone (or along with their research mentor) and 15% alone with regular meetings for reporting progress. Only 19% indicated they worked with a group on the same project.



IT STARTS HERE.

Apprentices were also asked about the types of activities they engaged in during their experience. As can be seen in Chart 7, the vast majority of respondents indicated interacting with STEM professionals and applying STEM knowledge to real life situations on most days or every day of the experience. The majority of apprentices also reported learning about STEM topics, learning about cutting-edge STEM research, and communicating with other apprentices about STEM on most days or every day. Mentors were asked similar questions about the nature of their apprentices' experiences. Overall, their responses paint a similar picture of the CQL experience (responses to these items can be found in Appendix C).[6]

Chart 7: Nature of Student Activities in CQL (n = 132-136)



Because increasing the number of students who pursue STEM careers is one goal of the CQL program, the apprentice questionnaire also asked how many jobs/careers in STEM in general, and STEM jobs/careers in the DoD more specifically, apprentices learned about during their experience. As can be seen in Table 14, nearly all apprentices reported learning about at least one STEM job/career, and the majority (51%) reported learning about 4 or more. Similarly, 86% of apprentices reported learning about at least one DoD STEM job/career, with 54% reporting learning about 3 or more.

[6] Because of the low response rates on both the student and mentor questionnaires, it is not possible to determine whether any differences between the two datasets are real or an artifact of which students and mentors provided data.

Table 14. Number of STEM Jobs/Careers Apprentices Learned about During CQL (n = 119)		
	STEM Jobs/Careers	**DoD STEM Jobs/Careers**
None	9%	14%
1	10%	19%
2	13%	13%
3	16%	11%
4	3%	5%
5 or more	48%	38%

Apprentices were also asked which resources impacted their awareness of DoD STEM careers. Participation in CQL (72%) and apprentices' mentors (69%) were most often reported as being somewhat or very much responsible for this impact (see Chart 8). In contrast, the AEOP resources (website, social media, brochure, and instructional supplies) were not particularly impactful as, for each source, more than 65% of apprentices reported not experiencing it or it having no impact on their awareness of DoD STEM careers.

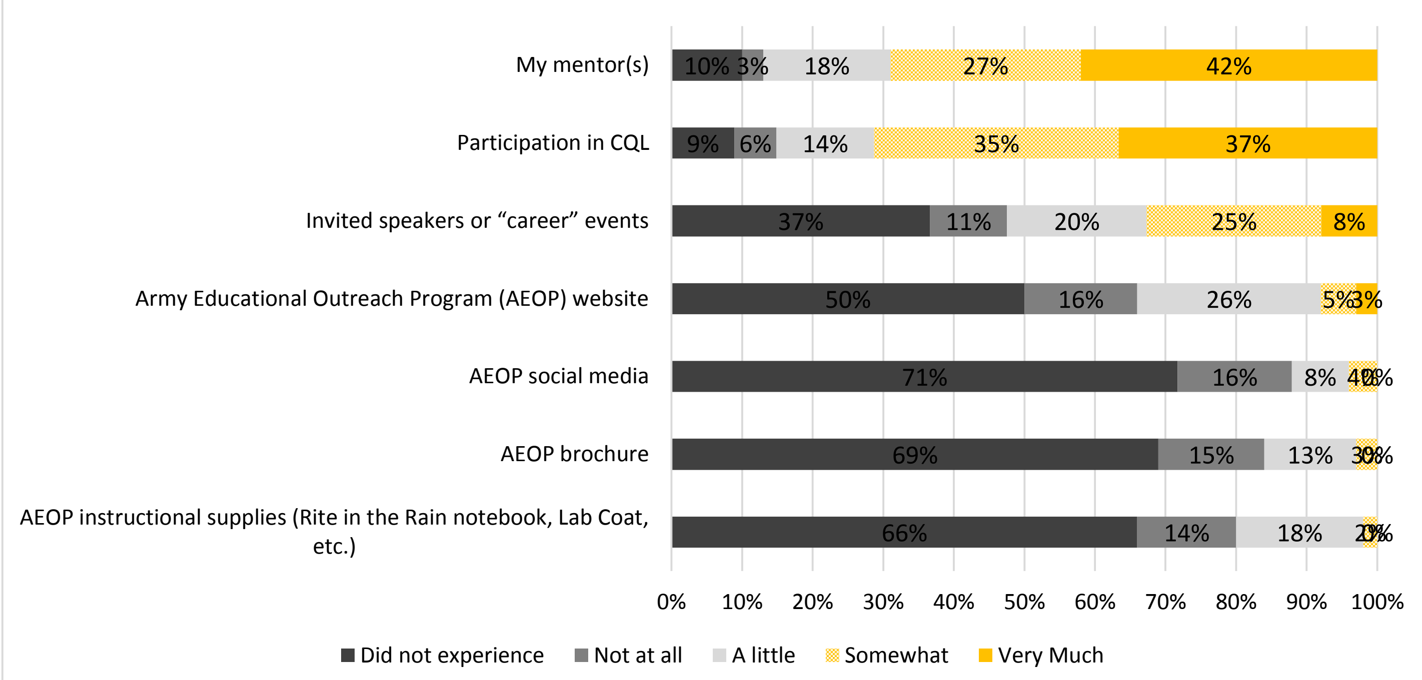
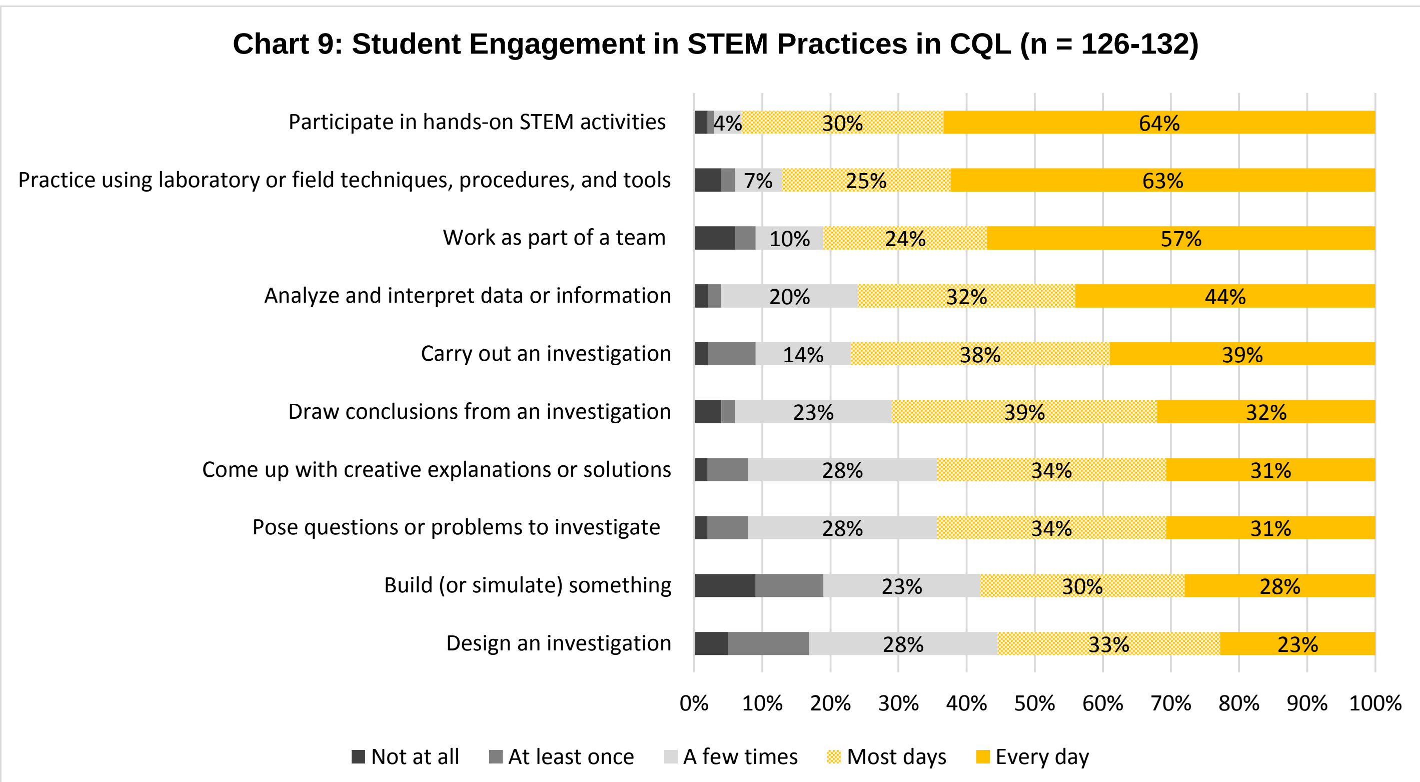


Chart 8: Impact of Resources on Student Awareness of DoD STEM Careers (n = 122-124)

The questionnaire also asked apprentices how often they engaged in various STEM practices during CQL. Results indicate that apprentices were very actively engaged in doing STEM during the program (see Chart 9). For example, 93% of responding apprentices indicated participating in hands-on STEM activities on most days or every day; 88% reported practicing using laboratory or field techniques, procedures, and tools; and 81% reported working as part of a team. In addition, apprentices indicated being integrally involved in the work of STEM on most days or every day, including carrying out an investigation (77%), analyzing and interpreting data or information (76%), drawing conclusions from an investigation (71%), coming up with creative explanations or solutions (65%), and posing questions or problems to investigate (65%). Overall, data from the mentor questionnaire (included in Appendix C) provide a similar sense of which practices CQL apprentices participated in most often. However, mentors' estimations of how often apprentices engaged in the practices appeared higher for several items (practice using laboratory or field techniques, procedures and tools; participate in hands-on STEM activities; work as part of a team; and carry out an investigation) and lower for one item (design an investigation). Again, it is not clear whether these differences were due to differences in interpretation or were related to which mentors and which apprentices responded to the questionnaires.



A composite score[7] was calculated for each of the two sets of items related to apprentices' STEM experiences in CQL, the first titled "Learning about STEM in CQL,"[8] and the second "Engaging in STEM Practices in CQL."[9] Response categories were converted to a scale of 1 = "Not at all" to 5 = "Every day" and the average across all items in the scale was calculated. The composite scores were used to test whether there were differences in apprentice experiences by gender and race/ethnic group (minority vs. non-minority apprentices). For both sets of items, there were no significant differences in composite scores by gender or race/ethnic group.

To examine how the CQL experience compares to their typical school experience, apprentices were asked how often they engaged in the same activities in school (individual item responses can be found in Appendix B). These responses were also combined into two composite variables: "Learning about STEM in School,"[10] and "Engaging in STEM Practices in School"[11] that are parallel to the ones asking about CQL. As can be seen in Chart 10, scores were significantly higher on the "in CQL" versions of both composites than on the "in school" versions (large effects of d = 0.720 standard deviations and d = 0.958 standard deviations respectively).[12] These data indicate that CQL provides apprentices with more intensive STEM learning experiences than they would typically receive in school.

[7] Using multiple statistical tests on related outcomes requires the use of a Type I error rate adjustment to reduce the likelihood of false positives (i.e., detecting a difference when one does not truly exist). However, Type I error rate adjustments lead to a reduction in statistical power (i.e., the ability to detect a difference if it does exist). The use of a composite score helps avoid both of these problems by reducing the total number of statistical tests used. In addition, composite scores are typically more reliable than individual questionnaire items.

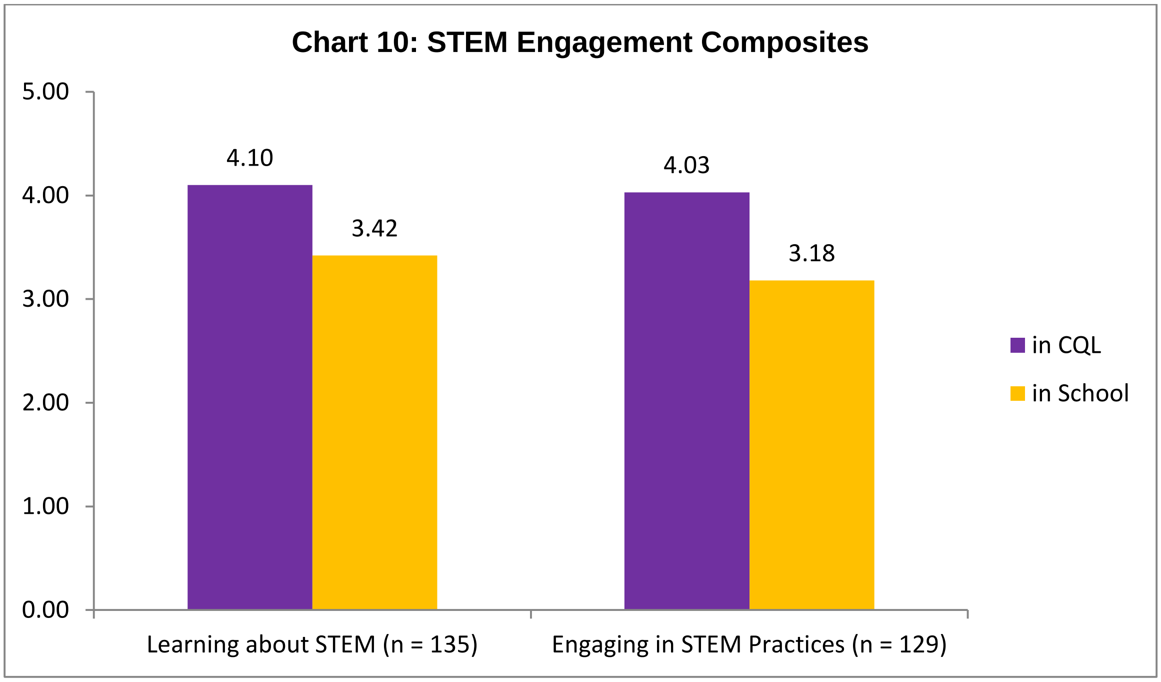
[8] The Cronbach's alpha reliability for these 6 items was 0.783.

[9] The Cronbach's alpha reliability for these 10 items was 0.859.

[10] Cronbach's alpha reliability of 0.863.

[11] Cronbach's alpha reliability of 0.923.

[12] Two-tailed independent samples t-test, Learning about STEM, $t(134) = 8.321$, $p < 0.001$, Engaging in STEM practices, $t(128) = 10.878$, $p < 0.001$



The Role of Mentors

Mentors play a critical role in the CQL program. Mentors supervise and support apprentices' work, advise apprentices on educational and career paths, and generally serve as STEM role models for CQL apprentices. The majority of mentors (63%) responding to the mentor questionnaire reported working with 1 apprentice, though responses ranged from 1 to 10 apprentices.

Mentors were asked whether or not they used a number of strategies when working with apprentices. These strategies comprised five main areas of effective mentoring:[13]

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.

[13] 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.

Large proportions of responding mentors used several strategies to help make the learning activities relevant to students (see Table 15).[14] For example, all reported finding out about student's backgrounds and interests at the beginning of the program. Many also gave students real-life problems to investigate or solve (84%); selected readings or activities that related to students' backgrounds (79%); and encouraged students to suggest new readings, activities, or projects (74%). The majority helped students become aware of the roles STEM plays in their everyday lives (63%) and made explicit provisions for students who wanted to carry out independent studies (56%).

Table 15. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 18-19)	
Item	**Questionnaire Respondents**
Finding out about students' backgrounds and interests at the beginning of the program	100%
Giving students real-life problems to investigate or solve	84%
Selecting readings or activities that relate to students' backgrounds	79%
Encouraging students to suggest new readings, activities, or projects	74%
Helping students become aware of the roles STEM plays in their everyday lives	63%
Making explicit provisions for students who wish to carry out independent studies	56%
Asking students to relate outside events or activities to topics covered in the program	44%
Helping students understand how STEM can help them improve their communities	39%

Similarly, mentors reported using a variety of strategies to support the diverse needs of students as learners. As can be seen in Table 16, nearly all responding mentors reported treating all students the same way, regardless of gender or race/ethnicity (89%); using gender neutral language (89%); and helping students find additional support if needed (89%). Many mentors found out about students' learning styles at the beginning of the program (79%); provided extra readings, activities, or other support for students lacking essential background knowledge or skills (74%); and used diverse teaching/mentoring activities to address a broad spectrum of students (68%).

[14] The student questionnaire included a subset of these items from each of the five categories. The student data are different from the mentor data (sometimes higher, sometimes lower), and can be found in Appendix B. It is not clear if the differences are due to which students and mentors responded or differences in apprentice and mentor perspectives.

Table 16. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 18-19)	
Item	**Questionnaire Respondents**
Interacting with all students in the same way regardless of their gender or race and ethnicity	89%
Using gender neutral language	89%
Directing students to other individuals or programs if I can only provide limited support	89%
Finding out about students' learning styles at the beginning of the program	79%
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	74%
Using diverse teaching/mentoring activities to address a broad spectrum of students	68%
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	44%

Mentors reported using many strategies to support students' development of collaboration and interpersonal skills (see Table 17). For example, nearly all of those responding to the questionnaire indicated having students work as members of a team on activities or projects (89%), listen to the ideas of others with an open mind (89%), and participate in giving and receiving feedback (89%). Many also had students exchange ideas with others whose backgrounds or viewpoints were different from their own (79%), explain difficult ideas to others (74%), and tell others about their backgrounds and interests (74%).

Table 17. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 18-19)	
Item	**Questionnaire Respondents**
Having students work on collaborative activities or projects as a member of a team	89%
Having students listen to the ideas of others with an open mind	89%
Having students participate in giving and receiving feedback	89%
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	79%
Having students explain difficult ideas to others	74%
Having students tell others about their backgrounds and interests	74%
Having students develop ways to resolve conflict and reach agreement among the team	68%
Having students pay attention to the feelings of all team members	63%

When asked about strategies used to support student engagement in authentic STEM activities, all responding mentors reported encouraging students to seek support from other team members; giving constructive feedback to improve students' STEM competencies; and demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use (see Table 18). In addition, nearly all responding mentors reported allowing students to work independently as appropriate for their self-management abilities and STEM competencies (95%), helping students practice STEM skills with supervision (95%), and having students access and critically review technical texts or media to support their work (95%). Encouraging opportunities in which students could learn from others (84%) and teaching or assigning readings about specific STEM subject matter (74%) were also widely used strategies.

Table 18. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 19)	
Item	**Questionnaire Respondents**
Encouraging students to seek support from other team members	100%
Giving constructive feedback to improve students' STEM competencies	100%
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	100%
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	95%
Helping students practice STEM skills with supervision	95%
Having students access and critically review technical texts or media to support their work	95%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	84%
Teaching (or assigning readings) about specific STEM subject matter	74%

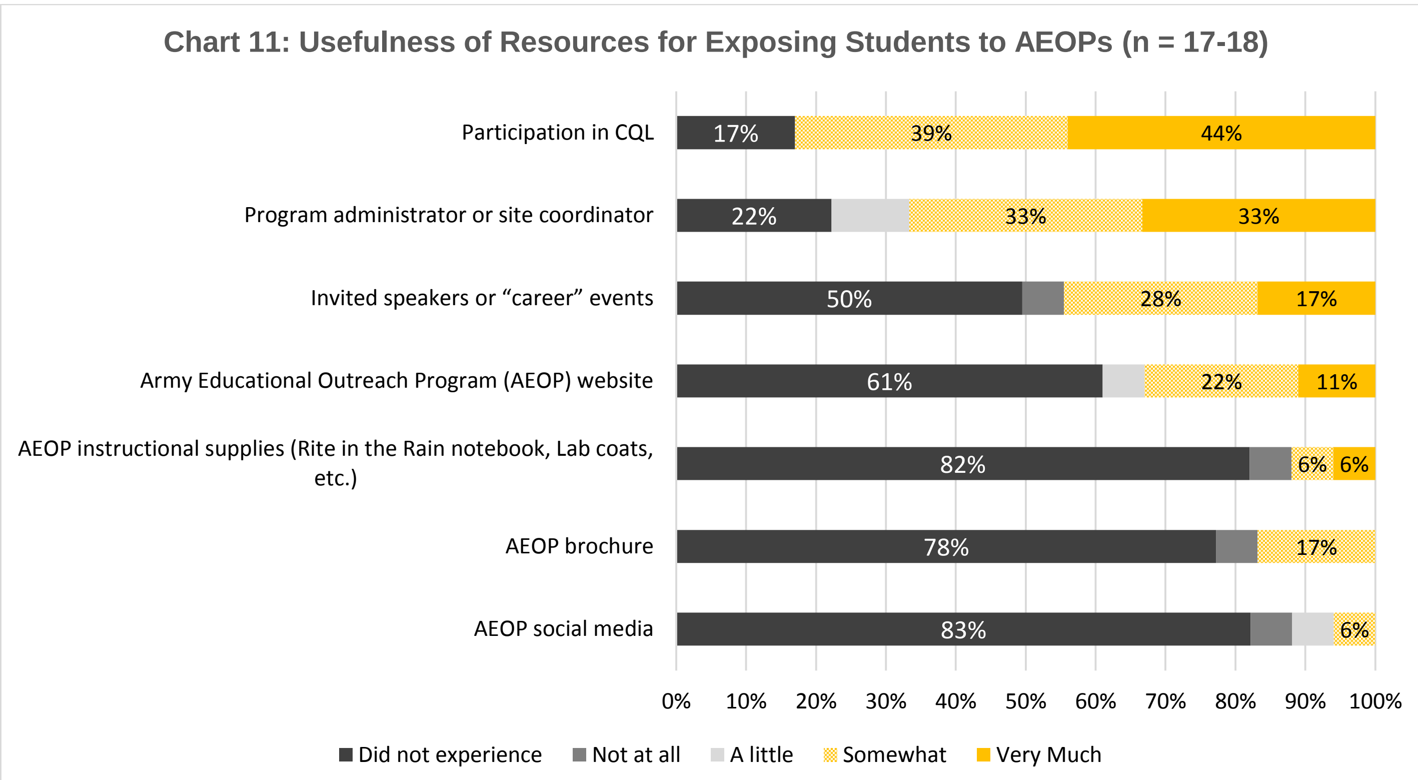
The last series of items about mentoring strategies focused on supporting students' STEM educational and career pathways (see Table 19). All of the responding mentors reported asking students about their educational and career interests. Many also shared personal experiences, attitudes, and values pertaining to STEM (84%), provided guidance to students about educational pathways that would prepare them for a STEM career (79%), helped students build effective STEM networks (68%), and discussed STEM career opportunities outside of the DoD or other government agencies (67%).

Table 19. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 18-19)	
Item	**Questionnaire Respondents**
Asking about students' educational and career interests	100%
Sharing personal experiences, attitudes, and values pertaining to STEM	84%
Providing guidance about educational pathways that would prepare students for a STEM career	79%
Helping students build effective STEM networks	68%
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	67%
Critically reviewing students' résumé, application, or interview preparations	63%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	58%
Discussing STEM career opportunities with the DoD or other government agencies	58%
Recommending extracurricular programs that align with students' educational goals	53%
Recommending student and professional organizations in STEM	47%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	32%
Recommending Army Educational Outreach Programs that align with students' educational goals	22%

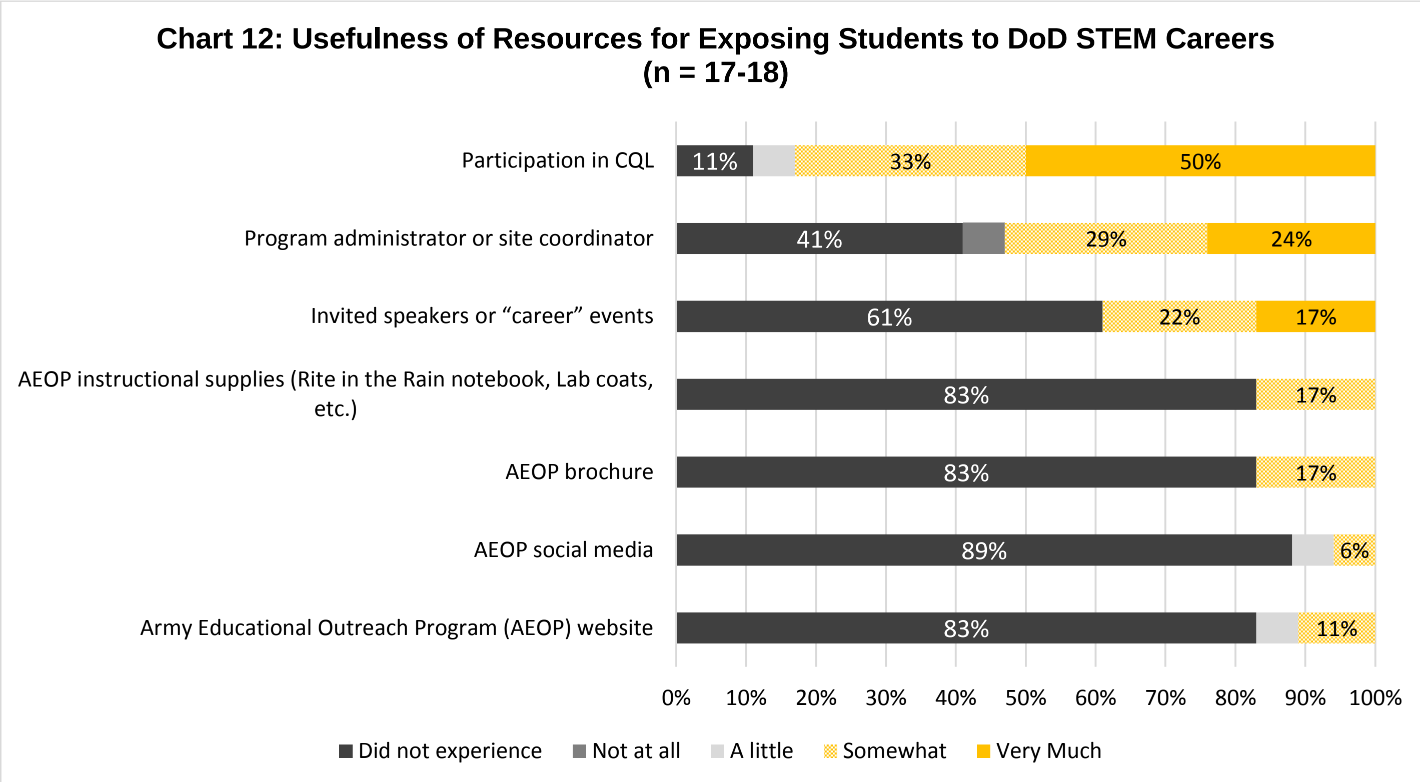
A separate item on the mentor questionnaire asked which of the AEOP programs mentors explicitly discussed with their students during CQL. Not surprisingly, the most frequently discussed program was CQL (74%), as can be seen in Table 20. Other than CQL, responding mentors had discussed few AEOP programs in which apprentices were eligible to participate. About one-third of the responding mentors indicated discussing at least one other AEOP with students, but the two most commonly selected were programs in which apprentices could no longer participate – SEAP (26%) and GEMS (22%). In terms of programs in which apprentices could still participate, some mentors indicated discussing GEMS Near Peers (21%) and the SMART scholarship (11%).

Table 20. Mentors Explicitly Discussing AEOPs with Students (n = 18-19)	
Item	**Questionnaire Respondents**
College Qualified Leaders (CQL)	74%
GEMS Near Peers	21%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	11%
Undergraduate Research Apprenticeship Program (URAP)	0%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	0%

Mentors were also asked how useful various resources were in their efforts to expose students to the different AEOPs. As can be seen in Chart 11, participation in CQL (83%), the program administrator or site coordinator (67%), and invited speakers or career events (44%) were most often rated as "somewhat" or "very much" useful. Materials provided by the AEOP program and ASEE tended not to be seen as very useful, with large proportions of mentors indicating they did not experience these resources. For example, 82% of responding mentors reported not experiencing AEOP instructional supplies (e.g., Rite in the Rain notebooks, lab coats), and only one mentor (6%) rated them as "very much" useful. In addition, more than three-fourths of responding mentors did not experience the AEOP brochure or social media; none found these resources very useful.



Mentors were also asked how useful these resources were for exposing students to DoD STEM careers (see Chart 12). As with the previous item, mentors were most likely to rate participation in CQL as useful, with 83% selecting "somewhat" or "very much." The program administrator or site coordinator (53%) was seen as "somewhat" or "very much" useful by the majority of responding mentors. Again, the AEOP materials were less likely to be seen as very useful for this purpose (a range of 6-17% selecting "somewhat" useful and none selecting "very much"), with over 80% of mentors indicating they did not experience each of these resources.



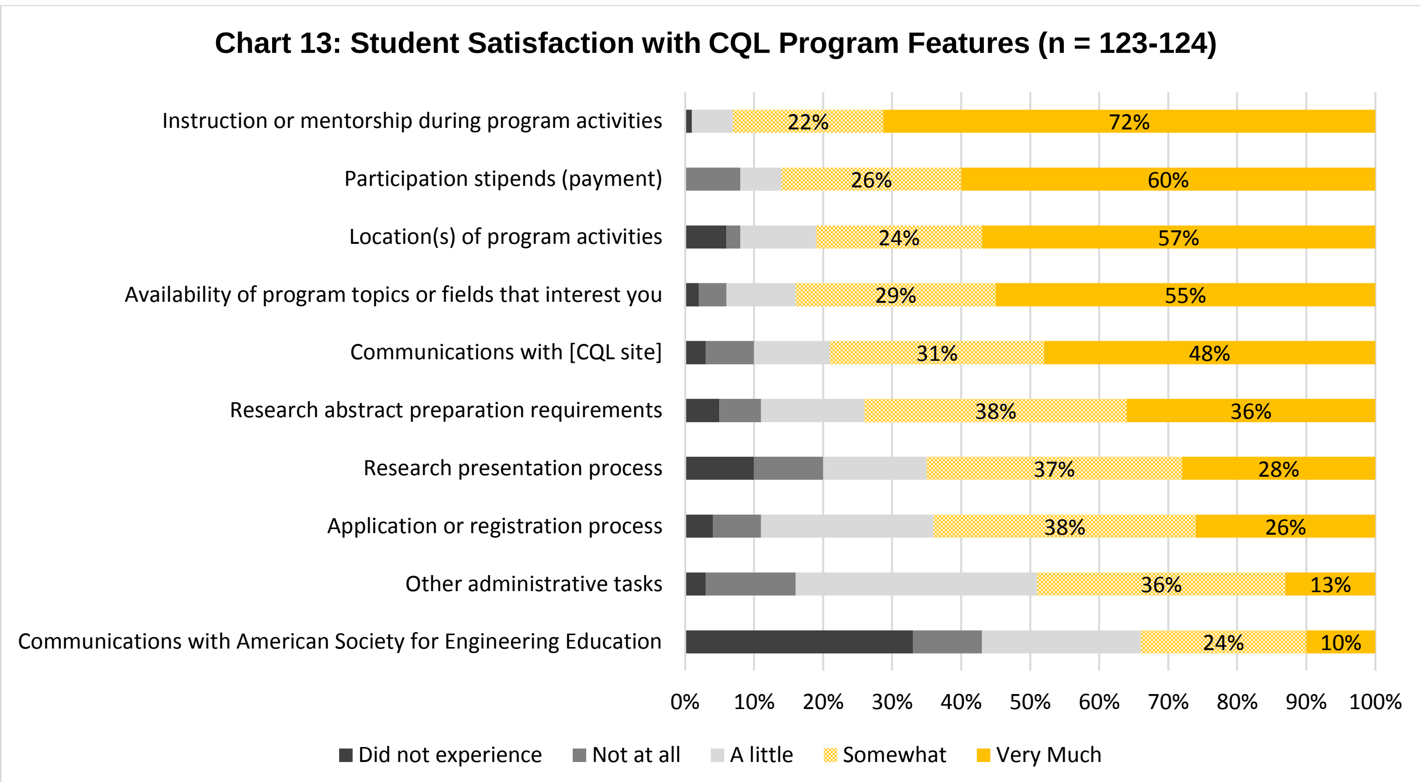
In focus groups, mentors were asked about efforts to educate apprentices about both other AEOPs and about DoD STEM research. Most commonly, mentors indicated that they did not talk to apprentices about other AEOPs and/or did not know much about other AEOPs themselves, making it difficult to talk to apprentices about them. In terms of increasing participants' awareness of DoD STEM research, mentors indicated that apprentices gained exposure to different types of work taking place on site through a variety of experiences related to their internship. These experiences included conversations between mentors and apprentices about career paths, conversations with other employees at the site about their work, and simply being exposed to different research through the work that apprentices did. For instance:

> *I think when we're just having a normal conversation, they're just asking what else is going on, or even when we're just having a general conversation, I tell them 'this lady does this.' I think it's just like, because we spend so much time with them, we talk about different things and it kind of comes up and you talk about different groups in the building. (CQL mentor)*

> *I've tried to introduce our students to other people outside of our team so they can learn what somebody in the next building or the next office does that's totally different from what they are doing. I think it is really good for them to learn a bigger picture of what the organization does. We hired them for specific purposes and projects but we inform them about other things that are going on too so they can learn as much as they can while they are here. (CQL mentor)*

Satisfaction with CQL

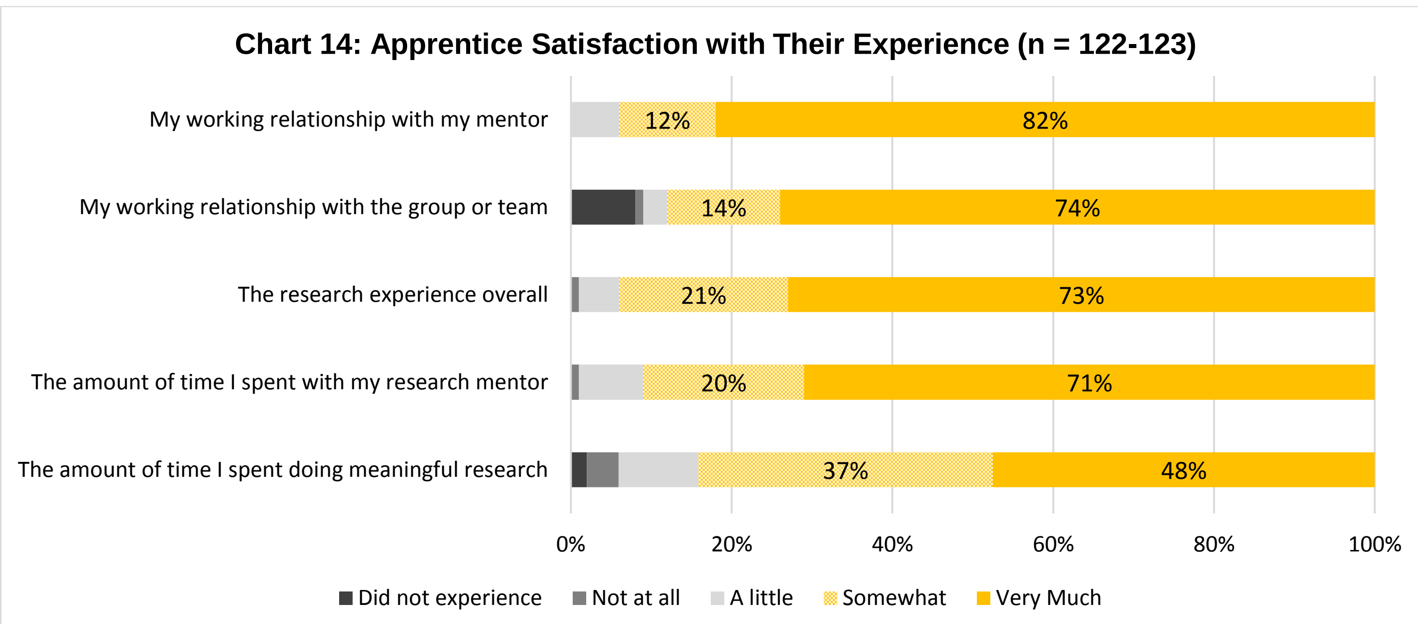
Apprentices and mentors were asked how satisfied they were with a number of features of the CQL program. As can be seen in Chart 13, the majority of responding apprentices were somewhat or very much satisfied with most of the listed program features. For example, 94% of apprentices were at least somewhat satisfied with instruction or mentorship during program activities, 85% with the stipend, 84% with the availability of program topics or fields that interest them, and 81% with location(s) of program activities. In contrast, fewer than half of responding participants were somewhat or very much satisfied with other administrative tasks (49%), and about one-third (34%) were at least somewhat satisfied with communications with ASEE.



Apprentices were also asked about their satisfaction with access to their mentor. As can be seen in Table 21, 61% of responding apprentices indicated their mentor was always available, and 23% that their mentor was available more than half of the time. Few apprentices indicated that their mentor was available half of the time or less.

Table 21. Apprentice Reports of Availability of Mentors (n = 124)	
Item	**Questionnaire Respondents**
The mentor was always available	61%
The mentor was available more than half of the time	23%
The mentor was available about half of the time of my project	10%
The mentor was available less than half of the time	7%

Similarly, apprentices were asked about their satisfaction with their mentors and the research experience (see Chart 14). The majority of apprentices indicated being satisfied "very much" with all but one feature (the amount of time spent doing meaningful research), with the vast majority being satisfied at least "somewhat" with each feature. For example, 82% of apprentices indicated "very much" when asked about their relationship with their mentor, with another 12% indicating "somewhat." Similarly, almost all were at least somewhat satisfied with the research experience overall (94%) and the amount of time spent with their research mentor (90%); and most reported being at least somewhat satisfied with their relationship with the group or team (88%) and with the time spent doing meaningful research (85%).



An open-ended item on the questionnaire asked apprentices about their overall satisfaction with their CQL experience. Almost all of the 74 apprentices who responded to the question had something positive to say about their experience (91%), although some also made negative comments (40%). In general, positive comments focused on the actual experience working at the site, while negative comments focused on administrative issues. Positive comments most commonly were quite general in nature (25 of 67), such as, "I was very satisfied; the program was very useful to me." Other common themes included complimenting their mentors and/or other lab staff with whom they worked (21 of 67), noting that the work experience in the labs was positive (21 of 67), and indicating that they learned a lot through the program (16 of 67). For example:

> *I was very satisfied. As always, I learned a great deal and was able to work with advanced technology, such as the SEM and Deep Silicon Etcher. Additionally, the department that I worked in and my mentors were very supportive; I received all the aid I required and more. (CQL apprentice)*

> *Overall, I really enjoyed my experience here at the [CQL site]. I most certainly learned a lot about EM technology, programming, and problem solving. I actually appreciated that I got to apply what I have already learned in class to the work that I got to do at my job. My mentors were very helpful, and I learned so much from them in the one-on-one setting that I got to work in. The hands-on experience was incredible. I got to use equipment that I could only look at in catalogs before my internship. Not only that, but I got to get very familiar with the equipment and learn from professionals who knew how to use them. I am very thankful for this internship and I feel like it has contributed a lot to my overall engineering education. I look forward to coming back here in the winter time. (CQL apprentice)*

> *I was very satisfied with my CQL experience. I truly felt that I was contributing to the community. I learned a lot about topics I hadn't yet learned about through school, and may not have considered learning about if I hadn't done this program. My mentor was extremely helpful and made sure I understood what we were doing and why. He made me feel like a part of the team. I also loved working in a professional research environment. I now know a lot more about the research process and research topics. Overall, I am extremely satisfied with the program and intend to return next year. I also hope to continue working for the DoD after college, as a result of this program. (CQL apprentice)*

"My mentors were very helpful, and I learned so much from them in the one-on-one setting that I got to work in. The hands-on experience was incredible. I got to use equipment that I could only look at in catalogs before my internship...I am very thankful for this internship and I feel like it has contributed a lot to my overall engineering education." -- CQL Apprentice

I am very satisfied with my CQL experience. I gained knowledge of STEM and STEM opportunities and careers, I got to work with real world research projects, and I gained valuable mentorship. I am now able to be more confident in myself, and the work that I will do in my future career. (CQL apprentice)

In contrast, about 30% of the apprentices who responded to this question described concerns with administrative aspects of the program. Among these concerns were descriptions of issues related to receiving payments, gaining clearance and access to do their work, and a general lack of communication. In the words of four apprentices:

The group I work with is great, and I enjoy my work and my research area. I am very satisfied with that aspect. However, I wish I could have taken care of all the administrative steps before my first day so that I could have unescorted access sooner than 6 weeks into the program, and computer access sooner than 8 weeks into the program. I have also been paid incorrectly twice, and once I wasn't paid for more than a week. It's a good thing my landlord was understanding, but that's really unprofessional. CQL is a great way to get student researchers into DoD positions, but it is not an easy or streamlined process, which ends up wasting student time and likely causes some students to leave STEM or DoD careers. (CQL apprentice)

[I] received my project from my mentor early on however it involved using a computer. I did not get my CAC card until half of the time I was appointed to be here was already passed, thus really only felt valuable for half of the time I was working. Overall this made me feel very disappointed with my own progress of research because although I was working for 3 months, I only got 1.5 months of work done. (CQL apprentice)

I have had a very positive experience with my mentor, my workplace, and my assigned duties while on internship here. I have had a very negative experience with CQL itself. During my first month here, I had to borrow several hundred dollars from my mentor and from my roommate in order to pay rent, because I'd made the mistaken assumption that I would get paid on time. Unfortunately, this was not the case: getting paid through CQL (itself routed through ASEE in some way) meant that there were many more possible points of failure and as a result, I got paid on the 19th of May for work I did in April. So far, the majority of my paychecks (despite being direct deposit) have been late, and from my discussions with other CQL students here I am not alone in that experience. Due to the interconnection between [the site], CQL, and ASEE, it was impossible to find out where the error had originated and it took a while to even determine who to contact to fix the problems...I did not find out about this

> *"I was very satisfied with my CQL experience. I truly felt that I was contributing to the community. I learned a lot about topics I hadn't yet learned about through school, and may not have considered learning about if I hadn't done this program."* -- CQL Apprentice

job through CQL, but because my mentor decided to register this job in [my university's] co-op database - only after I was accepted there did I even start the CQL process, and my experiences with CQL itself have shown that it is an intrusive program that adds a needless barrier between myself and my workplace. My mentor and I have discussed the possibility of my returning to the lab in the future as an independent contractor, since other employees here have worked here that way for years without major issues. While I would very much like to return to [this site] in the future, I will not do so through CQL if I can possibly avoid it. (CQL apprentice)

My day to day lab experience with my mentor was amazing. I learned a lot from him, and he helped me get another job for next year. However, this has been one of the most poorly run programs I have been a part of, and the only reason I would come back would be to work for my mentor because this past summer was a disgrace. The first pay check was 3 weeks late, and I almost lost my housing for the summer. I had to be escorted around for over 6 weeks and was unable to do most of my work, and I couldn't even make the presentation that CQL required me to write because I did not have computer access. In addition, most of the guidelines seemed to have been thrown together on the fly, and no one knew what was going on. Most of our information was obtained because we had to chase people down to find things out when that information should have been given to us at the beginning. I would not recommend working for the CQL program to anyone else, and I hope that the Army chooses a different program to run the internship program because it has been a joke. (CQL apprentice)

When asked to identify three ways in which the program could be improved, 83 apprentices provided at least one suggestion. The most common theme, by far, in the responses to this open-ended item, described by 71 (86%) related to the logistical issues. For example, 22 apprentices (31% of apprentices commenting on logistical issues) made comments related to communication, 19 apprentices (27%) made comments related to payment, and 17 apprentices (24%) pointed to problems gaining access and clearance. For instance:

More communication before arrival about what [we] will be doing to better prepare [would be helpful]. (CQL apprentice)

I received very little information on what I needed to do when I arrived at [the CQL site]. So, more information on the arrival process would be nice. (CQL apprentice)

I did not receive my stipend for the month of June until the last week of July, so I had practically worked 2 full months before I was paid. (CQL apprentice)

Organization. Getting paid a week and a half late was honestly kind of upsetting. Start security clearance earlier so students can have badge and CAC on arrival. (CQL apprentice)

Badge, CAC, and computer access processing for privileges around the lab. It needs to be sped up or made ready when the students start working at the lab. (CQL apprentice)

Streamline the paperwork and badging process. It shouldn't take a month and 15 visits to administrators to get things worked out. (CQL apprentice)

Outside of logistical issues, other suggestions related to project expectations and requirements, including the nature and clarity of those requirements (22% of apprentices responding to the question), and providing more opportunities for apprentices to interact with each other in or out of work (13%). Examples include:

[Provide] more defined final project parameters. (CQL apprentice)

Make any CQL requirements easier to access. I only heard about the symposium and posters from word of mouth. (CQL apprentice)

Students should have the option of choosing their specific project. (CQL apprentice)

[Include] more traveling or events for students to meet one another. (CQL apprentice)

Allow for students to have more interactions with one another to learn about each other's projects. (CQL apprentice)

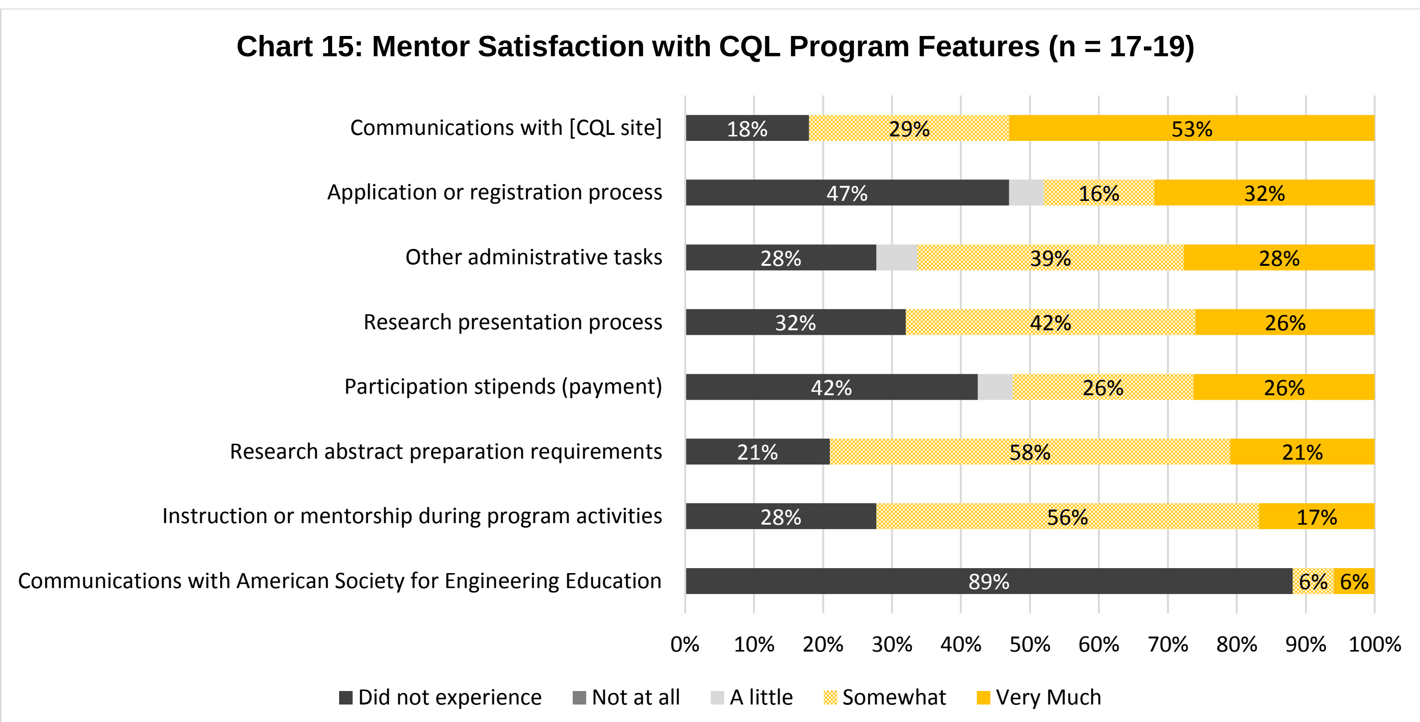
During focus groups, apprentices were also asked about how the CQL program could be improved. Their responses highlighted many of the same issues described above, including issues with clearance and computer access, lack of clarity about expectations and requirements, and disorganization. Another common theme in focus groups was experiencing difficulties due to late notification of acceptance into the CQL program. In particular, apprentices described unease, difficulties finding housing, and tensions with other employment or education opportunities. Three said:

I don't live in the area so the notification process I felt took quite a bit longer than it should. I had to plan out my summer and sublease a place and move all my stuff down here so…My mentor hinted that I was accepted and then they chose me. But seeing the actual document and the payment, there is no real communication until the official letter is received maybe 3 weeks before I had to move down here. I needed to know, I needed to let my other job know that I wasn't going to be there. It ended up working out. (CQL apprentice)

We got the email notification of whether we got in the program or not on the 8th of May and the program started on May 29th I think. For some of us that applied to multiple things, that was kind of late notice. To be honest, I was about to take another job and I'm glad that I didn't considering that it wasn't as good of a job as this one turned out to be. (CQL apprentice)

I interviewed for this position about a year before I got it. I was actually also applying to another internship that wanted me to make a decision before I heard back from [the CQL site] so I actually wanted to start here the summer before last summer but I ended up taking that internship because I didn't know that I had been approved. So I guess it would be good to try to be aware of other companies in the area that are looking for student interns because some of them want the student to decide whether or not they accept the position before they heard back from here. So, obviously I took the internship I was sure of. (CQL apprentice)

Mentors also generally reported being somewhat or very much satisfied with the program components they experienced (see Chart 15). For example 82% were at least somewhat satisfied with communications with their CQL site, 79% with the research abstract preparation requirements, and 72% with instruction or mentorship during program activities. Items with lower levels of satisfaction were due primarily to the large number of responding mentors who reported not experiencing the item, rather than to large numbers expressing dissatisfaction. For example, only 11% of responding mentors reported being at least somewhat satisfied with communications with ASEE, however 89% indicated that they did not experience communications with ASEE. In addition, 56% of responding mentors were at least somewhat satisfied with participation stipends (payment), but 42% indicated that they did not experience this feature; 50% indicated that they were at least somewhat satisfied with the application or registration process, but 47% did not experience that feature.



As with the apprentice questionnaire, the questionnaire for mentors included open-ended items asking their opinions about the program. One item asked them to identify the three most important benefits of CQL; 13 mentors identified at least one benefit. Although several important benefits of the program were listed, the most frequently described were the opportunity for apprentices to gain knowledge and experience (6 of 13, or 46%) as well as exposing apprentices to STEM research and real-world applications (5 of 13, or 38%).

Mentors were also asked to note three ways in which CQL should be improved for future participants. The 11 individuals who responded to this question offered varied suggestions, including improving logistics and organization (5 of 11, or 45%), lengthening the program (4 of 11, or 36%), providing additional apprentice support and resources (3 of 11, or 27%), providing additional mentor support (3 of 11, or 27%), and broadening participation of both mentors and participants (2 of 11, or 18%).

Lastly, mentors were asked to share their overall satisfaction with their CQL experience. The responses were largely positive. Of the 10 individuals who responded to this question, 70% were complimentary of the apprentices, 40% noted that the experience was enjoyable and beneficial for them personally, and 40% described benefits to the apprentices. For example:

> *I am very satisfied with my CQL experience. I have had the pleasure of working with a highly qualified, motivated, and overall excellent student. Much of the gains that she has made are due primarily to her skills and knowledge that she brought with her to the position, although I have observed significant gains in confidence and skill with regards to data analysis and interpretation. (CQL mentor)*

> *My student was great to work with and I look forward to the opportunity to work with him again possibly in the future. I enjoy working with the students and giving them an opportunity to gain real work experience prior to graduation. It is what steered me into research while I was attending undergraduate school. I will continue to mentor students as long as possible as I feel it's an invaluable tool in promoting STEM. (CQL mentor)*

> *It was excellent. These students are highly motivated and extremely hardworking. It's a delight to include them in research projects and to see growth in their knowledge and scientific expertise. (CQL mentor)*

In summary, findings from the Actionable Program Evaluation indicate that the CQL program is successfully engaging apprentices in authentic STEM experiences. The CQL program actively engages apprentices in learning about STEM and in STEM practices through authentic work experiences, more than they would typically experience in school. As part of this engagement, a clear majority of mentors employed strategies to help make the learning activities relevant to apprentices, support the diverse needs of apprentices as learners, support apprentices' development of collaboration and interpersonal skills, and support apprentice engagement in authentic STEM activities. Overall, apprentices and mentors were somewhat or very much satisfied with their experience in the CQL program. However, apprentices and mentors reported dissatisfaction with administrative functions, such as receiving stipends and gaining clearance and access in a timely manner, which negatively impacted the experience for at least some apprentices. In short, these apprentices were generally quite pleased with the work they did and their interactions with mentors and other lab personnel, but were frustrated with administrative issues that detracted from, and in some cases interfered with, that work experience.

In addition, recruitment efforts have been minimally successful at recruiting students from underrepresented and underserved populations. The majority of participants came from groups traditionally well represented in STEM fields (males, Whites, Asians). In addition, both mentors and apprentices tended to learn about CQL through pre-existing relationships with other individuals (e.g., colleagues, friends, professors, family members, pre-existing relationship with a mentor), rather than through broader recruitment efforts (e.g., websites, social media, brochures). The prevalence of these pre-existing relationships in recruiting apprentices in particular may have limited opportunities to include more students from underrepresented and underserved populations.

Outcomes Evaluation

The evaluation of CQL included measurement of several outcomes relating to AEOP and program objectives, including impacts on apprentices' STEM competencies (e.g., knowledge and skills), STEM identity and confidence, interest in and intent for future STEM engagement (e.g., further education, careers), attitudes toward research, and their knowledge of and interest in participating in additional AEOP opportunities.[15] STEM competencies are necessary for a STEM-literate citizenry. STEM competencies include foundational knowledge, skills, and abilities in STEM, as well as the confidence to apply them appropriately. STEM competencies are important for those engaging in STEM enterprises, but also for all members of society as critical consumers of information and effective decision makers in a world that is heavily reliant on STEM. The evaluation of CQL also measured apprentices' self-reported gains in STEM competencies and engagement in opportunities intended to develop what is considered to be a critical STEM skill in the 21st century—collaboration and teamwork.

[15] The outcomes measured in the evaluation study were informed by the following documents:

Committee on STEM Education. (2013*). Federal Science, Technology, Engineering, and Mathematics (STEM) education 5-year strategic plan: A report from the Committee on STEM Education, National Science and Technology Council.* Washington, DC: The White House, Office of Science and Technology Policy.

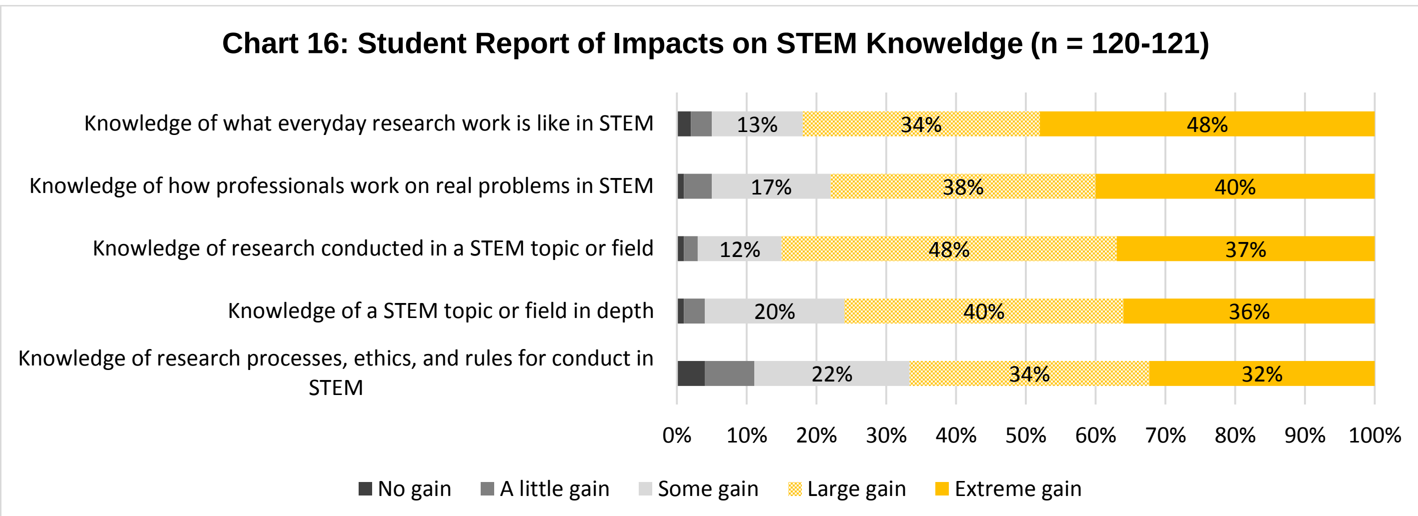
National Research Council. (2009). Learning Science in Informal Environments: People, Places, and Pursuits. Committee on Learning Science in Informal Environments. Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, Editors. Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

President's Council of Advisors on Science and Technology (P-CAST). (February 2012). *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics.* Executive Office of the President.

Report of the Academic Competitiveness Council (ACC). (2007). U.S. Department of Education. Available on the Department's Web site at: http://www.ed.gov/about/inits/ed/competitiveness/acc-mathscience/index.html.

STEM Knowledge and Skills

As can be seen in Chart 16, nearly all responding apprentices reported gains in their STEM knowledge as a result of the CQL program, with clear majorities indicating large or extreme gains in each area. For example, large or extreme gains were reported by 85% of apprentices in their knowledge of research conducted in a STEM topic or filed, and by 83% in their knowledge of what everyday research work is like in STEM. Similar impacts were reported for knowledge of how professionals work on real problems in STEM (79%), knowledge of a STEM topic or field in depth (76%), and knowledge of research processes, ethics, and rules for conduct in STEM (66%). Mentors reported similar impacts on their apprentices' STEM knowledge, although they tended to estimate slightly larger gains than apprentices noted themselves (See Appendix C). Again, it is not clear whether the difference is meaningful, or an artifact of which mentors and apprentices responded to the questionnaire.



These apprentice questionnaire items were combined into a composite variable[16] to test for differential impacts across subgroups of apprentices. There were no significant differences between male and female apprentices or between minority and non-minority apprentices; in other words, these subgroups of apprentices reported similar impacts of the program on their STEM knowledge.

The apprentice questionnaire also asked about perceived impacts on STEM skills, i.e., apprentices' abilities to use STEM practices. Apprentices were presented with different sets of items depending on the focus of their CQL experience (science vs. technology, engineering, or mathematics). Table 22 shows the percentage of responding apprentices reporting large or extreme gains in science-related practices. More than half of the responding apprentices reported at least large gains on many of the items. For example, 75% reported at least large gains on their ability to carry out procedures for an investigation and record data accurately. Similarly, 60% or more reported at least large gains on their

[16] The Cronbach's alpha reliability for these 5 items was 0.926.

ability to read technical or scientific tests, or using other media, to learn about the natural or designed world (65%); decide what type of data to collect in order to answer a question (63%); identify the limitations of data collected in an investigation (63%); ask a question (about a phenomenon) that can be answered with one or more investigations (62%); apply knowledge, logic, and creativity to propose explanations that can be tested with investigations (60%); and support a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge (60%). Fewer responding apprentices reported at least large gains on their ability to consider alternative interpretations of data when deciding on the best explanation for a phenomenon (43%), use data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon (42%), use mathematics or computers to analyze numeric data (35%), and use computer-based models to investigate cause and effect relationships of a simulated phenomenon (30%). For almost all of these items, mentors' reports of apprentices' gains appeared somewhat higher than apprentices' own reports (see Appendix C). These differences may be due to data quality concerns described previously, or differences in perspectives between apprentices and mentors.

Table 22. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Science Practices (n = 55-58)	
Item	**Questionnaire Respondents**
Carrying out procedures for an investigation and recording data accurately	75%
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	65%
Deciding what type of data to collect in order to answer a question	63%
Identifying the limitations of data collected in an investigation	63%
Asking a question (about a phenomenon) that can be answered with one or more investigations	62%
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	60%
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	60%
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	59%
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	57%
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	56%
Using data or interpretations from other researchers or investigations to improve an explanation	55%
Asking questions to understand the data and interpretations others use to support their explanations	55%
Testing how changing one variable affects another variable, in order to understand relationships between variables	54%
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	53%
Integrating information from multiple sources to support your explanations of phenomena	53%
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	53%
Making a model to represent the key features and functions of an observed phenomenon	51%
Asking questions based on observations of real-world phenomena	50%
Supporting a proposed explanation (for a phenomenon) with data from investigations	49%
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	49%
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	43%
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	42%
Using mathematics or computers to analyze numeric data	35%
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	30%

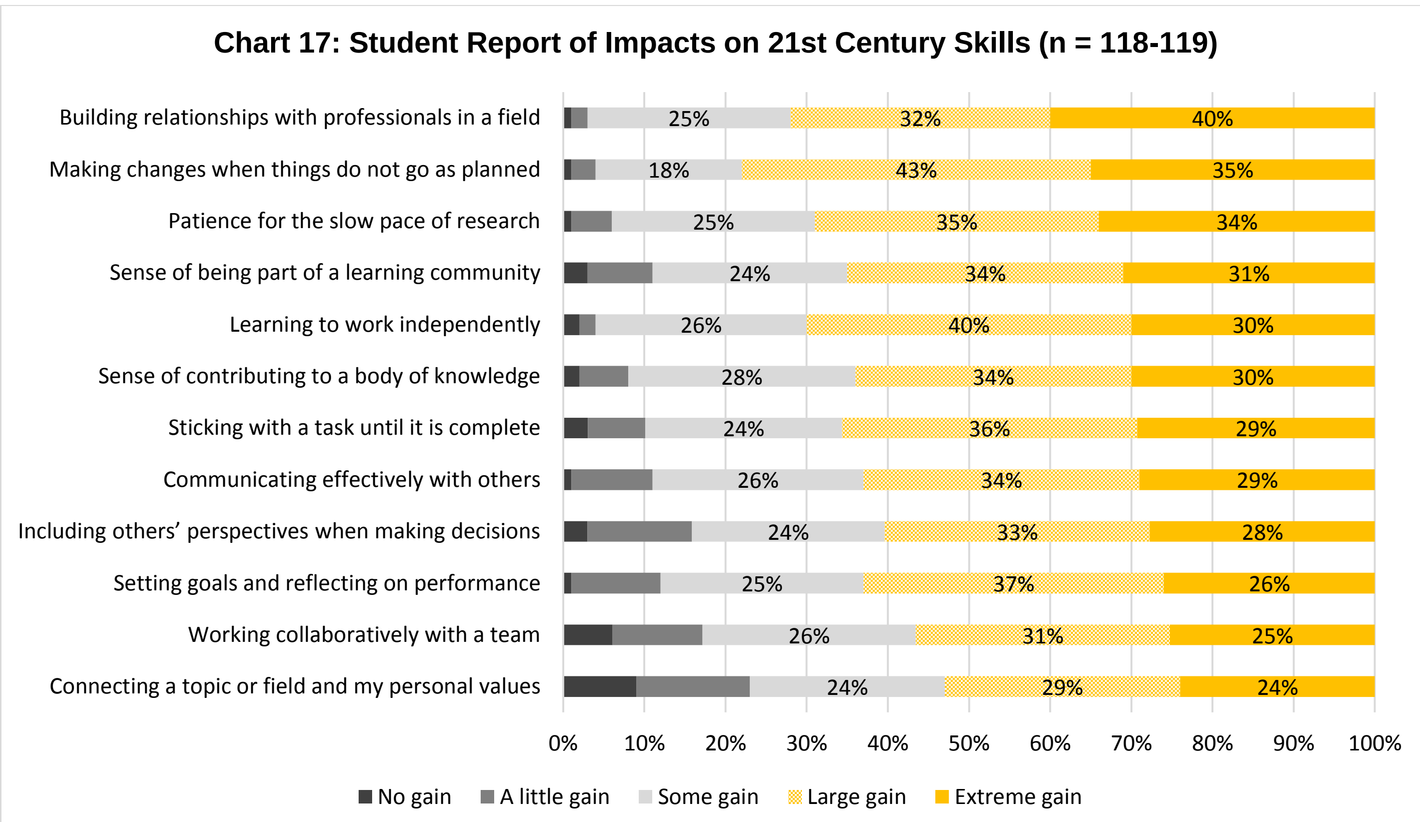
Table 23 shows data for apprentices whose experience focused on the other STEM areas (technology, engineering, and mathematics), specifically self-reported impacts on their abilities related to key engineering practices. A majority of responding apprentices reported large or extreme gains in most of the engineering practices. For example, 60% or more indicated large or extreme gains in their ability to support a proposed solution with relevant scientific, mathematical and/or engineering knowledge (67%); use mathematics or computers to analyze numeric data (66%); design procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected (62%); identify the limitations of the data collected in an investigation (62%); use data or interpretations from other researchers or investigations to improve a solution (62%); apply knowledge, logic, and creativity to propose solutions that can be tested with investigation (60%); decide what type of data to collect in order to test if a solution functions as intended (60%); read technical or scientific texts, or using other media, learn about the natural or designed worlds (60%); and communicate information about their design processes and/or solutions in different formats (60%). Fewer apprentices noted at least large gains in their ability to integrate information from multiple sources to support their solution to a problem (48%) and identify real-world problems based on social, technological, or environmental issues (47%).

Unlike items related to apprentices' gains in science practices, for all items related to gains in key engineering practices, mentors' reports of apprentice gains appeared lower than apprentices' own reports (see Appendix C). These inconsistencies may again be related to data quality concerns described previously, or may be related to differences in perspectives between apprentices and mentors. Another explanation may be that apprentices had lower estimates of their competencies in engineering practices prior to CQL (perhaps because of limited prior opportunities to engage in those practices) than their mentors did (basing their initial estimates on what they saw apprentices doing at the beginning of the internship), thus apprentices may have seen themselves as having greater gains than those estimated by their mentors.

Table 23. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Engineering Practices (n = 57-58)	
Item	**Questionnaire Respondents**
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	67%
Using mathematics or computers to analyze numeric data	66%
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	62%
Identifying the limitations of the data collected in an investigation	62%
Using data or interpretations from other researchers or investigations to improve a solution	62%
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	60%
Deciding what type of data to collect in order to test if a solution functions as intended	60%
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	60%
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	60%
Asking questions to understand the data and interpretations others use to support their solutions	58%
Defining a problem that can be solved by developing a new or improved object, process, or system	57%
Supporting a proposed solution (for a problem) with data from investigations	57%
Displaying numeric data in charts or graphs to identify patterns and relationships	56%
Considering alternative interpretations of data when deciding if a solution functions as intended	55%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	55%
Deciding what additional data or information may be needed to find the best solution to a problem	55%
Using data from investigations to defend an argument that conveys how a solution meets design criteria	54%
Carrying out procedures for an investigation and recording data accurately	53%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	53%
Making a model that represents the key features or functions of a solution to a problem	52%
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	52%
Using computer-based models to investigate cause and effect relationships of a simulated solution	50%
Integrating information from multiple sources to support your solution to a problem	48%
Identifying real-world problems based on social, technological, or environmental issues	47%

Composite scores were calculated for each set of practices items[17] on the apprentice questionnaire to examine whether the CQL program had differential impacts on subgroups of apprentices. There were no significant differences between male and female apprentices or between minority and non-minority apprentices on either composite.

The apprentice questionnaire also asked apprentices about the impact of CQL on their "21st Century Skills" that are necessary across a wide variety of fields. As can be seen in Chart 17, more than half of responding apprentices reported large or extreme gains on each of these skills, including making changes when things do not go as planned (78%), building relationships with professionals in a field (72%), and learning to work independently (71%). Apprentices reported similar gains regardless of gender or race/ethnicity.[18] For most of the items, mentor reports of apprentice gains in this area are somewhat higher than apprentices' own reports (see Appendix C).



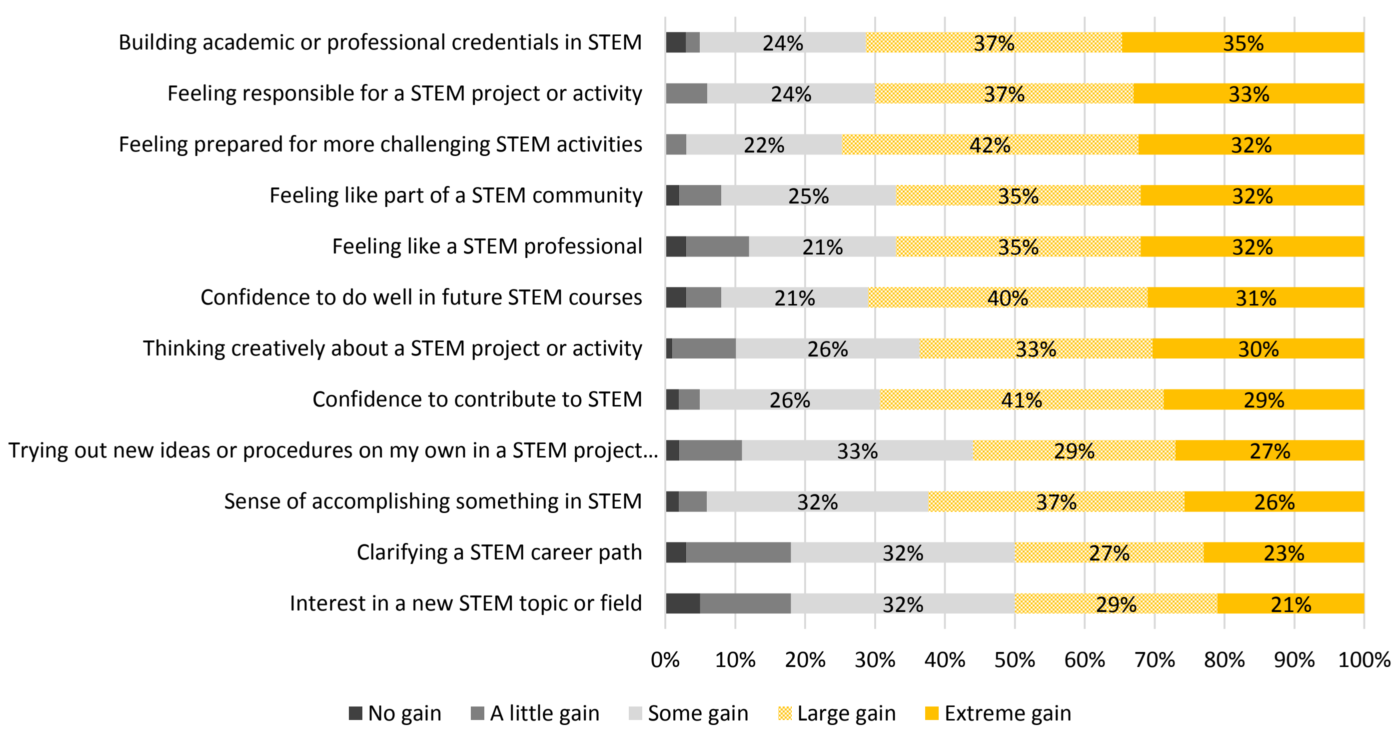
[17] The science practices composite has a Cronbach's alpha reliability of 0.960; the engineering practices composite has a Cronbach's alpha reliability of 0.971.

[18] The Cronbach's alpha reliability for these 12 items was 0.953.

STEM Identity and Confidence

Deepening apprentices' STEM knowledge and skills are important for increasing the likelihood that they will pursue STEM further in their education and/or careers. However, they are unlikely to do so if they do not see themselves as capable of succeeding in STEM.[19] Consequently, the apprentice questionnaire included a series of items intended to measure the impact of CQL on apprentices' STEM identity. These data are shown in Chart 18 and suggest that the program has had a positive impact in this area as at least half of responding apprentices reported large or extreme gains in each area. For example, 74% of responding apprentices reported a large or extreme gain in their feelings of preparedness for more challenging STEM activities, and 72% reported a large or extreme gain in building academic or professional credentials in STEM. Similarly, substantial proportions of apprentices reported large or greater gain on their confidence to do well in future STEM courses (71%), confidence to contribute to STEM (70%), feeling responsible for a STEM project or activity (70%), feeling like part of a STEM community (68%), and feeling like a STEM professional (67%). Comparing results on the composite created from these items,[20] there were no significant differences in impact based on gender or race/ethnicity.

Chart 18: Student Report of Impacts on STEM Identity (n = 117)



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

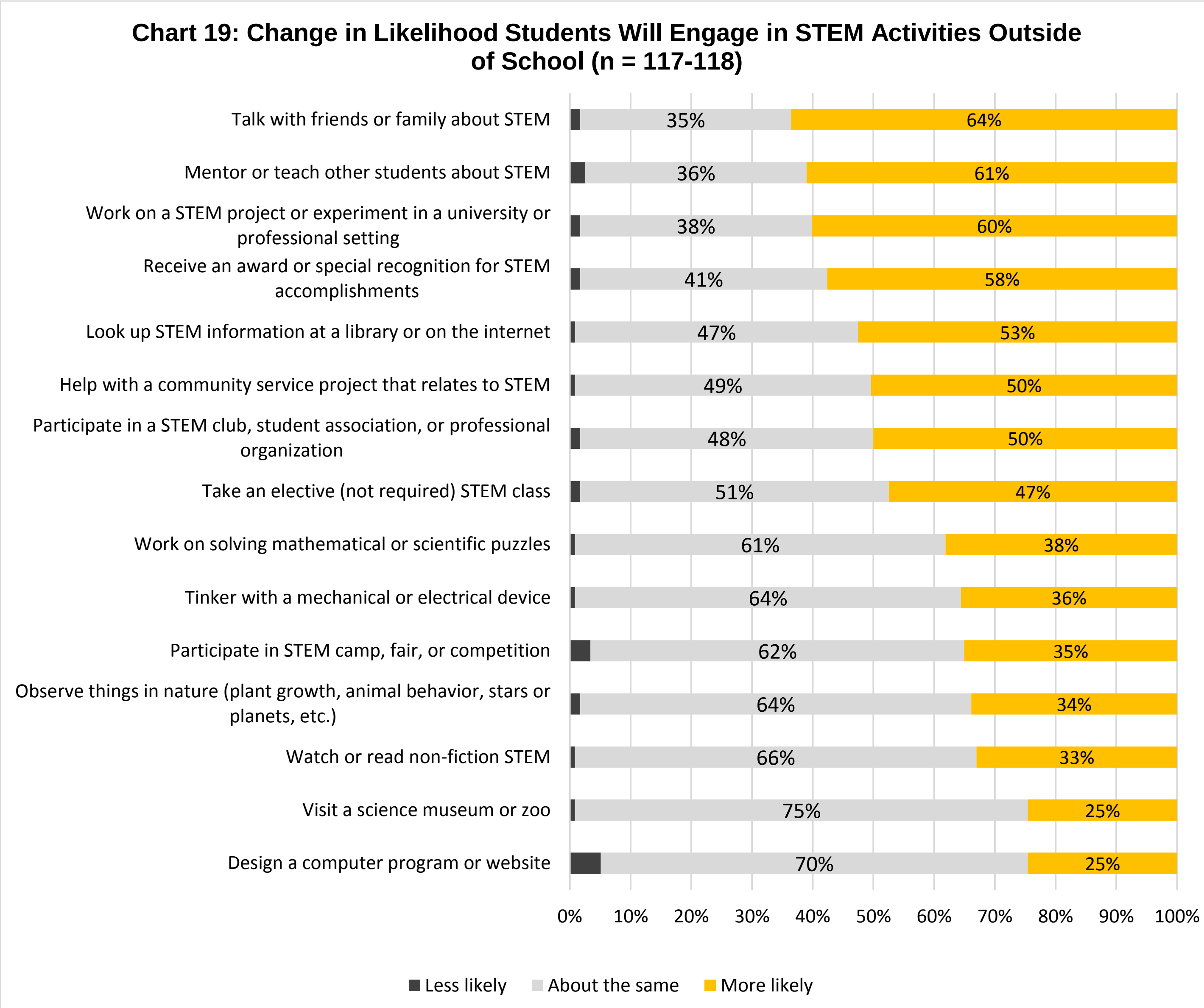
[20] The Cronbach's alpha reliability for these 12 items was 0.953.

Interest and Future Engagement in STEM

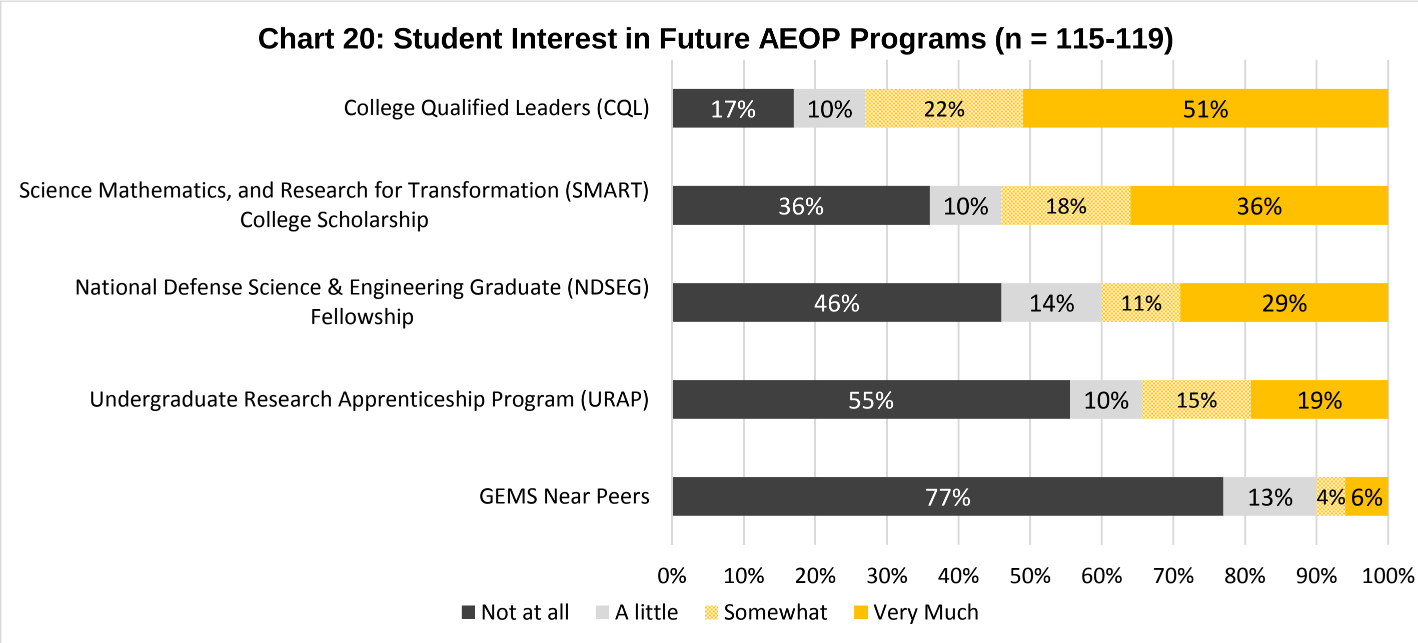
A key goal of the AEOP program is to develop a STEM-literate citizenry. Accordingly, apprentices need to be engaged both in and out of school with high quality STEM activities. In order to examine the impact of CQL on apprentices' interest in future engagement in STEM, the questionnaire asked them to reflect on whether the likelihood of their engaging in STEM activities outside of school changed as a result of their experience. As can be seen in Chart 19, the vast majority of apprentices indicated that they were no less likely to engage in any of these activities as a result of CQL; for about half the activities, the majority indicated they were more likely to engage in the activities, but for the other half, the majority indicated the likelihood they would engage in the activities was about the same. For example, 64% reported being more likely to talk with friends or family about STEM, 61% to mentor or teach other apprentices about STEM, and 60% to work on a STEM project or experiment in a university or professional setting. In contrast, 75% indicated that they were no more or less likely to visit a science museum or zoo, 70% to design a computer program or website, 66% to watch or read non-fiction STEM, 64% to observe things in nature, and 64% to tinker with a mechanical or electrical device. A composite score was created from these items,[21] and composite scores were compared across subgroups of apprentices. There were no statistically significant differences by gender or race/ethnicity. Although there were no significant differences for the composite, there were several individual items with significant differences by gender or race/ethnicity. Most notably, more minority apprentices than non-minority apprentices thought they would receive an award or special recognition for STEM accomplishments (a moderate effect size, d=0.541).[22] It is possible that this difference may be, in part, an indicator of minority apprentices believing they have gained more from the project and/or having more confidence in their STEM competencies, so may be worth further investigation.

[21] These 15 items had a Cronbach's alpha reliability of 0.921.

[22] Two-tailed independent samples t-test, $t(116) = 2.02$, $p = 0.045$

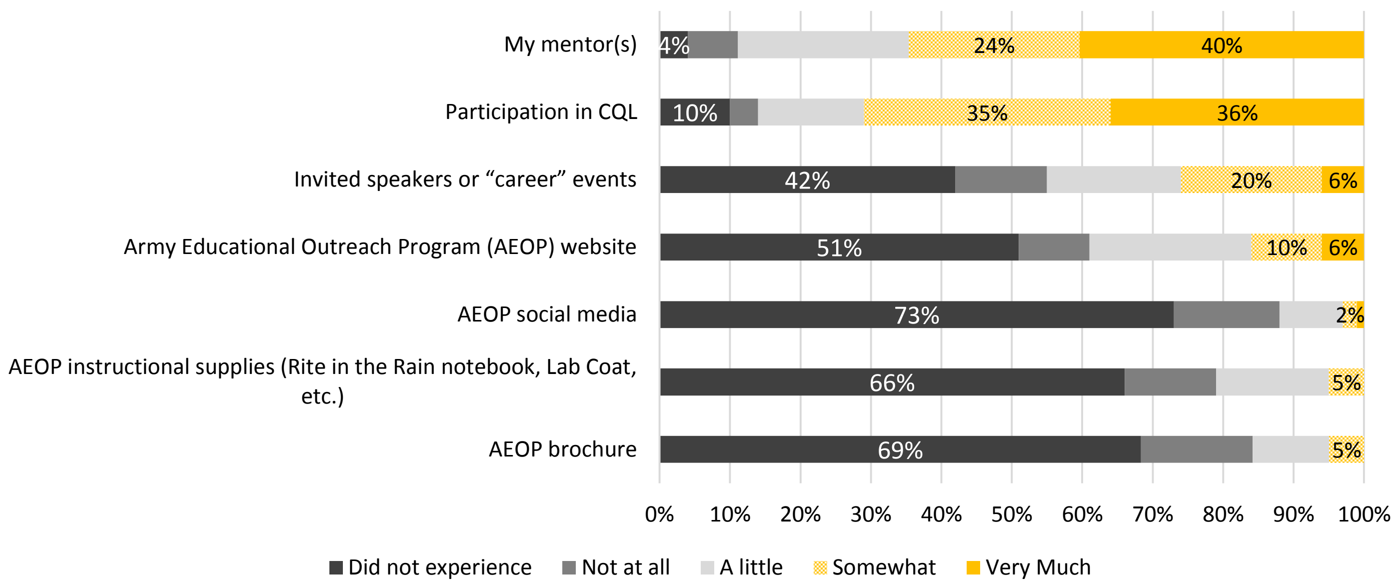


Apprentices were also asked how interested they are in participating in future AEOP programs. A large majority (73%) indicated being "somewhat" or "very much" interested in participating in CQL again, 53% in SMART, and 49% in NDSEG (see Chart 20). The majority expressed no interest in participating in GEMS Near Peers (77%) and URAP (55%).



Apprentices were asked which resources impacted their awareness of the various AEOPs. As can be seen in Chart 21, participating in CQL and the apprentices' mentors impacted apprentices' awareness of AEOPs the most, with 72% and 65% of responding apprentices respectively selecting "somewhat" or "very much". Over half of the responding apprentices had not experienced AEOP resources such as AEOP social media (73%), the AEOP brochure (69%), AEOP instruction supplies (66%), and the AEOP website (51%).

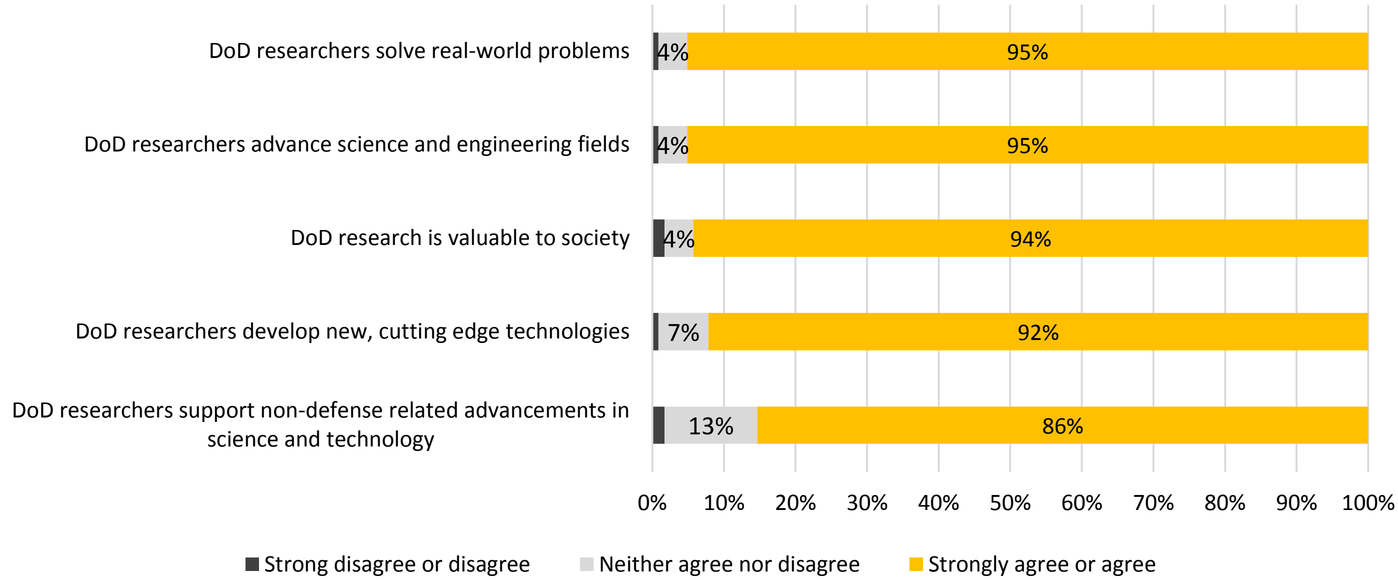
Chart 21: Impact of Resources on Student Awareness of AEOPs (n = 121-124)



Attitudes toward Research

Apprentices' attitudes about the importance of DoD research is considered an important prerequisite to their continued interest in the field and potential involvement in the future. In order to gauge apprentices' attitudes in this area, the questionnaire also asked about their opinions of what DoD researchers do and the value of DoD research more broadly. The data indicate that responding apprentices have favorable opinions (see Chart 22). For example, 95% agreed or strongly agreed that DoD researchers solve real-world problems, 95% that DoD researchers advance science and engineering fields, 94% that DoD research is valuable to society, 92% that DoD researchers develop cutting-edge technologies, and 86% that DoD researchers support non-defense related advancements in science and technology.

Chart 22: Student Opinions about DoD Researchers and Research (n = 118)



Education and Career Aspirations

The evaluation study also examined the program's impact on apprentices' education and career aspirations. In terms of education, the questionnaire asked apprentices how far they wanted to go in school before and after participating in CQL. As can be seen in Table 24, when asked to think back on how far they wanted to go in school before participating in CQL, 70% indicated they wanted an education beyond a Bachelor's degree (i.e., more education after college or an advanced or professional degree) prior to CQL; that percentage rose to 90% after CQL, primarily as a result of more apprentices wanting to pursue a Ph.D. This shift towards more education was statistically significant[23] and quite substantial in size (an effect size[24] of ϕ= 0.600).

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[23] Chi-square test of independence, $\chi^2(2) = 42.82$, $p < 0.001$

[24] The effect size for a chi-square test of independence is calculated as $\varphi = \sqrt{\frac{\chi^2}{n}}$. With 2 degrees of freedom, ϕ of 0.07 is considered small, 0.21 medium, and 0.35 large.

Table 24. Apprentice Education Aspirations (n = 119)		
	Before CQL	**After CQL**
Go to a trade or vocational school	0%	0%
Go to college for a little while	13%	1%
Finish college (get a Bachelor's degree)	17%	8%
Get more education after college	7%	5%
Get a master's degree	28%	31%
Get a Ph.D.	19%	35%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	9%	9%
Get a combined M.D./Ph.D.	3%	7%
Get another professional degree (law, business, etc.)	4%	3%

In terms of career aspirations, apprentices were asked what kind of work they expect to be doing at age 30, both reflecting on what their aspiration was before participating in CQL and after CQL (see Table 25). The vast majority of responding apprentices expressed interest in STEM-related careers both before and after participating in CQL. For example, 39% indicated aspiring to a career in engineering before CQL, with another 13% interested in medicine. After CQL, 43% of apprentices expressed interest in engineering, and 11% in medicine. To examine whether the CQL program increased apprentices' interest in STEM-related careers, each career option was coded as being STEM related or non-STEM related. There was not a statistically significant increase in the proportion of apprentices aspiring to a STEM-related career. The overall lack of shift in apprentices' career aspirations may be related to the nature of the CQL program and the apprentices it attracts; that is, apprentices are undergraduate students, recent college graduates, or graduate students who were predominately motivated to participate in the program because they were already interested in STEM (see Table 14).

Table 25. Apprentice Career Aspirations (n = 119)		
	Before CQL	**After CQL**
Engineering	39%	43%
Medicine (doctor, dentist, veterinarian, etc.)	13%	11%
Physical science (physics, chemistry, astronomy, materials science, etc.)	9%	8%
Biological Science	7%	7%
Science (no specific subject)	4%	5%
Computer science	5%	4%
Technology	3%	2%
Teaching, STEM	2%	2%
Health (nursing, pharmacy, technician, etc.)	2%	2%
Social science (psychologist, sociologist, etc.)	4%	2%
Business	2%	2%
Earth, atmospheric or oceanic science	1%	1%
Mathematics or statistics	0%	1%
English/language arts	1%	1%
Military, police, or security	1%	1%
Art (writing, dancing, painting, etc.)	0%	1%
Agricultural science	1%	0%
Environmental science	0%	0%
Teaching, non-STEM	0%	0%
Law	0%	0%
Farming	0%	0%
Skilled trade (carpenter, electrician, plumber, etc.)	0%	0%
Undecided	3%	2%
Other†	4%	8%

† Before, other includes “Biodefense/Biomedical Engineering,” “Biological or Physical Science,” “Dietician,” “I am 30,” and “Librarian.” After, other includes “Dietician,” “Forensic Science,” “Healthcare Administration,” “ibid,” “Librarian,” “Medical Physics/Biodefense/Biomedical Engineering,” “Neurology,” “PA School/Health Professional,” and “Public Health.”

Apprentices were also asked the extent to which they expect to use their STEM knowledge, skills, and/or abilities in their work when they are age 30. As can be seen in Table 26, almost all apprentices expect to use STEM somewhat in their career. A majority (66%) expect to use STEM 76-100% of the time in their work, 19% expect to use STEM 51-75% of the time, and 12% expect to use STEM 26-50% of the time.

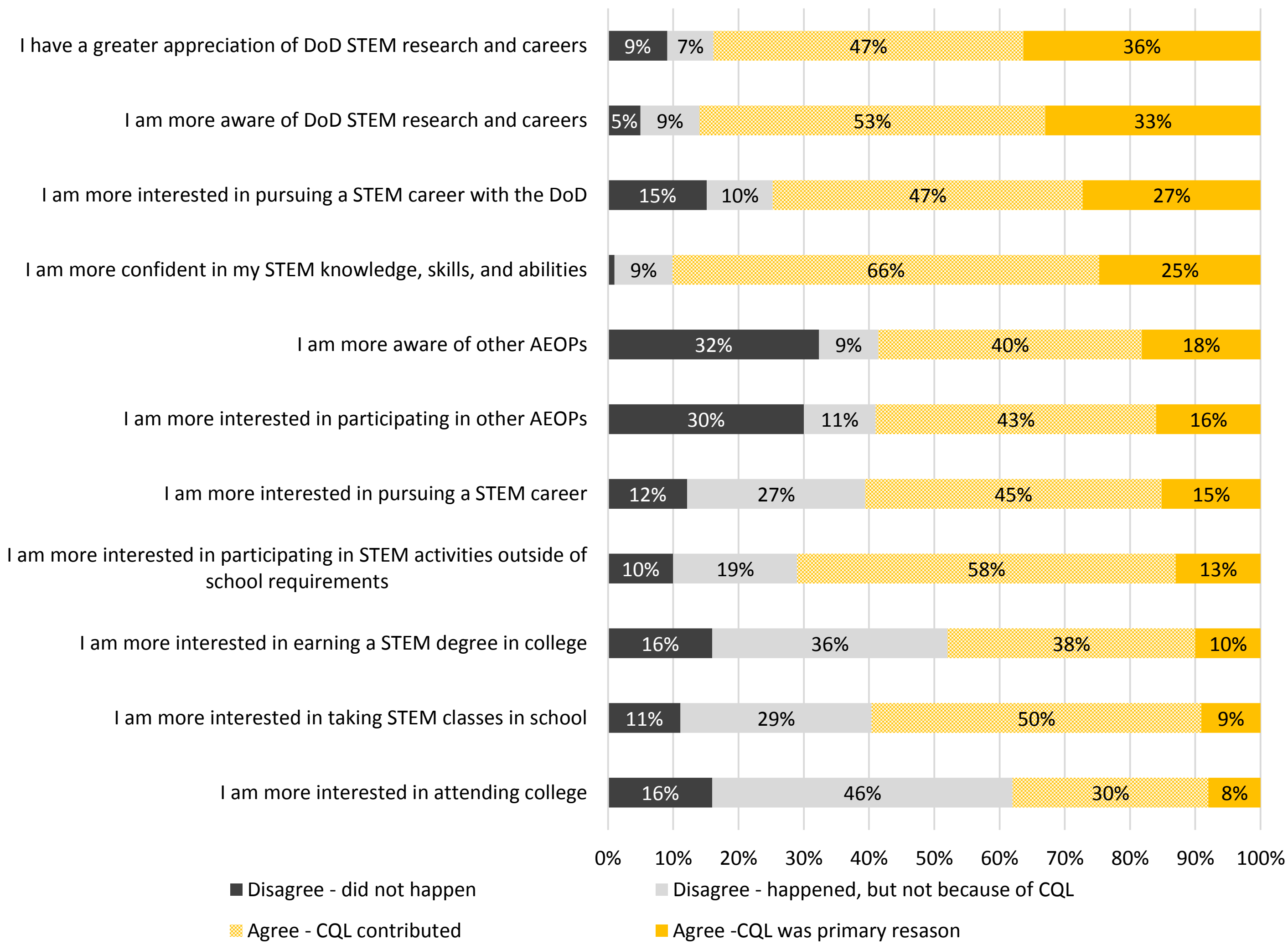
Table 26. Apprentices Expecting to use STEM in Their Work at Age 30 (n = 118)	
	Questionnaire Respondents
Not at all	1%
Less than 25% of the time	2%
26% to 50% of the time	12%
51% to 75% of the time	19%
75% to 100% of the time	66%

Overall Impact

Lastly, apprentices were asked about impacts of participating in CQL more broadly. From these data, it is evident that apprentices thought the program had a substantial impact on them (see Chart 23). For example, a large majority of responding apprentices indicated an impact of participation in CQL on confidence in their STEM knowledge, skills, and abilities, with 66% reporting that CQL contributed to this impact and another 25% reporting that CQL was the primary reason for this impact. Similarly, many apprentices indicated that participation in CQL had an impact on their awareness of DoD STEM research and careers (53% reporting that CQL contributed, and 33% reporting that CQL was the primary reason), their appreciation of DoD STEM research and careers (47% and 36%), and their interest in pursuing a STEM career with the DoD (47% and 27%). Apprentices also reported an impact on their interest in participating in STEM activities outside of school requirements (58% and 13%), pursuing a STEM career (45% and 15%), and taking STEM classes in school (50% and 9%). CQL had the least impact on responding apprentices' interest in attending college (30% and 8%) and earning a STEM degree in college (38% and 10%), which is perhaps to be expected given that responding apprentices were primarily college students (undergraduate or graduate), or recent college graduates, who already had an interest in STEM fields. These items were combined into a composite variable[25] to test for differences among subgroups of apprentices; no significant differences were found by gender or race/ethnicity.

[25] The Cronbach's alpha reliability for these 11 items was 0.921.

Chart 23: Student Opinions of CQL Impacts (n = 105-108)



An open-ended item on the questionnaire asked apprentices to list the three most important ways they benefited from the program; 90 apprentices provided at least one answer to the question. Apprentices' responses addressed a variety of themes. More than half of the responding apprentices (61%) wrote about gaining real-world experience. Half of the

> *"This internship has really helped me fulfill not only my personal goals but also my professional goals. I got to grow over the past four years and really know what I want and set goals for myself that I will be able to accomplish."* -- CQL Apprentice

responding apprentices listed gaining knowledge, including knowledge related to STEM content, careers, and research. Other common themes included having opportunities to network and make connections (32%) and having benefits related to future careers or education, such as building a resume; impacting career or education possibilities; and gaining information about, exposure to, or preparation for a career (26%).

Apprentices' comments from the focus groups expand on some of these impacts. As three said:

> *When I did the first two years of my engineering schooling, I kind of thought, "why do I need to do this?" I feel like it's not going to help me at all. Working now, I've learned how my schooling will be incorporated in my future work and it has been encouraging to know that I'm actually going to school and learning things that will actually benefit me. (CQL apprentice)*

> *Not a whole lot of people can say that they are incredibly comfortable doing DNA and RNA extractions or just following lab protocol from the lab setting and I can actually say that I am comfortable with that kind of stuff now. So I can just say that I have that experience. I just hear that anyone that's getting jobs now, it's not how you did in school, it's the type of experience you have, so I figure the more experience you have, the better off you are getting a job. (CQL apprentice)*

> *This internship has really helped me fulfill not only my personal goals but also my professional goals. I got to grow over the past four years and really know what I want and set goals for myself that I will be able to accomplish and be able to contribute positively to the work that I'm doing, the team that I'm working with, and what we do to make sure that we get the job done. (CQL apprentice)*

Summary of Findings

The FY14 evaluation of CQL collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in the following table.

2014 CQL Evaluation Findings	
Participant Profiles	
CQL had limited success at serving students of historically underrepresented and underserved populations.	• CQL attracted some participation of female students—a population that is historically underrepresented in engineering fields. However, enrollment data suggests that participation of female students was limited: 75% of enrolled apprentices were male, 25% were female.
	• CQL served some students from historically underrepresented and underserved race/ethnicity groups, however that involvement was limited. The vast majority of enrolled apprentices identified themselves as "White" or "Asian"; only 8% identified themselves as being from an underrepresented or underserved minority group (5% Black or African American & 3% Hispanic or Latino).
CQL had limited success in recruiting past AEOP program participants.	• Questionnaire data indicate that the vast majority of responding apprentices had participated in CQL at least once (although it's not clear whether the one time was including or in addition to current participation), and 30% had participated more than once. In addition, just over 30% of students had participated in SEAP at least once. However, for other AEOP programs, the vast majority of responding apprentices have never participated (ranging from 87% to 98%).
Actionable Program Evaluation	
CQL recruitment was largely the result of pre-existing relationships	• Mentor questionnaire data indicate that recruitment of students was most commonly done through colleagues, personal acquaintances, and contact from the student.
	• Apprentice questionnaire data indicate that apprentices most commonly learned about CQL from someone who works at an Army laboratory, teachers or professors, immediate family members, university resources, friends, mentors, or past CQL participants. In addition, apprentice focus group data support the idea that pre-existing relationships were instrumental in making students aware of CQL.
CQL apprentices were motivated to participate in CQL by a variety of factors.	• Apprentices were motivated to participate in CQL, according to questionnaire data, by an interest in STEM, the desire to expand laboratory and research skills, and the opportunity to learn in ways that are not possible in school. Other highly motivating factors included building a college application or résumé, earning a stipend or award while doing STEM, networking opportunities, and opportunities to use advanced laboratory technology. Focus group data also suggest that apprentices were motivated by the opportunity to gain job and research experience.

CQL engages apprentices in meaningful STEM learning.	• Most apprentices (67-93%) report learning about STEM topics, applications of STEM to real-life situations, STEM careers, and cutting-edge STEM research on most days or every day of their CQL experience.
	• Most apprentices had opportunities to engage in a variety of STEM practices during their CQL experience. For example, 93% reported participating in hands-on STEM activities; 88% practicing using laboratory or field techniques, procedures, and tools; 81% working as part of a team; 77% carrying out an investigation; and 76% analyzing and interpreting data or information on most days or every day.
	• Apprentices reported greater opportunities to learn about STEM and greater engagement in STEM practices in their CQL experience than they typically have in school.
	• A clear majority of mentors report using strategies to help make learning activities relevant to apprentices, support the needs of diverse learners, develop apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
CQL promotes DoD STEM research and careers but can improve marketing of other AEOP opportunities.	• Most mentor interviewees and questionnaire respondents reported limited awareness of AEOP initiatives. Subsequently, mentors did not consistently educate their apprentices about AEOPs or encourage apprentices to participate in them. The majority of responding mentors (61-89%) mentioned never experiencing AEOP informational resources including the AEOP website, AEOP instructional supplies, the AEOP brochures, and AEOP social media.
	• Nearly all CQL participants reported learning about at least one STEM career, and about half (51%) reported learning about 4 or more. Similarly, 86% of students reported learning about at least one DoD STEM job, with 54% reporting they learned about 3 or more. Mentors and the CQL experience contributed the most to this impact.
The CQL experience is valued by apprentices and mentors, although program administration is an area for improvement.	• Responding apprentices reported satisfaction with their mentor and working experience during the CQL program. For example, over 90% of responding apprentices reported being at least "somewhat" satisfied with their mentor, the time they spent with their mentor, and the research experience overall.
	• In an open-ended item on the questionnaire, almost all of the responding participants had something positive to say about the program. However, about 30% described frustration with administrative aspects of the program including a lack of communication, payment problems, and delays in getting clearance and access that limited their ability to do meaningful work. Perhaps more notably, when asked how the program could be improved, the most common theme by far (86% of students responding to the question) was logistical issues including payment, communication, and obtaining clearance and access. In addition, in focus groups, apprentices described difficulties associated with late notification of acceptance (e.g., having to decide on other job opportunities before being notified of CQL acceptance, having to find housing on short notice).

Outcomes Evaluation	
CQL had positive impacts on apprentices' STEM knowledge and competencies.	• A majority of apprentices reported large or extreme gains in their knowledge of what everyday research work is like in STEM, how professionals work on real problems in STEM, research conducted in a STEM topic or field, a STEM topic or field in depth, and the research processes, ethics, and rules for conduct in STEM. These impacts were identified across all apprentice groups.
	• Many apprentices also reported impacts on their abilities to do STEM, including such things as carrying out procedures for an investigation and recording data accurately; supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge; using mathematics or computers to analyze numeric data; reading technical or scientific tests, or using other media, to learn about the natural or designed worlds; deciding what type of data to collect in order to answer a question; identifying the limitations of data collected in an investigation; asking a question that can be answered with one or more investigations; designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected; and using data or interpretations from other researchers or investigations to improve a solution.
CQL had positive impacts on apprentices' 21st Century Skills.	• A large majority of apprentices reported large or extreme gains in the areas of making changes when things do not go as planned, building relationships with professionals in the field, learning to work independently, patience for the slow pace of research, sticking with a task until it is complete, and sense of being part of a learning community.
CQL positively impacted apprentices' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many apprentices reported a large or extreme gains on items related to STEM identify including feeling prepared for more challenging STEM activities, building academic or professional credentials in STEM, confidence to do well in future STEM courses, feeling responsible for a STEM project or activity, confidence to contribute in STEM, feeling like part of a STEM community, and feeling like a STEM professional.
	• Apprentices also reported positively on the likelihood that they would engage in additional STEM activities outside of school. A majority of apprentices indicated that as a result of CQL they were more likely to talk with friends or family about STEM, mentor or teach other students about STEM, work on a STEM project or experiment in a university or professional setting, receive an award or special recognition for STEM accomplishments, and look up STEM information at a library or on the internet.
CQL succeeded in raising apprentices' education aspirations, but did not change their career aspirations.	• After participating in CQL, apprentices indicated being more likely to go further in their schooling than they would have before CQL, with the greatest change being in the proportion of apprentices who wanted to get a Ph.D. (19% before CQL, 35% after).
	• Apprentices were asked to indicate what kind of work they expected to be doing at age 30, and the data were coded as STEM-related or non-STEM-related. Although the vast majority of apprentices indicated interest in a STEM-related career, there was not a statistically significant difference from before CQL to after.

CQL apprentices are largely unaware of AEOP initiatives, but apprentices show interest in future AEOP opportunities.	• Apprentice and mentors were largely unaware of other AEOP initiatives, but 73% of responding apprentices were at least somewhat interested in participating in CQL in the future, 54% in SMART, 40% in NDSEG, and 34% in URAP. Apprentices reported that their CQL participation and their mentors had the most impact on their awareness of AEOPs.
CQL apprentices have positive opinions about DoD researchers and research.	• The vast majority of apprentices reported that they agreed or strongly agreed that DoD researchers solve real-world problems (95%), DoD researchers advance science and engineering fields (95%), DoD research is valuable to society (94%), DoD researchers develop new, cutting edge technologies (92%), and DoD researchers support non-defense related advancements in science and technology (86%).

Recommendations

1. The CQL program has the goal of broadening the talent pool in STEM fields. Overall, the program has had limited success in attracting students from groups historically underrepresented and underserved in these fields. In addition, personal relationships continue to factor highly into how students learn about and are recruited to CQL. The program may want to consider doing more to increase the number and diversity of students who participate in CQL. In particular, the program may consider how to more actively recruit students nationwide. Given that the program involves college students and includes a stipend to help with housing expenses, recruitment does not need to be limited to locations near CQL sites. By more actively recruiting, and broadening recruitment efforts beyond local sites, the program is likely to receive more applications, including more from groups that are historically underrepresented and underserved. Mentor focus groups elicited some suggestions for changes to recruitment strategies. These suggestions include having a centralized CQL recruitment and application process (rather than site specific) as well as advertising more with high schools (so that future college students are aware of the program) and with colleges, including working with college job placement services and posting fliers prominently where students will see them. In addition, the program may want to consider how students are recruited and subsequently selected to serve as apprentices. Although some mentors did not know how students were recruited, others reported that there were no targeted recruitment strategies for students from underrepresented and underserved groups. In order to meet the goal of serving more students from underrepresented or underserved groups, the program could develop guidance to balance selecting the strongest candidates (e.g. best match between apprentice interest and mentor work), regardless of race or gender, and providing more opportunities for students from underrepresented and underserved groups to participate.

2. Similarly, efforts to recruit mentors should be considered. The number of apprentices who can participate in CQL is limited by the number of mentors available. In order to broaden participation and provide more opportunities to qualified candidates, the program needs to recruit more mentors. One potential factor impacting mentor participation – time – came out in a focus group; mentors noted that colleagues were not interested in serving as

mentors because of the time it takes them to work with apprentices, which can detract from other responsibilities. In addition, on the questionnaire, some responding mentors suggested providing more support for mentors. As a result, it may be productive to consider what supports can be put in place to help mentors efficiently and effectively utilize their apprentices. For example, mentors may benefit from ideas for ways in which apprentices can productively contribute to ongoing research. In addition, potential mentors should be made aware of these supports as well as potential benefits to their project from involving apprentices in their work.

3. Given the goal of having students progress from other AEOP programs into CQL, and from CQL into other programs, the program may want to consider implementing marketing and recruitment efforts targeting past AEOP participants and to work with sites to increase both mentors' and students' exposure to AEOP. Apprentice questionnaire data indicate that few apprentices had previously participated in other AEOPs. Implementing marketing and recruitment efforts targeted at past AEOP participants may increase the number of participants in other AEOP programs who progress into CQL and may broaden CQL participation of students from underrepresented and underserved groups as several other AEOP programs specifically target these students. In addition, responding CQL mentors and apprentices tended to lack knowledge of AEOP programs beyond CQL. In focus groups, mentors indicated that they would be willing to educate students about other AEOP programs if they knew more about those programs themselves, suggesting that improving mentor awareness of programs would also improve student awareness. Alternatively, given that CQL participants are completing internships on active research, and potential mentors may already be hesitant to participate due to time considerations, the program may want to consider ways to educate apprentices about AEOP opportunities that do not rely on the mentor (e.g., presentations during an orientation; information provided during the student symposium). In addition, given the limited use of the AEOP website, print materials, and social media, the program should consider how these materials could be adjusted to provide students with more information and facilitate their enrollment in other AEOPs, or what alternative strategies may be more effective.

4. Efforts should be made to address administrative difficulties. Although participants were pleased with their experience, frustration with administrative and logistical aspects was quite evident in responses, and in some cases detracted from program goals. In particular, students reported difficulties due to late notification of acceptance, including missing out on participating in the past, and late payment. Students also reported negative impacts on their ability to do meaningful work because of delays in getting clearance and computer access. In addition, some students indicated that they, and their mentors, expended considerable time and effort to remedy these administrative issues. Although some students indicated that these issues would not keep them from participating again, other students indicated that they would not participate again, may work at the lab again but would do so through other channels, or were discouraged from participating in CQL or working for the DoD in the future. Given that one AEOP goal is to "broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base," efforts should be made to remedy these administrative issues so as not to detract from apprentices' or mentors' experience with the program. One suggestion that came out of apprentice questionnaire

and focus group data is to begin the process for students to obtain clearance and computer access early, so that they have computer access when they begin the internship and can begin doing meaningful work.

5. Additional efforts should be undertaken to improve participation in evaluation activities, as the low response rates for both the student and mentor questionnaires raise questions about the representativeness of the results. Improved communication with the individual program sites about expectations for the evaluation may help. In addition, the evaluation instruments may need to be streamlined as perceived response burden can affect participation. In particular, consideration should be given to better tailoring questionnaires to particular programs and whether the parallel nature of the student and mentor questionnaires is necessary, with items being asked only of the most appropriate data source. Given that CQL apprentices are career age, as well as the significant investment that Army research installations make in each apprentice, it may prove important to conduct a CQL alumni study in the near future. The purpose of which would serve to establish the extent to which CQL apprentices subsequently become employed in the Army or DoD.

Appendices

Appendix A

FY14 CQL Evaluation Plan

Questionnaires

Purpose:
As per the approved FY14 AEOP APP, the external evaluation of CQL conducted by VT includes two post-program questionnaires:

1. AEOP Youth Questionnaire to be completed by students (apprentices); and
2. AEOP Mentor Questionnaire to be completed by Army S&Es and/or other laboratory personnel that supervise, guide, or support apprentices during their CQL research activities.

Questionnaires are the primary method of data collection for AEOP evaluation and collect information about participants' experiences with and perceptions of program resources, structures, and activities; potential benefits to participants; and strengths and areas of improvement for programs.

The questionnaires have been revised for FY14 to align with:

- Army's strategic plan and AEOP Priorities 1 (STEM Literate Citizenry), 2 (STEM Savvy Educators) *and* 3 (Sustainable Infrastructure);
- Federal guidance for evaluation of Federal STEM investments (e.g., inclusive of implementation and outcomes evaluation, and outcomes of STEM-specific competencies, transferrable competencies, attitudes about/identifying with STEM, future engagement in STEM-related activities, and educational/career pathways);
- Best practices and published assessment tools in STEM education, STEM informal/outreach, and the evaluation/ research communities;
- AEOP's vision to improve the quality of the data collected, focusing on changes in intended student outcomes and contributions of AEOPs like CQL effecting those changes.

The use of common questionnaires and sets of items that are appropriate across programs will allow for comparisons across AEOP programs and, if administered in successive years, longitudinal studies of students as they advance through pipelines within the AEOP. Because the questionnaires incorporate batteries of items from existing tools that have been validated in published research, external comparisons may also be possible.

All AEOPs are expected to administer the Youth and Mentor questionnaires provided for their program. Both the Youth and Mentor questionnaires have two versions, an "advanced" version (JSHS and apprenticeship programs) or a "basic" version (all other programs). The same basic set of items are used in both, with slightly modified items and/or additional items used in the advanced version. Additionally, the surveys are customized to gather information specific structures, resources, and activities of programs.

Site Visits/Onsite Focus Groups

Purpose:
As per the approved FY14 AEOP APP, the external evaluation of CQL conducted by VT includes site visits for 2-3 laboratories with a local GEMS-SEAP-CQL pipeline.

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

Site Selection:
VT evaluators will visit one or two sites in the National Capitol region whose site schedules would provide a range of STEM topics and grade levels impacted. In addition, we will select two distant sites with new, developing, or atypical programming, or that serve distinct populations. The sites will be mutually agreed upon by VT, ASEE, and the CAM--preliminary conversations include Adelphi, Alabama, and Champaign. VT will coordinate site visits directly with the lab coordinators at the selected sites (final site selection will be made and sites notified by mid-June).

Evaluation Activities during CQL Site Visits:

- One 45 minute focus group with 6-8 youth participants (apprentices);
- One 45-minute focus group with 6-8 mentors;
- 30-60 minutes to observe your program (specifically, to see one to a few apprentices engaged in program activities, preferably with their mentors, in the lab setting or in a group meeting); and

10-15 minute transitions between each evaluation activity for moving groups in and out and providing evaluators with time to organize paperwork and take nature breaks.

Data Analyses
Quantitative and qualitative data were compiled and analyzed after all data collection concluded. Evaluators summarized quantitative data with descriptive statistics such as numbers of respondents, frequencies and proportions of responses, average response when responses categories are assigned to a 6-point scale (e.g., 1 = "Strongly Disagree" to 6 = "Strongly Agree"), and standard deviations. Emergent coding was used for the qualitative data to identify the most common themes in responses.

Evaluators conducted inferential statistics to study any differences among participant groups (e.g., by gender or race/ethnicity) that could indicate inequities in the CQL program. Statistical significance indicates whether a result is unlikely to be due to chance alone. Statistical significance was determined with t-tests, chi-square tests, and various non-parametric tests as appropriate, with significance defined at $p < 0.05$. Because statistical significance is sensitive to the number of respondents, it is more difficult to detect significant changes with small numbers of respondents. Practical significance, also known as effect size, indicates the magnitude of an effect, and is typically reported when differences are statistically significant. The formula for effect sizes depends on the type of statistical test used, and is specified, along with generally accepted rules of thumb for interpretation, in the body of the report.

Appendix B

FY14 CQL Student Questionnaire and Data Summaries

2014 College Qualified Leaders (CQL): CQL Youth Survey

Virginia Tech conducts program evaluation on behalf of the American Society for Engineering Education (ASEE) and U.S. Army to determine how well the Army Educational Outreach Programs (AEOP) is achieving its goals of promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). As part of this study Virginia Tech is surveying students (like you) who have participated in the College Qualified Leaders (CQL) program. The survey will collect information about you, your experiences in school, and your experiences in CQL.

About this survey:

- While this survey is not anonymous, your responses are CONFIDENTIAL. When analyzing data and reporting results, your name will not be linked to any item responses or any comments you make.
- Responding to this survey is VOLUNTARY. You are not required to participate, although we hope you do because your responses will provide valuable information for meaningful and continuous improvement.
- If you provide your email address, the AEOP may contact you in the future to ask about your academic and career success.
- The survey takes about 25 – 30 minutes to complete on average, but it could take less time.
- In the online survey you can scroll over purple print in the survey to see definitions of words or phrases.

If you have any additional questions or concerns, please contact one of the following people:

Tanner Bateman, Virginia Tech
Senior Project Associate, AEOPCA
(540) 231-4540, tbateman@vt.edu

Rebecca Kruse, Virginia Tech
Evaluation Director, AEOPCA
(703) 336-7922, rkruse75@vt.edu

If you are 17 and under, your parent/guardian provided permission for you to participate in the evaluation study when they authorized your participation in the AEOP program you just completed or will soon complete.

Q1. Do you agree to participate in this survey? (required)

- ❍ Yes, I agree to participate in this survey
- ❍ No, I do not wish to participate in this survey **If selected, respondent will be directed to the end of the survey**

Q2. Please provide your personal information below:

First Name: ____
Last Name: ____

Q3. What is your email address? (optional)

Email: ____

Q4. So that we can determine how diverse students respond to participation in AEOP programs please tell us about yourself and your school

What grade will you start in the fall? (select one)

- ❍ 4th
- ❍ 5th
- ❍ 6th
- ❍ 7th
- ❍ 8th
- ❍ 9th
- ❍ 10th
- ❍ 11th
- ❍ 12th
- ❍ College freshman
- ❍ College sophomore
- ❍ College junior
- ❍ College senior
- ❍ Graduate program
- ❍ Other (specify): ____________________
- ❍ Choose not to report

Q5. What is your gender?

- ❍ Male
- ❍ Female
- ❍ Choose not to report

Q6. What is your race or ethnicity?

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

Q7. Where was the CQL program located?

- ❍ Army Aviation & Missile Research Development and Engineering Center-Redstone Arsenal (Huntsville, AL)
- ❍ Army Center for Environmental Health Research (Fort Detrick, MD)
- ❍ Army Medical Research Institute of Chemical Defense (Aberdeen, MD)
- ❍ Army Medical Research Institute for Infectious Diseases (Fort Detrick, MD)
- ❍ Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)
- ❍ Army Research Laboratory–Adelphi (Adelphi, MD)
- ❍ Army Criminal Investigation Command-Defense Forensic Science Center (Forest Park, GA)
- ❍ Edgewood Chemical Biological Center (Edgewood, MD)
- ❍ Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)
- ❍ Engineer Research & Development Center-Topographic Engineering Center (Alexandria, VA)
- ❍ Engineer Research & Development Center-Mississippi (Vicksburg, MS)
- ❍ Walter Reed Army Institute of Research (Silver Spring, MD)

Q8. How did you learn about CQL? (Check all that apply)

- ❑ American Society for Engineering Education website
- ❑ Army Educational Outreach Program (AEOP) website
- ❑ Facebook, Twitter, Pinterest, or other social media
- ❑ School or university newsletter, email, or website
- ❑ News story or other media coverage
- ❑ Past participant of CQL
- ❑ Friend
- ❑ Immediate family member (mother, father, siblings)
- ❑ Extended family member (grandparents, aunts, uncles, cousins)
- ❑ Friend of the family
- ❑ Teacher or professor
- ❑ Guidance counselor
- ❑ Mentor from CQL
- ❑ Someone who works at an Army laboratory
- ❑ Someone who works with the Department of Defense
- ❑ Other, (specify): ____________________

Q9. How motivating were the following factors in your decision to participate in CQL?

	Not at all	A little	Somewhat	Very much
Teacher or professor encouragement	❍	❍	❍	❍
An academic requirement or school grade	❍	❍	❍	❍
Desire to learn something new or interesting	❍	❍	❍	❍
The program mentor(s)	❍	❍	❍	❍
Building college application or résumé	❍	❍	❍	❍
Networking opportunities	❍	❍	❍	❍
Interest in science, technology, engineering, or mathematics (STEM)	❍	❍	❍	❍
Interest in STEM careers with the Army	❍	❍	❍	❍
Having fun	❍	❍	❍	❍
Earning stipend or award while doing STEM	❍	❍	❍	❍
Opportunity to do something with friends	❍	❍	❍	❍
Opportunity to use advanced laboratory technology	❍	❍	❍	❍
Desire to expand laboratory or research skills	❍	❍	❍	❍
Learning in ways that are not possible in school	❍	❍	❍	❍
Serving the community or country	❍	❍	❍	❍
Parent encouragement	❍	❍	❍	❍
Exploring a unique work environment	❍	❍	❍	❍

Other, (specify)	❍	❍	❍	❍

Q10. How often do you do each of the following in STEM classes at school this year?

	Not at all	At least once	A few times	Most days	Every day
Learn about new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍

Q11. How often did you do each of the following in CQL this year?

	Not at all	At least once	A few times	Most days	Every day
Learn about new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍

Q12. How often do you do each of the following in STEM classes at school this year?

	Not at all	At least once	A few times	Most days	Every day
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍

Q13. How often did you do each of the following in CQL this year?

	Not at all	At least once	A few times	Most days	Every day
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍

Communicate with other students about STEM	❍	❍	❍	❍	❍

Q14. How often do you do each of the following in STEM classes at school this year?

	Not at all	At least once	A few times	Most days	Every day
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍

Q15. How often did you do each of the following in CQL this year?

	Not at all	At least once	A few times	Most days	Every day
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍

Q16. Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during CQL:

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍
AEOP website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
Army STEM Career Magazine	❍	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍

Participation in CQL	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat)	❍	❍	❍	❍	❍

Q17. Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during CQL:

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍
AEOP website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
Army STEM Career Magazine	❍	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in CQL	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat)	❍	❍	❍	❍	❍

Q18. How SATISFIED were you with each of the following CQL program features?

	Did not experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Other administrative tasks	❍	❍	❍	❍	❍
Communications with American Society for Engineering Education	❍	❍	❍	❍	❍
Communications with [CQL site]	❍	❍	❍	❍	❍
Location(s) of program activities	❍	❍	❍	❍	❍
Availability of program topics or fields that interest you	❍	❍	❍	❍	❍
Instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍
Research presentation process	❍	❍	❍	❍	❍

Q19. Which of the following best describes your primary research mentor?

❍ I did not have a research mentor
❍ Teacher
❍ Coach
❍ Parent
❍ Club or activity leader (School club, Boy/Girls Scouts, etc.)

- ❍ STEM researcher (private industry, university, or DoD/government employee, etc.)
- ❍ Other (specify) ____________________

Q20. Which of the following statements best reflects the input you had into your project initially?
- ❍ I did not have a project
- ❍ I was assigned a project by my mentor
- ❍ I worked with my mentor to design a project
- ❍ I had a choice among various projects suggested by my mentor
- ❍ I worked with my mentor and members of a research team to design a project
- ❍ I designed the entire project on my own

Q21. Which of the following statements best reflects the availability of your mentor?
- ❍ I did not have a mentor
- ❍ The mentor was never available
- ❍ The mentor was available less than half of the time
- ❍ The mentor was available about half of the time of my project
- ❍ The mentor was available more than half of the time
- ❍ The mentor was always available

Q22. Which of the following statements best reflects your working as part of a group or team?
- ❍ I worked alone (or alone with my research mentor)
- ❍ I worked with others in a shared laboratory or other space, but we work on different projects
- ❍ I worked alone on my project and I met with others regularly for general reporting or discussion
- ❍ I worked alone on a project that was closely connected with projects of others in my group
- ❍ I work with a group who all worked on the same project

Q23. How SATISFIED were you with each of the following:

	Did Not Experience	Not at all	A little	Somewhat	Very much
My working relationship with my mentor	❍	❍	❍	❍	❍
My working relationship with the group or team	❍	❍	❍	❍	❍
The amount of time I spent doing meaningful research	❍	❍	❍	❍	❍
The amount of time I spent with my research mentor	❍	❍	❍	❍	❍
The research experience overall	❍	❍	❍	❍	❍

Q24. Which of the following statements apply to your research experience? (Choose ALL that apply)
- ❑ I presented a talk or poster to other students or faculty
- ❑ I presented a talk or poster at a professional symposium or conference
- ❑ I attended a symposium or conference
- ❑ I wrote or co-wrote a paper that was/will be published in a research journal
- ❑ I wrote or co-wrote a technical paper or patent
- ❑ I will present a talk or poster to other students or faculty
- ❑ I will present a talk or poster at a professional symposium or conference
- ❑ I will attend a symposium or conference
- ❑ I will write or co-write a paper that was/will be published in a research journal

- ❑ I will write or co-write a technical paper or patent
- ❑ I won an award or scholarship based on my research

Q25. The list below describes mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies that your mentor(s) used when working directly with you in CQL:

	Yes - my mentor used this strategy with me	No - my mentor did not use this strategy with me
Helped me become aware of the roles STEM play in my everyday life	❍	❍
Helped me understand how STEM can help me improve my community	❍	❍
Used teaching/mentoring activities that addressed my learning style	❍	❍
Provided me with extra support when I needed it	❍	❍
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	❍	❍
Allowed me to work on a collaborative project as a member of a team	❍	❍
Helped me practice a variety of STEM skills with supervision	❍	❍
Gave me constructive feedback to improve my STEM knowledge, skills, or abilities	❍	❍
Gave me guidance about educational pathways that would prepare me for a STEM career	❍	❍
Recommended Army Educational Outreach Programs that match my interests	❍	❍
Discussed STEM career opportunities with DoD or other government agencies	❍	❍

Q26. Which category best describes the focus of your CQL experience?
- ❍ Science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics

Q27. AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q28. **AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?** ****Only presented to respondents who selected "science" in Q26****

	No gain	A little gain	Some gain	Large gain	Extreme gain
Asking questions based on observations of real-world phenomena	❍	❍	❍	❍	❍
Asking a question (about a phenomenon) that can be answered with one or more investigations	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to answer a question	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable, in order to understand relationships between variables	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed explanation (for a phenomenon) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve an explanation	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their explanations	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	❍	❍	❍	❍	❍

Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your explanations of phenomena	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically)	❍	❍	❍	❍	❍

Q29. AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "technology," "engineering," or "mathematics" in Q26**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Identifying real-world problems based on social, technological, or environmental issues	❍	❍	❍	❍	❍
Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	❍	❍	❍	❍	❍
Making a model that represents the key features or functions of a solution to a problem	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to test if a solution functions as intended	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated solution	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution functions as intended	❍	❍	❍	❍	❍
Displaying numeric data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed solution (for a problem) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	❍	❍	❍	❍	❍

Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their solutions	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how a solution meets design criteria	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best solution to a problem	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically)	❍	❍	❍	❍	❍

Q30. AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍
Sticking with a task until it is complete	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Patience for the slow pace of research	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Sense of contributing to a body of knowledge	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and my personal values	❍	❍	❍	❍	❍

Q31. AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Interest in a new STEM topic or field	❍	❍	❍	❍	❍

Clarifying a STEM career path	❍	❍	❍	❍	❍
Sense of accomplishing something in STEM	❍	❍	❍	❍	❍
Building academic or professional credentials in STEM	❍	❍	❍	❍	❍
Feeling prepared for more challenging STEM activities	❍	❍	❍	❍	❍
Confidence to do well in future STEM courses	❍	❍	❍	❍	❍
Confidence to contribute to STEM	❍	❍	❍	❍	❍
Thinking creatively about a STEM project or activity	❍	❍	❍	❍	❍
Trying out new ideas or procedures on my own in a STEM project or activity	❍	❍	❍	❍	❍
Feeling responsible for a STEM project or activity	❍	❍	❍	❍	❍
Feeling like a STEM professional	❍	❍	❍	❍	❍
Feeling like part of a STEM community	❍	❍	❍	❍	❍

Q32. AS A RESULT OF YOUR CQL experience, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?

	Much less likely	Less likely	About the same before and after	More likely	Much more likely
Visit a science museum or zoo	❍	❍	❍	❍	❍
Watch or read non-fiction STEM	❍	❍	❍	❍	❍
Look up STEM information at a library or on the internet	❍	❍	❍	❍	❍
Tinker with a mechanical or electrical device	❍	❍	❍	❍	❍
Work on solving mathematical or scientific puzzles	❍	❍	❍	❍	❍
Design a computer program or website	❍	❍	❍	❍	❍
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	❍	❍	❍	❍	❍
Talk with friends or family about STEM	❍	❍	❍	❍	❍
Mentor or teach other students about STEM	❍	❍	❍	❍	❍
Help with a community service project that relates to STEM	❍	❍	❍	❍	❍
Participate in a STEM club, student association, or professional organization	❍	❍	❍	❍	❍
Participate in STEM camp, fair, or competition	❍	❍	❍	❍	❍
Take an elective (not required) STEM class	❍	❍	❍	❍	❍

Work on a STEM project or experiment in a university or professional setting	❍	❍	❍	❍	❍
Receive an award or special recognition for STEM accomplishments	❍	❍	❍	❍	❍

Q33. How far did you want to go in school BEFORE participating in CQL?
- ❍ Graduate from high school
- ❍ Go to a trade or vocational school
- ❍ Go to college for a little while
- ❍ Finish college (get a Bachelor's degree)
- ❍ Get more education after college
- ❍ Get a master's degree
- ❍ Get a Ph.D.
- ❍ Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
- ❍ Get a combined M.D. / Ph.D.
- ❍ Get another professional degree (law, business, etc.)

Q34. How far do you want to go in school AFTER participating in CQL?
- ❍ Graduate from high school
- ❍ Go to a trade or vocational school
- ❍ Go to college for a little while
- ❍ Finish college (get a Bachelor's degree)
- ❍ Get more education after college
- ❍ Get a master's degree
- ❍ Get a Ph.D.
- ❍ Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
- ❍ Get a combined M.D. / Ph.D.
- ❍ Get another professional degree (law, business, etc.)

Q35. BEFORE CQL, what kind of work did you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career goals BEFORE CQL)
- ❍ Undecided
- ❍ Science (no specific subject)
- ❍ Physical science (e.g., physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric or oceanic science
- ❍ Agricultural science
- ❍ Environmental science
- ❍ Computer science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Teaching, STEM
- ❍ Teaching, non-STEM
- ❍ Medicine (e.g., doctor, dentist, veterinarian, etc.)
- ❍ Health (e.g., nursing, pharmacy, technician, etc.)
- ❍ Social science (e.g., psychologist, sociologist)
- ❍ Business
- ❍ Law
- ❍ English/language arts
- ❍ Farming
- ❍ Military, police, or security
- ❍ Art (e.g., writing, dancing, painting, etc.)
- ❍ Skilled trade (carpenter, electrician, plumber, etc.)

Other ____________________

Q36. AFTER CQL, what kind of work do you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career AFTER CQL)

- ❍ Undecided
- ❍ Science (no specific subject)
- ❍ Physical science (e.g., physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric or oceanic science
- ❍ Agricultural science
- ❍ Environmental science
- ❍ Computer science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Teaching, STEM
- ❍ Teaching, non-STEM
- ❍ Medicine (e.g., doctor, dentist, veterinarian, etc.)
- ❍ Health (e.g., nursing, pharmacy, technician, etc.)
- ❍ Social science (e.g., psychologist, sociologist)
- ❍ Business
- ❍ Law
- ❍ English/language arts
- ❍ Farming
- ❍ Military, police, or security
- ❍ Art (e.g., writing, dancing, painting, etc.)
- ❍ Skilled trade (carpenter, electrician, plumber, etc.)

Other ____________________

Q37. When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?

- ❍ not at all
- ❍ up to 25% of the time
- ❍ up to 50% of the time
- ❍ up to 75% of the time
- ❍ up to 100% of the time

Q38. How many times have you participated in any of the following Army Educational Outreach Programs (AEOPs)?
If you have heard of an AEOP but never participated select "Never". If you have not heard of an AEOP select "Never heard of it".

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
Engineering Encounters Bridge Design Contest (EEBDC)-formerly West Point Bridge Design Contest	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍

College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q39. How interested are you in participating in the following programs in the future?

	Not at all	A little	Somewhat	Very much
Camp Invention	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍
Engineering Encounters Bridge Design Contest (EEBDC)-formerly West Point Bridge Design Contest	❍	❍	❍	❍
Junior Science & Humanities Symposium	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍
UNITE	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍

Q40. How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during CQL?

❍ None
❍ 1
❍ 2
❍ 3
❍ 4
❍ 5 or more

Q41. How many Department of Defense (DoD) STEM jobs/careers did you learn about during CQL?

- ❍ None
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5 or more

Q42. Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍
DoD researchers support non-defense related advancements in science and technology	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

Q43. Which of the following statements describe you after participating in CQL?

	Disagree - This did not happen	Disagree - This happened but not because of CQL	Agree - CQL contributed	Agree - CQL was primary reason
I am more confident in my STEM knowledge, skills, and abilities	❍	❍	❍	❍
I am more interested in participating in STEM activities outside of school requirements	❍	❍	❍	❍
I am more aware of other AEOPs	❍	❍	❍	❍
I am more interested in participating in other AEOPs	❍	❍	❍	❍
I am more interested in taking STEM classes in school	❍	❍	❍	❍
I am more interested in attending college	❍	❍	❍	❍
I am more interested in earning a STEM degree in college	❍	❍	❍	❍
I am more interested in pursuing a STEM career	❍	❍	❍	❍
I am more aware of DoD STEM research and careers	❍	❍	❍	❍

I have a greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
I am more interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q44. What are the three most important ways that you have benefited from CQL?

Benefit #1:

Benefit #2:

Benefit #3:

Q45. What are the three ways that CQL should be improved for future participants?

Improvement #1:

Improvement #2:

Improvement #3:

Q46. Tell us about your overall satisfaction with your CQL experience.

CQL Youth Data Summary

So that we can determine how diverse students respond to participation in AEOP programs, please tell us about yourself and your school. What grade will you start in the fall? (select one) (Avg. = 15.57, SD = 1.14)		
	Freq.	**%**
4th	0	0%
5th	0	0%
6th	0	0%
7th	0	0%
8th	0	0%
9th	0	0%
10th	0	0%
11th	0	0%
12th	0	0%
College freshman (13)	1	1%
College sophomore (14)	27	19%
College junior (15)	32	23%
College senior (16)	30	22%
Graduate program (17)	35	25%
Other, (specify)	8	6%
Choose not to report	6	4%
Total	**139**	**100%**

Note. Other = "Graduated" (n = 3), "Applying to Graduate Program", "College Super Senior", "Continued internship", "I will have graduate at the end of this term and will take a class as a non-degree seeking student in the fall", and "Research Technician at the WRAIR and NIH".

What is your gender?		
	Freq.	**%**
Male	78	56%
Female	60	43%
Choose not to report	1	1%
Total	**139**	**100%**

What is your race or ethnicity?		
	Freq.	%
Hispanic or Latino	7	5%
Asian	29	21%
Black or African American	9	6%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	2	1%
White	77	55%
Other race or ethnicity, (specify):	5	4%
Choose not to report	10	7%
Total	139	100%

Note. Other = "Bi-racial", "Iranian", "Middle Eastern", "White-Asian", and "Korean, White".

Where was the CQL program located? (Select ONE)						
	Freq.	%			Freq.	%
Army Aviation & Missile Research Development and Engineering Center-Redstone Arsenal (Huntsville, AL)	7	5%		Army Criminal Investigation Command-Defense Forensic Science Center (Forest Park, GA)	1	1%
Army Center for Environmental Health Research (Fort Detrick, MD)	3	2%		Edgewood Chemical Biological Center (Edgewood, MD)	0	0%
Army Medical Research Institute of Chemical Defense (Aberdeen, MD)	6	4%		Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)	7	5%
Army Medical Research Institute for Infectious Diseases (Fort Detrick, MD)	16	12%		Engineer Research & Development Center-Topographic Engineering Center (Alexandria, VA)	0	0%
Army Research Laboratory- Aberdeen Proving Ground (Aberdeen, MD)	37	27%		Engineer Research & Development Center-Mississippi (Vicksburg, MS)	0	0%
Army Research Laboratory–Adelphi (Adelphi, MD)	36	26%		Walter Reed Army Institute of Research (Silver Spring, MD)	26	19%
				Total	139	100%

How did you learn about CQL? (Check all that apply) (n = 137)						
	Freq.	%			Freq.	%
American Society for Engineering Education website	2	1%		Extended family member (grandparents, aunts, uncles, cousins)	6	4%
Army Educational Outreach Program (AEOP) website	18	13%		Friend of the family	10	7%
Facebook, Twitter, Pinterest, or other social media	0	0%		Teacher or professor	32	23%
School or university newsletter, email, or website	24	18%		Guidance counselor	2	1%
News story or other media coverage	0	0%		Mentor from CQL	22	16%
Past participant of CQL	22	16%		Someone who works at an Army laboratory	36	26%
Friend	23	17%		Someone who works with the Department of Defense	13	9%
Immediate family member (mother, father, siblings)	26	19%		Other, (specify):	6	4%

Note. Other = "Drexel University Co-op", "I applied for the SMART program and when I was looking around at information for that program I came across this program.", "I didn't learn about CQL directly, but only though a co-op job offer at Drexel.", "job board", and "WRAIR".

How motivating were the following factors in your decision to participate in CQL?	1	2	3	4	n	Avg.	SD
Teacher or professor encouragement	54 (39%)	21 (15%)	26 (19%)	36 (26%)	137	**2.32**	1.24
An academic requirement or school grade	103 (75%)	10 (7%)	16 (12%)	8 (6%)	137	**1.48**	0.92
Desire to learn something new or interesting	0 (0%)	4 (3%)	29 (21%)	103 (76%)	136	**3.73**	0.51
The program mentor(s)	16 (12%)	24 (18%)	44 (32%)	52 (38%)	136	**2.97**	1.02
Building college application or résumé	7 (5%)	7 (5%)	23 (17%)	100 (73%)	137	**3.58**	0.81
Networking opportunities	4 (3%)	11 (8%)	38 (28%)	84 (61%)	137	**3.47**	0.77
Interest in science, technology, engineering, or mathematics (STEM)	0 (0%)	3 (2%)	23 (17%)	111 (81%)	137	**3.79**	0.46
Interest in STEM careers with the Army	18 (13%)	22 (16%)	42 (31%)	54 (40%)	136	**2.97**	1.05
Having fun	9 (7%)	34 (25%)	51 (37%)	43 (31%)	137	**2.93**	0.91
Earning stipend or award while doing STEM	4 (3%)	15 (11%)	35 (26%)	83 (61%)	137	**3.44**	0.80
Opportunity to do something with friends	83 (61%)	25 (18%)	10 (7%)	19 (14%)	137	**1.74**	1.08
Opportunity to use advanced laboratory technology	10 (7%)	16 (12%)	30 (22%)	81 (59%)	137	**3.33**	0.95
Desire to expand laboratory or research skills	3 (2%)	3 (2%)	20 (15%)	111 (81%)	137	**3.74**	0.61
Learning in ways that are not possible in school	1 (1%)	4 (3%)	22 (16%)	110 (80%)	137	**3.76**	0.54

Serving the community or country	16 (12%)	23 (17%)	48 (35%)	50 (36%)	137	**2.96**	1.00
Parent encouragement	46 (34%)	33 (24%)	28 (20%)	30 (22%)	137	**2.31**	1.15
Exploring a unique work environment	6 (4%)	13 (9%)	46 (34%)	72 (53%)	137	**3.34**	0.83
Other, (specify)	16 (80%)	0 (0%)	2 (10%)	2 (10%)	20	**1.50**	1.05

Note. Response scale: **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much". Other = "Matches my professional goals".

How often do you do each of the following in STEM classes at school this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn about new science, technology, engineering, or mathematics (STEM) topics	10 (7%)	8 (6%)	21 (16%)	44 (33%)	52 (39%)	135	**3.89**	1.20
Apply STEM knowledge to real life situations	12 (9%)	9 (7%)	48 (36%)	43 (32%)	23 (17%)	135	**3.41**	1.12
Learn about cutting-edge STEM research	14 (11%)	16 (12%)	58 (44%)	30 (23%)	15 (11%)	133	**3.12**	1.10
Learn about different STEM careers	17 (13%)	21 (16%)	55 (41%)	32 (24%)	10 (7%)	135	**2.98**	1.10
Interact with STEM professionals	17 (13%)	21 (16%)	36 (27%)	28 (21%)	33 (24%)	135	**3.29**	1.33

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in CQL this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn about new science, technology, engineering, or mathematics (STEM) topics	2 (1%)	2 (1%)	27 (20%)	57 (42%)	48 (35%)	136	**4.08**	0.86
Apply STEM knowledge to real life situations	3 (2%)	2 (1%)	13 (10%)	43 (32%)	75 (55%)	136	**4.36**	0.88
Learn about cutting-edge STEM research	1 (1%)	5 (4%)	26 (19%)	49 (36%)	55 (40%)	136	**4.12**	0.89
Learn about different STEM careers	6 (4%)	12 (9%)	53 (39%)	34 (25%)	31 (23%)	136	**3.53**	1.07
Interact with STEM professionals	1 (1%)	1 (1%)	8 (6%)	24 (18%)	102 (75%)	136	**4.65**	0.69

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in STEM classes at school this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Practice using laboratory or field techniques, procedures, and tools	13 (10%)	11 (9%)	50 (39%)	44 (34%)	11 (9%)	129	**3.22**	1.06
Participate in hands-on STEM activities	9 (7%)	13 (10%)	61 (47%)	37 (29%)	9 (7%)	129	**3.19**	0.96
Work as part of a team	7 (5%)	6 (5%)	55 (43%)	41 (32%)	20 (16%)	129	**3.47**	0.99
Communicate with other students about STEM	5 (4%)	8 (6%)	29 (22%)	40 (31%)	47 (36%)	129	**3.90**	1.09

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in CQL this year?								
	1	2	3	4	5	n	Avg.	SD
Practice using laboratory or field techniques, procedures, and tools	5 (4%)	2 (2%)	9 (7%)	33 (25%)	83 (63%)	132	**4.42**	0.97
Participate in hands-on STEM activities	3 (2%)	1 (1%)	5 (4%)	39 (30%)	84 (64%)	132	**4.52**	0.81
Work as part of a team	8 (6%)	4 (3%)	13 (10%)	31 (24%)	75 (57%)	131	**4.23**	1.14
Communicate with other students about STEM	8 (6%)	11 (8%)	25 (19%)	34 (26%)	54 (41%)	132	**3.87**	1.21

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	6 (5%)	12 (10%)	61 (49%)	28 (23%)	17 (14%)	124	**3.31**	0.99
Design an investigation	18 (15%)	30 (24%)	47 (38%)	23 (19%)	6 (5%)	124	**2.75**	1.07
Carry out an investigation	18 (15%)	21 (17%)	51 (41%)	24 (19%)	10 (8%)	124	**2.90**	1.12
Analyze and interpret data or information	8 (6%)	8 (6%)	44 (35%)	41 (33%)	23 (19%)	124	**3.51**	1.07
Draw conclusions from an investigation	8 (6%)	10 (8%)	56 (45%)	36 (29%)	14 (11%)	124	**3.31**	1.00
Come up with creative explanations or solutions	9 (7%)	14 (11%)	52 (42%)	32 (26%)	17 (14%)	124	**3.27**	1.07
Build (or simulate) something	12 (10%)	21 (17%)	59 (48%)	24 (19%)	8 (6%)	124	**2.96**	1.01

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

How often do you do each of the following in CQL this year?								
	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	3 (2%)	7 (6%)	35 (28%)	43 (34%)	39 (31%)	127	**3.85**	1.00
Design an investigation	6 (5%)	15 (12%)	35 (28%)	42 (33%)	29 (23%)	127	**3.57**	1.11
Carry out an investigation	2 (2%)	9 (7%)	18 (14%)	48 (38%)	49 (39%)	126	**4.06**	0.98
Analyze and interpret data or information	2 (2%)	3 (2%)	25 (20%)	40 (32%)	56 (44%)	126	**4.15**	0.93
Draw conclusions from an investigation	5 (4%)	3 (2%)	29 (23%)	49 (39%)	41 (32%)	127	**3.93**	1.00
Come up with creative explanations or solutions	2 (2%)	8 (6%)	35 (28%)	43 (34%)	39 (31%)	127	**3.86**	0.98
Build (or simulate) something	11 (9%)	13 (10%)	30 (23%)	38 (30%)	36 (28%)	128	**3.59**	1.24

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during CQL:								
	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	79 (64%)	13 (11%)	19 (15%)	9 (7%)	3 (2%)	123	**2.05**	0.89
Army Educational Outreach Program (AEOP) website	63 (51%)	12 (10%)	29 (23%)	12 (10%)	8 (6%)	124	**2.26**	0.93
AEOP social media	91 (73%)	19 (15%)	11 (9%)	2 (2%)	1 (1%)	124	**1.55**	0.75
AEOP brochure	83 (69%)	19 (16%)	13 (11%)	6 (5%)	0 (0%)	121	**1.66**	0.75
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	82 (66%)	16 (13%)	20 (16%)	6 (5%)	0 (0%)	124	**1.76**	0.69
My mentor(s)	5 (4%)	9 (7%)	30 (24%)	30 (24%)	50 (40%)	124	**3.02**	0.99
Invited speakers or "career" events	52 (42%)	16 (13%)	24 (19%)	25 (20%)	7 (6%)	124	**2.32**	0.93
Participation in CQL	12 (10%)	5 (4%)	18 (15%)	44 (35%)	45 (36%)	124	**3.15**	0.85

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during CQL:								
	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	76 (62%)	20 (16%)	19 (15%)	7 (6%)	1 (1%)	123	**1.77**	0.79
Army Educational Outreach Program (AEOP) website	61 (50%)	19 (16%)	32 (26%)	6 (5%)	4 (3%)	122	**1.92**	0.82
AEOP social media	87 (71%)	20 (16%)	10 (8%)	5 (4%)	0 (0%)	122	**1.57**	0.74
AEOP brochure	86 (69%)	18 (15%)	16 (13%)	4 (3%)	0 (0%)	124	**1.63**	0.67
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	82 (66%)	17 (14%)	22 (18%)	3 (2%)	0 (0%)	124	**1.67**	0.61
My mentor(s)	12 (10%)	4 (3%)	22 (18%)	34 (27%)	52 (42%)	124	**3.20**	0.88
Invited speakers or "career" events	45 (37%)	13 (11%)	24 (20%)	31 (25%)	10 (8%)	123	**2.49**	0.92
Participation in CQL	11 (9%)	7 (6%)	17 (14%)	43 (35%)	46 (37%)	124	**3.13**	0.89

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

How SATISFIED were you with each of the following CQL program features?								
	0	1	2	3	4	n	Avg.	SD
Application or registration process	5 (4%)	9 (7%)	31 (25%)	47 (38%)	32 (26%)	124	**2.86**	0.90
Other administrative tasks	4 (3%)	16 (13%)	43 (35%)	44 (36%)	16 (13%)	123	**2.50**	0.89
Communications with American Society for Engineering Education	41 (33%)	13 (10%)	28 (23%)	30 (24%)	12 (10%)	124	**2.49**	0.93

Communications with [CQL site]	4 (3%)	9 (7%)	14 (11%)	38 (31%)	59 (48%)	124	**3.23**	0.93
Location(s) of program activities	7 (6%)	2 (2%)	14 (11%)	30 (24%)	71 (57%)	124	**3.45**	0.77
Availability of program topics or fields that interest you	3 (2%)	5 (4%)	12 (10%)	36 (29%)	68 (55%)	124	**3.38**	0.83
Instruction or mentorship during program activities	1 (1%)	0 (0%)	7 (6%)	27 (22%)	89 (72%)	124	**3.67**	0.58
Participation stipends (payment)	0 (0%)	10 (8%)	8 (6%)	32 (26%)	74 (60%)	124	**3.37**	0.92
Research abstract preparation requirements	6 (5%)	7 (6%)	19 (15%)	47 (38%)	45 (36%)	124	**3.10**	0.88
Research presentation process	12 (10%)	12 (10%)	19 (15%)	46 (37%)	34 (28%)	123	**2.92**	0.95

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Which of the following best describes your primary research mentor?		
	Freq.	**%**
I did not have a research mentor	1	1%
Teacher	10	8%
Coach	6	5%
Parent	2	2%
Club or activity leader (School club, Boy/Girls Scouts)	2	2%
STEM researcher (university, industry, or DoD/government employee)	102	82%
Other (specify)	1	1%
Total	**124**	**100%**

Which of the following statements best reflects the input you had into your project initially?		
	Freq.	**%**
I did not have a project	1	1%
I was assigned a project by my mentor	54	44%
I worked with my mentor to design a project	22	18%
I had a choice among various projects suggested by my mentor	21	17%
I worked with my mentor and members of a research team to design a project	22	18%
I designed the entire project on my own	4	3%
Total	**124**	**100%**

Which of the following statements best reflects the availability of your mentor?		
	Freq.	%
I did not have a mentor	0	0%
The mentor was never available	0	0%
The mentor was available less than half of the time	7	6%
The mentor was available about half of the time of my project	12	10%
The mentor was available more than half of the time	29	23%
The mentor was always available	76	61%
Total	**124**	**100%**

Which of the following statements best reflects your working as part of a group or team?		
	Freq.	%
I worked alone (or alone with my research mentor)	17	14%
I worked with others in a shared laboratory or other space, but we work on different projects	39	31%
I worked alone on my project and I met with others regularly for general reporting or discussion	18	15%
I worked alone on a project that was closely connected with projects of others in my group	26	21%
I work with a group who all worked on the same project	24	19%
Total	**124**	**100%**

How SATISFIED were you with each of the following?								
	0	1	2	3	4	n	Avg.	SD
My working relationship with my mentor	0 (0%)	0 (0%)	7 (6%)	15 (12%)	100 (82%)	122	**3.76**	0.55
My working relationship with the group or team	10 (8%)	1 (1%)	4 (3%)	17 (14%)	91 (74%)	123	**3.75**	0.56
The amount of time I spent doing meaningful research	2 (2%)	5 (4%)	12 (10%)	45 (37%)	59 (48%)	123	**3.31**	0.81
The amount of time I spent with my research mentor	0 (0%)	1 (1%)	10 (8%)	25 (20%)	87 (71%)	123	**3.61**	0.67
The research experience overall	0 (0%)	1 (1%)	6 (5%)	26 (21%)	90 (73%)	123	**3.67**	0.61

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Which of the following statements apply to your research experience? (choose all that apply) (n = 117)						
	Freq.	%			Freq.	%
I presented a talk or poster to other students or faculty	63	54%		I will present a talk or poster to other students or faculty	55	47%
I presented a talk or poster at a professional symposium or conference	24	21%		I will present a talk or poster at a professional symposium or conference	29	25%
I attended a symposium or conference	33	28%		I will attend a symposium or conference	26	22%
I wrote or co-wrote a paper that was/will be published in a research journal	9	8%		I will write or co-write a paper that was/will be published in a research journal	36	31%
I wrote or co-wrote a technical paper or patent	16	14%		I will write or co-write a technical paper or patent	38	32%
				I won an award or scholarship based on my research	2	2%

The list below describes mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies that your mentor(s) used when working directly with you for CQL:					
		Yes – my mentor used this strategy with me		No – my mentor did not use this strategy with me	
	n	Freq.	%	Freq.	%
Helped me become aware of the roles STEM play in my everyday life	121	70	58%	51	42%
Helped me understand how STEM can help me improve my community	121	73	60%	48	40%
Used teaching/mentoring activities that addressed my learning style	121	88	73%	33	27%
Provided me with extra support when I needed it	121	113	93%	8	7%
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	121	86	71%	35	29%
Allowed me to work on a collaborative project as a member of a team	120	94	78%	26	22%
Helped me practice a variety of STEM skills with supervision	121	103	85%	18	15%
Gave me constructive feedback to improve my STEM knowledge, skills, or abilities	121	111	92%	10	8%
Gave me guidance about educational pathways that would prepare me for a STEM career	120	82	68%	38	32%
Recommended Army Educational Outreach Programs that match my interests	120	42	35%	78	65%

Discussed STEM career opportunities with DoD or other government agencies	119	67	56%	52	44%

Which category best describes the focus of your CQL experience?		
	Freq.	**%**
Science	59	50%
Technology	13	11%
Engineering	44	37%
Mathematics	3	3%
Total	**119**	**100%**

AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Knowledge of a STEM topic or field in depth	1 (1%)	4 (3%)	24 (20%)	49 (40%)	43 (36%)	121	**4.07**	0.87
Knowledge of research conducted in a STEM topic or field	1 (1%)	2 (2%)	15 (12%)	58 (48%)	45 (37%)	121	**4.19**	0.78
Knowledge of research processes, ethics, and rules for conduct in STEM	5 (4%)	9 (7%)	27 (22%)	41 (34%)	39 (32%)	121	**3.83**	1.09
Knowledge of how professionals work on real problems in STEM	1 (1%)	5 (4%)	20 (17%)	46 (38%)	49 (40%)	121	**4.13**	0.89
Knowledge of what everyday research work is like in STEM	2 (2%)	4 (3%)	15 (13%)	41 (34%)	58 (48%)	120	**4.24**	0.92

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Asking questions based on observations of real-world phenomena	3 (5%)	6 (10%)	20 (34%)	16 (28%)	13 (22%)	58	**3.52**	1.11
Asking a question (about a phenomenon) that can be answered with one or more investigations	2 (3%)	3 (5%)	17 (29%)	24 (41%)	12 (21%)	58	**3.71**	0.97
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	1 (2%)	3 (5%)	19 (33%)	20 (34%)	15 (26%)	58	**3.78**	0.96
Making a model to represent the key features and functions of an observed phenomenon	9 (16%)	9 (16%)	10 (18%)	16 (28%)	13 (23%)	57	**3.26**	1.40

Deciding what type of data to collect in order to answer a question	2 (4%)	2 (4%)	17 (30%)	19 (33%)	17 (30%)	57	**3.82**	1.02
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	5 (9%)	6 (11%)	12 (21%)	19 (34%)	14 (25%)	56	**3.55**	1.23
Identifying the limitations of data collected in an investigation	1 (2%)	5 (9%)	15 (26%)	24 (42%)	12 (21%)	57	**3.72**	0.96
Carrying out procedures for an investigation and recording data accurately	1 (2%)	2 (4%)	11 (19%)	24 (42%)	19 (33%)	57	**4.02**	0.92
Testing how changing one variable affects another variable, in order to understand relationships between variables	5 (9%)	3 (5%)	18 (32%)	21 (37%)	10 (18%)	57	**3.49**	1.12
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	19 (33%)	9 (16%)	12 (21%)	6 (11%)	11 (19%)	57	**2.67**	1.52
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	8 (14%)	8 (14%)	16 (29%)	15 (27%)	9 (16%)	56	**3.16**	1.28
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	3 (5%)	7 (13%)	16 (29%)	15 (27%)	14 (25%)	55	**3.55**	1.17
Using mathematics or computers to analyze numeric data	8 (14%)	9 (16%)	20 (35%)	10 (18%)	10 (18%)	57	**3.09**	1.27
Supporting a proposed explanation (for a phenomenon) with data from investigations	4 (7%)	4 (7%)	21 (37%)	19 (33%)	9 (16%)	57	**3.44**	1.07
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	4 (7%)	7 (12%)	12 (21%)	25 (44%)	9 (16%)	57	**3.49**	1.12
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	3 (5%)	7 (13%)	14 (25%)	21 (38%)	11 (20%)	56	**3.54**	1.11
Using data or interpretations from other researchers or investigations to improve an explanation	3 (5%)	8 (14%)	14 (25%)	18 (32%)	13 (23%)	56	**3.54**	1.16
Asking questions to understand the data and interpretations others use to support their explanations	3 (5%)	6 (11%)	16 (29%)	14 (25%)	17 (30%)	56	**3.64**	1.18
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	3 (5%)	11 (19%)	19 (33%)	14 (25%)	10 (18%)	57	**3.30**	1.13

Deciding what additional data or information may be needed to find the best explanation for a phenomenon	1 (2%)	9 (16%)	15 (26%)	21 (37%)	11 (19%)	57	**3.56**	1.04
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	1 (2%)	7 (12%)	12 (21%)	20 (35%)	17 (30%)	57	**3.79**	1.06
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	2 (4%)	10 (18%)	17 (30%)	17 (30%)	11 (19%)	57	**3.44**	1.10
Integrating information from multiple sources to support your explanations of phenomena	2 (4%)	10 (18%)	15 (26%)	14 (25%)	16 (28%)	57	**3.56**	1.18
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	3 (5%)	6 (11%)	18 (32%)	16 (28%)	14 (25%)	57	**3.56**	1.13

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Identifying real-world problems based on social, technological, or environmental issues	4 (7%)	6 (10%)	21 (36%)	20 (34%)	7 (12%)	58	**3.34**	1.05
Defining a problem that can be solved by developing a new or improved object, process, or system	4 (7%)	3 (5%)	18 (31%)	21 (36%)	12 (21%)	58	**3.59**	1.09
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	2 (3%)	2 (3%)	19 (33%)	22 (38%)	13 (22%)	58	**3.72**	0.97
Making a model that represents the key features or functions of a solution to a problem	4 (7%)	4 (7%)	20 (34%)	18 (31%)	12 (21%)	58	**3.52**	1.11
Deciding what type of data to collect in order to test if a solution functions as intended	2 (3%)	3 (5%)	18 (31%)	21 (36%)	14 (24%)	58	**3.72**	1.01
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	3 (5%)	2 (3%)	17 (29%)	22 (38%)	14 (24%)	58	**3.72**	1.04
Identifying the limitations of the data collected in an investigation	5 (9%)	2 (3%)	15 (26%)	25 (43%)	11 (19%)	58	**3.60**	1.11
Carrying out procedures for an investigation and recording data accurately	4 (7%)	4 (7%)	19 (33%)	15 (26%)	16 (28%)	58	**3.60**	1.17

Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	4 (7%)	10 (17%)	14 (24%)	12 (21%)	18 (31%)	58	**3.52**	1.29
Using computer-based models to investigate cause and effect relationships of a simulated solution	9 (16%)	5 (9%)	15 (26%)	17 (29%)	12 (21%)	58	**3.31**	1.33
Considering alternative interpretations of data when deciding if a solution functions as intended	5 (9%)	4 (7%)	17 (29%)	20 (34%)	12 (21%)	58	**3.52**	1.16
Displaying numeric data in charts or graphs to identify patterns and relationships	4 (7%)	3 (5%)	18 (32%)	14 (25%)	18 (32%)	57	**3.68**	1.18
Using mathematics or computers to analyze numeric data	2 (3%)	5 (9%)	13 (22%)	22 (38%)	16 (28%)	58	**3.78**	1.06
Supporting a proposed solution (for a problem) with data from investigations	2 (3%)	5 (9%)	18 (31%)	19 (33%)	14 (24%)	58	**3.66**	1.05
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	1 (2%)	2 (4%)	16 (28%)	25 (44%)	13 (23%)	57	**3.82**	0.89
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	2 (3%)	5 (9%)	19 (33%)	20 (34%)	12 (21%)	58	**3.60**	1.02
Using data or interpretations from other researchers or investigations to improve a solution	1 (2%)	6 (10%)	15 (26%)	22 (38%)	14 (24%)	58	**3.72**	1.01
Asking questions to understand the data and interpretations others use to support their solutions	1 (2%)	3 (5%)	20 (35%)	19 (33%)	14 (25%)	57	**3.74**	0.95
Using data from investigations to defend an argument that conveys how a solution meets design criteria	5 (9%)	8 (14%)	13 (23%)	21 (37%)	10 (18%)	57	**3.40**	1.19
Deciding what additional data or information may be needed to find the best solution to a problem	2 (3%)	4 (7%)	20 (34%)	20 (34%)	12 (21%)	58	**3.62**	1.01
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	5 (9%)	18 (32%)	19 (33%)	15 (26%)	57	**3.77**	0.95
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	2 (3%)	6 (10%)	19 (33%)	21 (36%)	10 (17%)	58	**3.53**	1.01

Integrating information from multiple sources to support your solution to a problem	2 (3%)	5 (9%)	23 (40%)	13 (22%)	15 (26%)	58	**3.59**	1.08
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	1 (2%)	7 (12%)	15 (26%)	19 (33%)	16 (28%)	58	**3.72**	1.06

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learning to work independently	2 (2%)	2 (2%)	31 (26%)	48 (40%)	36 (30%)	119	**3.96**	0.89
Setting goals and reflecting on performance	1 (1%)	13 (11%)	30 (25%)	44 (37%)	31 (26%)	119	**3.76**	0.99
Sticking with a task until it is complete	4 (3%)	8 (7%)	29 (24%)	43 (36%)	35 (29%)	119	**3.82**	1.04
Making changes when things do not go as planned	1 (1%)	4 (3%)	21 (18%)	51 (43%)	42 (35%)	119	**4.08**	0.86
Patience for the slow pace of research	1 (1%)	6 (5%)	30 (25%)	42 (35%)	40 (34%)	119	**3.96**	0.93
Working collaboratively with a team	7 (6%)	13 (11%)	31 (26%)	37 (31%)	30 (25%)	118	**3.59**	1.16
Communicating effectively with others	1 (1%)	12 (10%)	31 (26%)	40 (34%)	35 (29%)	119	**3.81**	1.00
Including others' perspectives when making decisions	3 (3%)	16 (13%)	28 (24%)	39 (33%)	33 (28%)	119	**3.70**	1.09
Sense of being part of a learning community	3 (3%)	10 (8%)	28 (24%)	41 (34%)	37 (31%)	119	**3.83**	1.04
Sense of contributing to a body of knowledge	2 (2%)	7 (6%)	33 (28%)	41 (34%)	36 (30%)	119	**3.86**	0.98
Building relationships with professionals in a field	1 (1%)	2 (2%)	30 (25%)	38 (32%)	48 (40%)	119	**4.09**	0.89
Connecting a topic or field and my personal values	11 (9%)	17 (14%)	28 (24%)	34 (29%)	29 (24%)	119	**3.45**	1.26

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR CQL EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Interest in a new STEM topic or field	6 (5%)	15 (13%)	37 (32%)	34 (29%)	25 (21%)	117	**3.49**	1.12
Clarifying a STEM career path	4 (3%)	17 (15%)	37 (32%)	32 (27%)	27 (23%)	117	**3.52**	1.10
Sense of accomplishing something in STEM	2 (2%)	5 (4%)	37 (32%)	43 (37%)	30 (26%)	117	**3.80**	0.93
Building academic or professional credentials in STEM	3 (3%)	2 (2%)	28 (24%)	43 (37%)	41 (35%)	117	**4.00**	0.95
Feeling prepared for more challenging STEM activities	0 (0%)	4 (3%)	26 (22%)	49 (42%)	38 (32%)	117	**4.03**	0.83

Confidence to do well in future STEM courses	3 (3%)	6 (5%)	25 (21%)	47 (40%)	36 (31%)	117	**3.91**	0.98
Confidence to contribute to STEM	2 (2%)	3 (3%)	30 (26%)	48 (41%)	34 (29%)	117	**3.93**	0.90
Thinking creatively about a STEM project or activity	1 (1%)	11 (9%)	31 (26%)	39 (33%)	35 (30%)	117	**3.82**	1.00
Trying out new ideas or procedures on my own in a STEM project or activity	2 (2%)	10 (9%)	39 (33%)	34 (29%)	32 (27%)	117	**3.72**	1.02
Feeling responsible for a STEM project or activity	0 (0%)	7 (6%)	28 (24%)	43 (37%)	39 (33%)	117	**3.97**	0.90
Feeling like a STEM professional	4 (3%)	10 (9%)	25 (21%)	41 (35%)	37 (32%)	117	**3.83**	1.08
Feeling like part of a STEM community	2 (2%)	7 (6%)	29 (25%)	41 (35%)	38 (32%)	117	**3.91**	0.98

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF YOUR CQL experience, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?

	1	2	3	4	5	n	Avg.	SD
Visit a science museum or zoo	0 (0%)	1 (1%)	88 (75%)	22 (19%)	7 (6%)	118	**3.30**	0.59
Watch or read non-fiction STEM	0 (0%)	1 (1%)	78 (66%)	26 (22%)	13 (11%)	118	**3.43**	0.70
Look up STEM information at a library or on the internet	0 (0%)	1 (1%)	55 (47%)	40 (34%)	22 (19%)	118	**3.70**	0.78
Tinker with a mechanical or electrical device	0 (0%)	1 (1%)	75 (64%)	32 (27%)	10 (8%)	118	**3.43**	0.66
Work on solving mathematical or scientific puzzles	0 (0%)	1 (1%)	72 (61%)	35 (30%)	10 (8%)	118	**3.46**	0.66
Design a computer program or website	1 (1%)	5 (4%)	83 (70%)	23 (19%)	6 (5%)	118	**3.24**	0.65
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	0 (0%)	2 (2%)	76 (64%)	36 (31%)	4 (3%)	118	**3.36**	0.58
Talk with friends or family about STEM	1 (1%)	1 (1%)	41 (35%)	56 (47%)	19 (16%)	118	**3.77**	0.76
Mentor or teach other students about STEM	0 (0%)	3 (3%)	43 (36%)	59 (50%)	13 (11%)	118	**3.69**	0.70
Help with a community service project that relates to STEM	1 (1%)	0 (0%)	57 (49%)	43 (37%)	16 (14%)	117	**3.62**	0.75
Participate in a STEM club, student association, or professional organization	1 (1%)	1 (1%)	57 (48%)	47 (40%)	12 (10%)	118	**3.58**	0.72
Participate in STEM camp, fair, or competition	1 (1%)	3 (3%)	72 (62%)	32 (27%)	9 (8%)	117	**3.38**	0.71
Take an elective (not required) STEM class	1 (1%)	1 (1%)	60 (51%)	40 (34%)	16 (14%)	118	**3.58**	0.77
Work on a STEM project or experiment in a university or professional setting	1 (1%)	1 (1%)	45 (38%)	44 (37%)	27 (23%)	118	**3.81**	0.83
Receive an award or special recognition for STEM accomplishments	1 (1%)	1 (1%)	48 (41%)	49 (42%)	19 (16%)	118	**3.71**	0.77

Note. Response scale: **1** = "Much less likely," **2** = "Less likely," **3** = "About the same before and after," **4** = "More likely," **5** = "Much more likely".

How far did you want to go in school BEFORE participating in CQL?		
	Freq.	**%**
Graduate from high school	1	1%
Go to a trade or vocational school	0	0%
Go to college for a little while	15	13%
Finish college (get a Bachelor's degree)	20	17%
Get more education after college	8	7%
Get a master's degree	33	28%
Get a Ph.D.	23	19%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	11	9%
Get a combined M.D. / Ph.D.	3	3%
Get another professional degree (law, business, etc.)	5	4%
Total	**119**	**100%**

How far did you want to go in school AFTER participating in CQL?		
	Freq.	**%**
Graduate from high school	1	1%
Go to a trade or vocational school	0	0%
Go to college for a little while	1	1%
Finish college (get a Bachelor's degree)	10	8%
Get more education after college	6	5%
Get a master's degree	37	31%
Get a Ph.D.	42	35%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	11	9%
Get a combined M.D. / Ph.D.	8	7%
Get another professional degree (law, business, etc.)	3	3%
Total	**119**	**100%**

BEFORE CQL, what kind of work did you expect to be doing when you are 30 years old (select the ONE answer that best describes your career goals BEFORE CQL)						
	Freq.	%			Freq.	%
Undecided	4	3%		Teaching, non-STEM	0	0%
Science (no specific subject)	5	4%		Medicine (doctor, dentist, veterinarian, etc.)	16	13%
Physical science (physics, chemistry, astronomy, materials science, etc.)	11	9%		Health (nursing, pharmacy, technician, etc.)	2	2%
Biological science	8	7%		Social science (psychologist, sociologist, etc.)	5	4%
Earth, atmospheric or oceanic science	1	1%		Business	2	2%
Agricultural science	1	1%		Law	0	0%
Environmental science	0	0%		English/language arts	1	1%
Computer science	6	5%		Farming	0	0%
Technology	3	3%		Military, police, or security	1	1%
Engineering	46	39%		Art (writing, dancing, painting, etc.)	0	0%
Mathematics or statistics	0	0%		Skilled trade (carpenter, electrician, plumber, etc.)	0	0%
Teaching, STEM	2	2%		Other, (specify):	5	4%
				Total	119	100%

Note. Other = “Biodefense/Biomedical Engineering”, “Biological or Physical Science”, “Dietician”, “I am 30”, and “Librarian.”

AFTER CQL, what kind of work do you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career goals AFTER CQL)						
	Freq.	%			Freq.	%
Undecided	2	2%		Teaching, non-STEM	0	0%
Science (no specific subject)	6	5%		Medicine (doctor, dentist, veterinarian, etc.)	13	11%
Physical science (physics, chemistry, astronomy, materials science, etc.)	10	8%		Health (nursing, pharmacy, technician, etc.)	2	2%
Biological science	8	7%		Social science (psychologist, sociologist, etc.)	2	2%
Earth, atmospheric or oceanic science	1	1%		Business	2	2%
Agricultural science	0	0%		Law	0	0%
Environmental science	0	0%		English/language arts	1	1%
Computer science	5	4%		Farming	0	0%
Technology	2	2%		Military, police, or security	1	1%

Engineering	51	43%		**Art (writing, dancing, painting, etc.)**	1	1%
Mathematics or statistics	1	1%		**Skilled trade (carpenter, electrician, plumber, etc.)**	0	0%
Teaching, STEM	2	2%		**Other, (specify):**	9	8%
				Total	**119**	**100%**

Note. Other = "Dietician", "Forensic science", "Healthcare Administration", "ibid.", "Librarian", "Medical Physics/Biodefense/ Biomedical Engineering", "Neurology", "PA School/Health Professional", and "Public Health".

When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?		
	Freq.	**%**
not at all	1	1%
less than 25% of the time	2	2%
26% to 50% of the time	14	12%
51% to 75% of the time	23	19%
76% to 100% of the time	78	66%
Total	**118**	**100%**

How many times have you participated in any of the following Army Educational Outreach Programs? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Camp Invention	87 (74%)	29 (25%)	1 (1%)	1 (1%)	0 (0%)	118	**1.10**	0.40
eCYBERMISSION	82 (69%)	31 (26%)	2 (2%)	2 (2%)	1 (1%)	118	**1.25**	0.69
Junior Solar Sprint (JSS)	83 (72%)	30 (26%)	0 (0%)	0 (0%)	2 (2%)	115	**1.19**	0.74
West Point Bridge Design Contest (WPBDC)	73 (62%)	35 (30%)	6 (5%)	2 (2%)	1 (1%)	117	**1.30**	0.67
Junior Science & Humanities Symposium (JSHS)	82 (70%)	33 (28%)	2 (2%)	0 (0%)	0 (0%)	117	**1.06**	0.24
Gains in the Education of Mathematics and Science (GEMS)	42 (36%)	61 (52%)	9 (8%)	1 (1%)	5 (4%)	118	**1.34**	0.81
GEMS Near Peers	51 (43%)	61 (51%)	4 (3%)	1 (1%)	2 (2%)	119	**1.18**	0.60
UNITE	79 (68%)	36 (31%)	1 (1%)	1 (1%)	0 (0%)	117	**1.08**	0.36
Science & Engineering Apprenticeship Program (CQL)	29 (24%)	52 (44%)	16 (13%)	9 (8%)	13 (11%)	119	**1.81**	1.11
Research & Engineering Apprenticeship Program (REAP)	67 (56%)	47 (39%)	1 (1%)	3 (3%)	1 (1%)	119	**1.19**	0.63
High School Apprenticeship Program (HSAP)	67 (57%)	47 (40%)	2 (2%)	0 (0%)	1 (1%)	117	**1.10**	0.46
College Qualified Leaders (CQL)	6 (5%)	13 (11%)	64 (54%)	17 (14%)	19 (16%)	119	**2.37**	0.90

Undergraduate Research Apprenticeship Program (URAP)	70 (60%)	45 (38%)	2 (2%)	0 (0%)	0 (0%)	117	**1.04**	0.20
Science Mathematics, and Research for Transformation (SMART) College Scholarship	43 (36%)	68 (57%)	4 (3%)	1 (1%)	3 (3%)	119	**1.20**	0.65
National Defense Science & Engineering Graduate (NDSEG) Fellowship	70 (59%)	47 (39%)	1 (1%)	0 (0%)	1 (1%)	119	**1.08**	0.45

Note. Response scale: **0** = "Never heard of it," **1** = "Never," **2** = "Once," **3**= "Twice," **4** = "Three or more times".

How interested are you in participating in the following programs in the future?

	1	2	3	4	n	Avg.	SD
Camp Invention	98 (84%)	12 (10%)	2 (2%)	5 (4%)	117	**1.26**	0.70
eCYBERMISSION	101 (86%)	12 (10%)	2 (2%)	3 (3%)	118	**1.21**	0.60
Junior Solar Sprint (JSS)	101 (86%)	12 (10%)	2 (2%)	2 (2%)	117	**1.19**	0.54
West Point Bridge Design Contest (WPBDC)	97 (83%)	11 (9%)	6 (5%)	3 (3%)	117	**1.27**	0.68
Junior Science & Humanities Symposium (JSHS)	99 (84%)	14 (12%)	3 (3%)	2 (2%)	118	**1.22**	0.57
Gains in the Education of Mathematics and Science (GEMS)	92 (79%)	16 (14%)	6 (5%)	3 (3%)	117	**1.32**	0.69
GEMS Near Peers	91 (77%)	15 (13%)	5 (4%)	7 (6%)	118	**1.39**	0.83
UNITE	97 (84%)	10 (9%)	3 (3%)	5 (4%)	115	**1.27**	0.72
Science & Engineering Apprenticeship Program (CQL)	68 (59%)	14 (12%)	13 (11%)	21 (18%)	116	**1.89**	1.19
Research & Engineering Apprenticeship Program (REAP)	72 (62%)	18 (15%)	11 (9%)	16 (14%)	117	**1.75**	1.10
High School Apprenticeship Program (HSAP)	101 (86%)	11 (9%)	2 (2%)	3 (3%)	117	**1.21**	0.60
College Qualified Leaders (CQL)	20 (17%)	12 (10%)	26 (22%)	60 (51%)	118	**3.07**	1.14
Undergraduate Research Apprenticeship Program (URAP)	65 (55%)	12 (10%)	18 (15%)	23 (19%)	118	**1.99**	1.22
Science Mathematics, and Research for Transformation (SMART) College Scholarship	43 (36%)	12 (10%)	21 (18%)	42 (36%)	118	**2.53**	1.31
National Defense Science & Engineering Graduate (NDSEG) Fellowship	55 (46%)	17 (14%)	13 (11%)	34 (29%)	119	**2.22**	1.30

Note. Response scale: **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during CQL?

	Freq.	%
None	11	9%
1	12	10%
2	16	13%
3	19	16%

4	4	3%
5 or more	57	48%
Total	**119**	**100%**

How many Department of Defense (DoD) STEM jobs/careers did you learn about during CQL?		
	Freq.	**%**
None	17	14%
1	23	19%
2	15	13%
3	13	11%
4	6	5%
5 or more	45	38%
Total	**119**	**100%**

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
DoD researchers advance science and engineering fields	1 (1%)	0 (0%)	5 (4%)	47 (40%)	65 (55%)	118	**4.48**	0.66
DoD researchers develop new, cutting edge technologies	1 (1%)	0 (0%)	8 (7%)	49 (42%)	60 (51%)	118	**4.42**	0.70
DoD researchers support non-defense related advancements in science and technology	1 (1%)	1 (1%)	15 (13%)	53 (45%)	48 (41%)	118	**4.24**	0.77
DoD researchers solve real-world problems	1 (1%)	0 (0%)	5 (4%)	50 (42%)	62 (53%)	118	**4.46**	0.66
DoD research is valuable to society	1 (1%)	1 (1%)	5 (4%)	41 (35%)	70 (59%)	118	**4.51**	0.70

Note. Response scale: **1** = “Strongly Disagree,” **2** = “Disagree,” **3** = “Neither Agree nor Disagree,” **4** = “Agree,” **5** = “Strongly Agree”.

Which of the following statements describe you after participating in CQL?							
	1	**2**	**3**	**4**	**n**	**Avg.**	**SD**
I am more confident in my STEM knowledge, skills, and abilities	1 (1%)	10 (9%)	76 (66%)	29 (25%)	116	**3.15**	0.59
I am more interested in participating in STEM activities outside of school requirements	12 (10%)	22 (19%)	68 (58%)	15 (13%)	117	**2.74**	0.81
I am more aware of other AEOPs	37 (32%)	10 (9%)	46 (40%)	21 (18%)	114	**2.45**	1.13
I am more interested in participating in other AEOPs	35 (30%)	13 (11%)	50 (43%)	19 (16%)	117	**2.45**	1.09

I am more interested in taking STEM classes in school	13 (11%)	34 (29%)	59 (50%)	11 (9%)	117	**2.58**	0.81
I am more interested in attending college	19 (16%)	54 (46%)	35 (30%)	9 (8%)	117	**2.29**	0.83
I am more interested in earning a STEM degree in college	19 (16%)	42 (36%)	44 (38%)	12 (10%)	117	**2.42**	0.88
I am more interested in pursuing a STEM career	14 (12%)	32 (27%)	53 (45%)	18 (15%)	117	**2.64**	0.89
I am more aware of DoD STEM research and careers	6 (5%)	10 (9%)	62 (53%)	39 (33%)	117	**3.15**	0.78
I have a greater appreciation of DoD STEM research and careers	11 (9%)	8 (7%)	55 (47%)	42 (36%)	116	**3.10**	0.90
I am more interested in pursuing a STEM career with the DoD	18 (15%)	12 (10%)	55 (47%)	32 (27%)	117	**2.86**	0.99

Note. Response scale: **1** = "Disagree – This did not happen," **2** = "Disagree – This happened but not because of CQL," **3** = "Agree – CQL contributed," **4** = "Agree – CQL was the primary reason".

Appendix C

FY14 CQL Mentor Questionnaire and Data Summaries

2014 College Qualified Leaders (CQL): CQL Mentor Survey

Virginia Tech is conducting an evaluation study on behalf of the Academy of Applied Science and the U.S. Army to determine how well CQL is achieving its goals of promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). As part of this study Virginia Tech is surveying adults who participate in CQL in the capacity of STEM mentors (e.g., instructors, research mentors, or competition advisors). The questionnaire will collect information about you, your experiences in school, and your experiences in CQL. The results of this survey will be used to help us improve CQL and to report to the organizations that support CQL.

About this survey:

- This research protocol has been approved for use with human subjects by the Virginia Tech IRB office.
- Although this questionnaire is not anonymous, it is CONFIDENTIAL. Prior to analysis and reporting responses will be de-identified and no one will be able to connect your responses to you or your apprentice's name.
- Only AEOP evaluation personnel will have access to completed questionnaires and personal information will be stored securely.
- Responding to this survey is VOLUNTARY. You are not required to participate, although we hope you do because your responses will provide valuable information for meaningful and continuous improvement.
- If you provide your email address, the AEOP may contact you in the future to ask about you or your students.

If you have any additional questions or concerns, please contact one of the following people:

Tanner Bateman, Virginia Tech
Senior Project Associate, AEOPCA
(540) 231-4540, tbateman@vt.edu

Rebecca Kruse, Virginia Tech
Evaluation Director, AEOPCA
(540) 315-5807, rkruse75@vt.edu

Q1 Do you agree to participate in this survey? (required)

❍ Yes, I agree to participate in this survey
❍ No, I do not wish to participate in this survey

If No, I do not wish to participate... Is Selected, Then Skip To End of Survey

Q2 Please provide your personal information below: (required)

First Name ____
Last Name ____

Q3 Please provide your email address: (optional)

Email ____

Q4 What is your gender?

- ❍ Male
- ❍ Female
- ❍ Choose not to report

Q5 What is your race or ethnicity?

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

Q6 Which of the following BEST describes your current occupation (select ONE)

- ❍ Teacher
- ❍ Other school staff
- ❍ University educator
- ❍ Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)
- ❍ Scientist, Engineer, or Mathematics professional
- ❍ Other, (specify): ____________________

Q7 Which of the following BEST describes your organization? (select ONE)

- ❍ No organization
- ❍ School or district (K-12)
- ❍ State educational agency
- ❍ Institution of higher education (vocational school, junior college, college, or university)
- ❍ Industry
- ❍ Department of Defense or other government agency
- ❍ Non-profit
- ❍ Other, (specify): ____________________

Q8 Which of the following best describes your primary area of research?

- ❍ Physical science (physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric, or oceanic science
- ❍ Agricultural science
- ❍ Environmental science
- ❍ Computer science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Medical, health, or behavioral science
- ❍ Social science (psychology, sociology, anthropology, etc.)
- ❍ Other, (specify) ____________________

Q9 Where was the CQL program located?

- ❍ Army Aviation & Missile Research Development and Engineering Center-Redstone Arsenal (Huntsville, AL)
- ❍ Army Center for Environmental Health Research (Fort Detrick, MD)
- ❍ Army Medical Research Institute of Chemical Defense (Aberdeen, MD)
- ❍ Army Medical Research Institute for Infectious Diseases (Fort Detrick, MD)
- ❍ Army Research Laboratory- Aberdeen Proving Ground (Aberdeen, MD)
- ❍ Army Research Laboratory–Adelphi (Adelphi, MD)
- ❍ Army Criminal Investigation Command-Defense Forensic Science Center (Forest Park, GA)
- ❍ Edgewood Chemical Biological Center (Edgewood, MD)
- ❍ Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)
- ❍ Engineer Research & Development Center-Topographic Engineering Center (Alexandria, VA)
- ❍ Engineer Research & Development Center-Mississippi (Vicksburg, MS)
- ❍ Walter Reed Army Institute of Research (Silver Spring, MD)

Q10 Which of the following BEST describes your role during CQL?

- ❍ Research Mentor
- ❍ Research Team Member but not a Principal Investigator (PI)
- ❍ Other, (specify) ____________________

Q11 How many CQL students did you work with this year?

Q12 How did you learn about CQL? (Check all that apply)

- ❑ ASEE website
- ❑ Army Educational Outreach Program (AEOP) website
- ❑ Facebook, Twitter, Pinterest, or other social media
- ❑ State or national educator conference
- ❑ STEM conference
- ❑ School, university, or professional organization newsletter, email or website
- ❑ A news story or other media coverage
- ❑ Past CQL participant
- ❑ A student
- ❑ A colleague
- ❑ A supervisor or superior
- ❑ CQL event or site host/director
- ❑ Workplace communications
- ❑ Someone who works at an Army laboratory
- ❑ Someone who works with the Department of Defense
- ❑ Other, (specify): ____________________

Q13 How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs (AEOPs) in any capacity? If you have heard of an AEOP but never participated select "Never." If you have not heard of an AEOP select "Never heard of it."

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍

Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q14 Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply)

- ❑ Applications from American Society for Engineering Education or the AEOP
- ❑ Personal acquaintance(s) (friend, family, neighbor, etc.)
- ❑ Colleague(s) in my workplace
- ❑ K-12 school teacher(s) outside of my workplace
- ❑ University faculty outside of my workplace
- ❑ Informational materials sent to K-12 schools or Universities outside of my workplace
- ❑ Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)
- ❑ Communication(s) generated by a university or faculty (newsletter, email blast, website)
- ❑ Career fair(s)
- ❑ Education conference(s) or event(s)
- ❑ STEM conference(s) or event(s)
- ❑ Organization(s) serving underserved or underrepresented populations
- ❑ Student contacted mentor
- ❑ I do not know how student(s) was recruited for apprenticeship
- ❑ Other, Specify: ____________________

Q15 How SATISFIED were you with each of the following CQL features?

	Did not experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Other administrative tasks	❍	❍	❍	❍	❍
Communications from American Society for Engineering Education	❍	❍	❍	❍	❍
Communications from [CQL site]	❍	❍	❍	❍	❍
Support for instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍
Research presentation process	❍	❍	❍	❍	❍

Q16 The list below describes instructional and mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

	Yes - I used this strategy	No - I did not use this strategy
Finding out about students' backgrounds and interests at the beginning of the program	❍	❍
Giving students real-life problems to investigate or solve	❍	❍
Asking students to relate outside events or activities to topics covered in the program	❍	❍
Selecting readings or activities that relate to students' backgrounds	❍	❍
Encouraging students to suggest new readings, activities, or projects	❍	❍
Making explicit provisions for students who wish to carry out independent studies	❍	❍
Helping students become aware of the roles STEM plays in their everyday lives	❍	❍
Helping students understand how STEM can help them improve their communities	❍	❍
Other, (specify):	❍	❍

Q17 The list below describes instructional and mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

	Yes - I used this strategy	No - I did not use this strategy
Finding out about students' learning styles at the beginning of the program	❍	❍
Interacting with all students in the same way regardless of their gender or race and ethnicity	❍	❍
Using gender neutral language	❍	❍
Using diverse teaching/mentoring activities to address a broad spectrum of students	❍	❍
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	❍	❍
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	❍	❍
Directing students to other individuals or programs if I can only provide limited support	❍	❍

Other, (specify):	❍	❍

Q18 The list below describes instructional and mentoring strategies that are effective ways to support students development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

	Yes - I used this strategy	No - I did not use this strategy
Having students tell others about their backgrounds and interests	❍	❍
Having students explain difficult ideas to others	❍	❍
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	❍	❍
Having students participate in giving and receiving feedback	❍	❍
Having students work on collaborative activities or projects as a member of a team	❍	❍
Having students listen to the ideas of others with an open mind	❍	❍
Having students pay attention to the feelings of all team members	❍	❍
Having students develop ways to resolve conflict and reach agreement among the team	❍	❍
Other, (specify):	❍	❍

Q19 The list below describes instructional and mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

	Yes - I used this strategy	No - I did not use this strategy
Teaching (or assigning readings) about specific STEM subject matter	❍	❍
Having students access and critically review technical texts or media to support their work	❍	❍
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	❍	❍
Helping students practice STEM skills with supervision	❍	❍
Giving constructive feedback to improve students' STEM competencies	❍	❍
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	❍	❍
Encouraging students to seek support from other team members	❍	❍

Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	❍	❍
Other, (specify):	❍	❍

Q20 The list below describes instructional and mentoring strategies that are effective ways to support students' STEM educational and career pathways. The list also includes items that reflect AEOP and Army priorities. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

	Yes - I used this strategy	No - I did not use this strategy
Asking about students' educational and career interests	❍	❍
Recommending extracurricular programs that align with students' educational goals	❍	❍
Recommending Army Educational Outreach Programs that align with students' educational goals	❍	❍
Providing guidance about educational pathways that would prepare students for a STEM career	❍	❍
Sharing personal experiences, attitudes, and values pertaining to STEM	❍	❍
Discussing STEM career opportunities with the DoD or other government agencies	❍	❍
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	❍	❍
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	❍	❍
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	❍	❍
Recommending student and professional organizations in STEM	❍	❍
Helping students build effective STEM networks	❍	❍
Critically reviewing students' résumé, application, or interview preparations	❍	❍
Other, (specify):	❍	❍

Q21 How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during CQL?

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍

Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍
Program manager or site coordinators	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in CQL	❍	❍	❍	❍	❍

Q22 Which of the following AEOPs did YOU EXPLICITLY DISCUSS with your student(s) during CQL? (check ALL that apply)

	Yes - I discussed this program with my student(s)	No - I did not discuss this program with my student(s)
Camp Invention	❍	❍
eCYBERMISSION	❍	❍
Junior Solar Sprint (JSS)	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍
GEMS Near Peers	❍	❍
UNITE	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍
College Qualified Leaders (CQL)	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍
I discussed AEOP with my student(s) but did not discuss any specific program	❍	❍

Q23 How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during CQL?

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍
Program manager or site coordinator	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in CQL	❍	❍	❍	❍	❍

Q24 Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍
DoD researchers support non-defense related advancements in science and technology	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

Q25 How often did YOUR STUDENT(S) have opportunities do each of the following in CQL?

	Not at all	At least once	A few times	Most days	Every day
Learn new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍

Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍

Q26 Which category best describes the focus of your student(s)' CQL experience?

❍ Science
❍ Technology
❍ Engineering
❍ Mathematics

Q27 AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q28 AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to respondents who selected "science" in Q26**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Asking questions based on observations of real-world phenomena	❍	❍	❍	❍	❍

Asking a question (about a phenomenon) that can be answered with one or more investigations	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to answer a question	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable, in order to understand relationships between variables	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed explanation (for a phenomenon) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve an explanation	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their explanations	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍

Integrating information from multiple sources to support your explanations of phenomena	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	❍	❍	❍	❍	❍

Q29 AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to respondents who selected "technology", "engineering", or "mathematics" in Q26**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Identifying real-world problems based on social, technological, or environmental issues	❍	❍	❍	❍	❍
Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	❍	❍	❍	❍	❍
Making a model that represents the key features or functions of a solution to a problem	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to test if a solution functions as intended	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated solution	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution functions as intended	❍	❍	❍	❍	❍
Displaying numeric data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed solution (for a problem) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍

Asking questions to understand the data and interpretations others use to support their solutions	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how a solution meets design criteria	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best solution to a problem	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	❍	❍	❍	❍	❍

Q30 AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍
Sticking with a task until it is completed	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Patience for the slow pace of research	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Sense of contributing to a body of knowledge	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and their personal values	❍	❍	❍	❍	❍

Q31 Which of the following statements describe YOUR STUDENT(S) after participating in the CQL program?

	Disagree - This did not happen	Disagree - This happened but not because of CQL	Agree - CQL contributed	Agree - CQL was primary reason
More confident in STEM knowledge, skills, and abilities	❍	❍	❍	❍

More interested in participating in STEM activities outside of school requirements	❍	❍	❍	❍
More aware of other AEOPs	❍	❍	❍	❍
More interested in participating in other AEOPs	❍	❍	❍	❍
More interested in taking STEM classes in school	❍	❍	❍	❍
More interested in attending college	❍	❍	❍	❍
More interested in earning a STEM degree in college	❍	❍	❍	❍
More interested in pursuing a STEM career	❍	❍	❍	❍
More aware of Department of Defense (DoD) STEM research and careers	❍	❍	❍	❍
Greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
More interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q32 What are the three most important strengths of CQL?

Strength #1

Strength #2

Strength #3

Q33 What are the three ways CQL should be improved for future participants?

Improvement #1

Improvement #2

Improvement #3

Q34 Tell us about your overall satisfaction with your CQL experience.

CQL Mentor Data Summary

What is your gender?		
	Freq.	%
Male	9	47%
Female	10	53%
Choose not to report	0	0%
Total	19	100%

What is your race or ethnicity?		
	Freq.	%
Hispanic or Latino	1	5%
Asian	3	16%
Black or African American	0	0%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	14	74%
Other race or ethnicity, (specify):	0	0%
Choose not to report	1	5%
Total	19	100%

Which of the following BEST describes your current occupation? (select ONE)		
	Freq.	%
Teacher	0	0%
Other school staff	0	0%
University educator	0	0%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	0	0%
Scientist, Engineer, or Mathematics professional	19	100%
Other, (specify):	0	0%
Total	19	100%

Which of the following BEST describes your organization? (select ONE)		
	Freq.	%
No organization	0	0%
School or district (K-12)	0	0%
State educational agency	0	0%
Institution of higher education (vocational school, junior college, college, or university)	0	0%
Industry	0	0%
Department of Defense or other government agency	19	100%
Non-profit	0	0%
Other, (specify):	0	0%
Total	**19**	**100%**

Which of the following best describes your primary area of research?						
	Freq.	%			Freq.	%
Physical science (physics, chemistry, astronomy, materials science)	2	11%		Technology	0	0%
Biological science	14	74%		Engineering	2	11%
Earth, atmospheric, or oceanic science	0	0%		Mathematics or statistics	0	0%
Agricultural science	0	0%		Medical, health, or behavioral science	1	5%
Environmental science	0	0%		Social science (psychology, sociology, anthropology, etc.)	0	0%
Computer science	0	0%		Other, (specify)	0	0%
				Total	**19**	**100%**

Where was the CQL program located? (Select ONE)						
	Freq.	%			Freq.	%
Army Aviation & Missile Research Development and Engineering Center-Redstone Arsenal (Huntsville, AL)	0	0%		Army Criminal Investigation Command-Defense Forensic Science Center (Forest Park, GA)	0	0%
Army Center for Environmental Health Research (Fort Detrick, MD)	2	11%		Edgewood Chemical Biological Center (Edgewood, MD)	0	0%
Army Medical Research Institute of Chemical Defense (Aberdeen, MD)	2	11%		Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)	3	16%

Army Medical Research Institute for Infectious Diseases (Fort Detrick, MD)	9	47%		Engineer Research & Development Center-Topographic Engineering Center (Alexandria, VA)	0	0%
Army Research Laboratory- Aberdeen Proving Ground (Aberdeen, MD)	0	0%		Engineer Research & Development Center-Mississippi (Vicksburg, MS)	0	0%
Army Research Laboratory–Adelphi (Adelphi, MD)	0	0%		Walter Reed Army Institute of Research (Silver Spring, MD)	3	16%
				Total	**19**	**100%**

Which of the following BEST describes your role during CQL?		
	Freq.	**%**
Research Mentor	18	95%
Research Team Member but not a Principal Investigator (PI)	1	5%
Other, (specify)	0	0%
Total	**19**	**100%**

How many CQL students did you work with this year?		
# of Students	**Freq.**	**%**
1	12	63%
2	5	26%
3	1	5%
4	0	0%
5	0	0%
6	0	0%
7	0	0%
8	0	0%
9	0	0%
10	1	5%
Total	**19**	**100%**

How did you learn about CQL? (Check all that apply) (n = 19)						
	Freq.	%			Freq.	%
American Society for Engineering Education website	0	0%		A student	0	0%
Army Educational Outreach Program (AEOP) website	1	5%		A colleague	6	32%
Facebook, Twitter, Pinterest, or other social media	0	0%		A supervisor or superior	3	16%
State or national educator conference	0	0%		CQL site host/director	5	26%
STEM conference	0	0%		Workplace communications	4	21%
School, university, or professional organization newsletter, email, or website	1	5%		Someone who works at an Army laboratory	3	16%
A news story or other media coverage	0	0%		Someone who works with the Department of Defense	2	11%
Past CQL participant	1	5%		Other, (specify):	0	0%

How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs in any capacity? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."								
	0	1	2	3	4	n	Avg.	SD
Camp Invention	10 (59%)	7 (41%)	0 (0%)	0 (0%)	0 (0%)	17	**1.00**	0.00
eCYBERMISSION	7 (41%)	6 (35%)	2 (12%)	2 (12%)	0 (0%)	17	**1.60**	0.84
Junior Solar Sprint (JSS)	10 (59%)	7 (41%)	0 (0%)	0 (0%)	0 (0%)	17	**1.00**	0.00
West Point Bridge Design Contest (WPBDC)	10 (59%)	7 (41%)	0 (0%)	0 (0%)	0 (0%)	17	**1.00**	0.00
Junior Science & Humanities Symposium (JSHS)	9 (53%)	6 (35%)	2 (12%)	0 (0%)	0 (0%)	17	**1.25**	0.46
Gains in the Education of Mathematics and Science (GEMS)	5 (28%)	9 (50%)	0 (0%)	2 (11%)	2 (11%)	18	**1.77**	1.24
GEMS Near Peers	6 (33%)	11 (61%)	0 (0%)	0 (0%)	1 (6%)	18	**1.25**	0.87
UNITE	10 (59%)	7 (41%)	0 (0%)	0 (0%)	0 (0%)	17	**1.00**	0.00
Science & Engineering Apprenticeship Program (SEAP)	3 (16%)	8 (42%)	1 (5%)	1 (5%)	6 (32%)	19	**2.31**	1.45
Research & Engineering Apprenticeship Program (REAP)	8 (47%)	9 (53%)	0 (0%)	0 (0%)	0 (0%)	17	**1.00**	0.00
High School Apprenticeship Program (HSAP)	5 (29%)	10 (59%)	1 (6%)	0 (0%)	1 (6%)	17	**1.33**	0.89
College Qualified Leaders (CQL)	0 (0%)	3 (17%)	9 (50%)	2 (11%)	4 (22%)	18	**2.39**	1.04
Undergraduate Research Apprenticeship Program (URAP)	9 (53%)	8 (47%)	0 (0%)	0 (0%)	0 (0%)	17	**1.00**	0.00

Science Mathematics, and Research for Transformation (SMART) College Scholarship	4 (22%)	11 (61%)	1 (6%)	1 (6%)	1 (6%)	18	**1.43**	0.94
National Defense Science & Engineering Graduate (NDSEG) Fellowship	11 (65%)	6 (35%)	0 (0%)	0 (0%)	0 (0%)	17	**1.00**	0.00

Note. Response scale: **0** = "Never heard of it," **1** = "Never," **2** = "Once," **3**= "Twice," **4** = "Three or more times".

Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply) (n = 19)						
	Freq.	**%**			**Freq.**	**%**
Applications from American Society for Engineering Education or the AEOP	3	16%		**Communication(s) generated by a university or faculty (newsletter, email blast, website)**	3	16%
Personal acquaintance(s) (friend, family, neighbor, etc.)	6	32%		**Career fair(s)**	0	0%
Colleague(s) in my workplace	6	32%		**Education conference(s) or event(s)**	1	5%
K-12 school teacher(s) outside of my workplace	1	5%		**STEM conference(s) or event(s)**	0	0%
University faculty outside of my workplace	3	16%		**Organization(s) serving underserved or underrepresented populations**	2	11%
Informational materials sent to K-12 schools or Universities outside of my workplace	1	5%		**Student contacted mentor**	6	32%
Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)	1	5%		**I do not know how student(s) was recruited for apprenticeship**	6	32%
				Other, Specify:	1	5%

Note. Other = "google search for research internships in the area".

How SATISFIED were you with each of the following CQL program features?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Application or registration process	9 (47%)	0 (0%)	1 (5%)	3 (16%)	6 (32%)	19	**3.50**	0.71
Other administrative tasks	5 (28%)	0 (0%)	1 (6%)	7 (39%)	5 (28%)	18	**3.31**	0.63
Communications with American Society for Engineering Education	16 (89%)	0 (0%)	0 (0%)	1 (6%)	1 (6%)	18	**3.50**	0.71
Communications with [CQL site]	3 (18%)	0 (0%)	0 (0%)	5 (29%)	9 (53%)	17	**3.64**	0.50
Instruction or mentorship during program activities	5 (28%)	0 (0%)	0 (0%)	10 (56%)	3 (17%)	18	**3.23**	0.44

Participation stipends (payment)	8 (42%)	0 (0%)	1 (5%)	5 (26%)	5 (26%)	19	**3.36**	0.67
Research abstract preparation requirements	4 (21%)	0 (0%)	0 (0%)	11 (58%)	4 (21%)	19	**3.27**	0.46
Research presentation process	6 (32%)	0 (0%)	0 (0%)	8 (42%)	5 (26%)	19	**3.38**	0.51

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

The list below describes mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Finding out about students' backgrounds and interests at the beginning of the program	19	19	100%	0	0%
Giving students real-life problems to investigate or solve	19	16	84%	3	16%
Asking students to relate outside events or activities to topics covered in the program	18	8	44%	10	56%
Selecting readings or activities that relate to students' backgrounds	19	15	79%	4	21%
Encouraging students to suggest new readings, activities, or projects	19	14	74%	5	26%
Making explicit provisions for students who wish to carry out independent studies	18	10	56%	8	44%
Helping students become aware of the roles STEM plays in their everyday lives	19	12	63%	7	37%
Helping students understand how STEM can help them improve their communities	18	7	39%	11	61%
Other, (specify):	5	0	0%	5	100%

The list below describes mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Finding out about students' learning styles at the beginning of the program	19	15	79%	4	21%
Interacting with all students in the same way regardless of their gender or race and ethnicity	19	17	89%	2	11%
Using gender neutral language	19	17	89%	2	11%

Using diverse teaching/mentoring activities to address a broad spectrum of students	19	13	68%	6	32%
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	18	8	44%	10	56%
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	19	14	74%	5	26%
Directing students to other individuals or programs if I can only provide limited support	19	17	89%	2	11%
Other, (specify):	6	1	17%	5	83%

Note. Other = " 'Tag-along' engineering practicum as participants assist trades personnel to better understand the impact of engineering design decisions on the workers who must deal with them on a daily basis".

The list below describes mentoring strategies that are effective ways to support students' development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in CQL.					
		Yes – I used this strategy		**No – I did not use this strategy**	
	n	**Freq.**	**%**	**Freq.**	**%**
Having students tell others about their backgrounds and interests	19	14	74%	5	26%
Having students explain difficult ideas to others	19	14	74%	5	26%
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	19	15	79%	4	21%
Having students participate in giving and receiving feedback	19	17	89%	2	11%
Having students work on collaborative activities or projects as a member of a team	19	17	89%	2	11%
Having students listen to the ideas of others with an open mind	18	16	89%	2	11%
Having students pay attention to the feelings of all team members	19	12	63%	7	37%
Having students develop ways to resolve conflict and reach agreement among the team	19	13	68%	6	32%
Other, (specify):	6	0	0%	6	100%

The list below describes mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in CQL.					
		Yes – I used this strategy		**No – I did not use this strategy**	
	n	**Freq.**	**%**	**Freq.**	**%**
Teaching (or assigning readings) about specific STEM subject matter	19	14	74%	5	26%

Having students access and critically review technical texts or media to support their work	19	18	95%	1	5%
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	19	19	100%	0	0%
Helping students practice STEM skills with supervision	19	18	95%	1	5%
Giving constructive feedback to improve students' STEM competencies	19	19	100%	0	0%
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	19	18	95%	1	5%
Encouraging students to seek support from other team members	19	19	100%	0	0%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	19	16	84%	3	16%
Other, (specify):	6	0	0%	6	100%

The list below describes mentoring strategies that are effective ways to support students' STEM educational and career pathways. The list also includes items that reflect AEOP and Army priorities. From the list below, please indicate which strategies you used when working with your student(s) in CQL.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Asking about students' educational and career interests	19	19	100%	0	0%
Recommending extracurricular programs that align with students' educational goals	19	10	53%	9	47%
Recommending Army Educational Outreach Programs that align with students' educational goals	18	4	22%	14	78%
Providing guidance about educational pathways that would prepare students for a STEM career	19	15	79%	4	21%
Sharing personal experiences, attitudes, and values pertaining to STEM	19	16	84%	3	16%
Discussing STEM career opportunities with the DoD or other government agencies	19	11	58%	8	42%
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	18	12	67%	6	33%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	19	11	58%	8	42%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	19	6	32%	13	68%
Recommending student and professional organizations in STEM	19	9	47%	10	53%

Helping students build effective STEM networks	19	13	68%	6	32%
Critically reviewing students' résumé, application, or interview preparations	19	12	63%	7	37%
Other, (specify):	6	0	0%	6	100%

How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during CQL?

	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	16 (89%)	1 (6%)	0 (0%)	1 (6%)	0 (0%)	18	**2.00**	1.41
Army Educational Outreach Program (AEOP) website	11 (61%)	0 (0%)	1 (6%)	4 (22%)	2 (11%)	18	**3.14**	0.69
AEOP social media	15 (83%)	1 (6%)	1 (6%)	1 (6%)	0 (0%)	18	**2.00**	1.00
AEOP brochure	14 (78%)	1 (6%)	0 (0%)	3 (17%)	0 (0%)	18	**2.50**	1.00
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	14 (82%)	1 (6%)	0 (0%)	1 (6%)	1 (6%)	17	**2.67**	1.53
Program administrator or site coordinator	4 (22%)	0 (0%)	2 (11%)	6 (33%)	6 (33%)	18	**3.29**	0.73
Invited speakers or "career" events	9 (50%)	1 (6%)	0 (0%)	5 (28%)	3 (17%)	18	**3.11**	0.93
Participation in CQL	3 (17%)	0 (0%)	0 (0%)	7 (39%)	8 (44%)	18	**3.53**	0.52

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Which of the following AEOPs did you EXPLICITLY DISCUSS with your student(s) during CQL?

		Yes - I discussed this program with my student(s)		No - I did not discuss this program with my student(s)	
	n	Freq.	%	Freq.	%
Camp Invention	18	0	0%	18	100%
eCYBERMISSION	18	0	0%	18	100%
Junior Solar Sprint (JSS)	18	0	0%	18	100%
West Point Bridge Design Contest (WPBDC)	18	0	0%	18	100%
Junior Science & Humanities Symposium (JSHS)	18	1	6%	17	94%
Gains in the Education of Mathematics and Science (GEMS)	18	4	22%	14	78%
GEMS Near Peers	19	4	21%	15	79%
UNITE	18	0	0%	18	100%
Science & Engineering Apprenticeship Program (SEAP)	19	5	26%	14	74%
Research & Engineering Apprenticeship Program (REAP)	19	1	5%	18	95%

High School Apprenticeship Program (HSAP)	18	0	0%	18	100%
College Qualified Leaders (CQL)	19	14	74%	5	26%
Undergraduate Research Apprenticeship Program (URAP)	18	0	0%	18	100%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	18	2	11%	16	89%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	18	0	0%	18	100%
I discussed AEOP with my student(s) but did not discuss any specific program	16	4	25%	12	75%

How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during CQL?

	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	15 (83%)	1 (6%)	0 (0%)	2 (11%)	0 (0%)	18	**2.33**	1.15
Army Educational Outreach Program (AEOP) website	15 (83%)	0 (0%)	1 (6%)	2 (11%)	0 (0%)	18	**2.67**	0.58
AEOP social media	16 (89%)	0 (0%)	1 (6%)	1 (6%)	0 (0%)	18	**2.50**	0.71
AEOP brochure	15 (83%)	0 (0%)	0 (0%)	3 (17%)	0 (0%)	18	**3.00**	0.00
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	15 (83%)	0 (0%)	0 (0%)	3 (17%)	0 (0%)	18	**3.00**	0.00
Program administrator or site coordinator	7 (41%)	1 (6%)	0 (0%)	5 (29%)	4 (24%)	17	**3.20**	0.92
Invited speakers or "career" events	11 (61%)	0 (0%)	0 (0%)	4 (22%)	3 (17%)	18	**3.43**	0.53
Participation in CQL	2 (11%)	0 (0%)	1 (6%)	6 (33%)	9 (50%)	18	**3.50**	0.63

Note. Response scale: **0** = "Did Not Experience," **1** = "Not at all," **2** = "A little," **3** = "Somewhat," **4** = "Very much".

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	0 (0%)	0 (0%)	0 (0%)	4 (22%)	14 (78%)	18	**4.78**	0.43
DoD researchers develop new, cutting edge technologies	0 (0%)	0 (0%)	1 (6%)	6 (33%)	11 (61%)	18	**4.56**	0.62
DoD researchers support non-defense related advancements in science and technology	0 (0%)	1 (6%)	2 (11%)	3 (17%)	12 (67%)	18	**4.44**	0.92
DoD researchers solve real-world problems	0 (0%)	1 (6%)	0 (0%)	3 (17%)	14 (78%)	18	**4.67**	0.77
DoD research is valuable to society	1 (5%)	0 (0%)	0 (0%)	3 (16%)	15 (79%)	19	**4.63**	0.96

Note. Response scale: **1** = "Strongly Disagree," **2** = "Disagree," **3** = "Neither Agree nor Disagree," **4** = "Agree," **5** = "Strongly Agree".

How often did YOUR STUDENT(S) have opportunities do each of the following in CQL?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	1 (5%)	5 (26%)	6 (32%)	7 (37%)	19	**4.00**	0.94
Apply STEM knowledge to real life situations	1 (6%)	2 (11%)	2 (11%)	4 (22%)	9 (50%)	18	**4.00**	1.28
Learn about cutting-edge STEM research	1 (5%)	0 (0%)	5 (26%)	6 (32%)	7 (37%)	19	**3.95**	1.08
Learn about different STEM careers	1 (5%)	4 (21%)	8 (42%)	4 (21%)	2 (11%)	19	**3.11**	1.05
Interact with STEM professionals	0 (0%)	0 (0%)	0 (0%)	2 (12%)	15 (88%)	17	**4.88**	0.33
Practice using laboratory or field techniques, procedures, and tools	0 (0%)	0 (0%)	0 (0%)	3 (17%)	15 (83%)	18	**4.83**	0.38
Participate in hands-on STEM activities	0 (0%)	0 (0%)	0 (0%)	3 (17%)	15 (83%)	18	**4.83**	0.38
Work as part of a team	1 (5%)	0 (0%)	1 (5%)	2 (11%)	15 (79%)	19	**4.58**	1.02
Communicate with other students about STEM	0 (0%)	1 (5%)	6 (32%)	5 (26%)	7 (37%)	19	**3.95**	0.97
Pose questions or problems to investigate	1 (5%)	2 (11%)	2 (11%)	5 (26%)	9 (47%)	19	**4.00**	1.25
Design an investigation	3 (16%)	3 (16%)	6 (32%)	4 (21%)	3 (16%)	19	**3.05**	1.31
Carry out an investigation	1 (6%)	0 (0%)	3 (17%)	3 (17%)	11 (61%)	18	**4.28**	1.13
Analyze and interpret data or information	2 (11%)	0 (0%)	2 (11%)	6 (33%)	8 (44%)	18	**4.00**	1.28
Draw conclusions from an investigation	1 (5%)	0 (0%)	5 (26%)	6 (32%)	7 (37%)	19	**3.95**	1.08
Come up with creative explanations or solutions	1 (5%)	0 (0%)	5 (26%)	6 (32%)	7 (37%)	19	**3.95**	1.08

Note. Response scale: **1** = "Not at all," **2** = "At least once," **3** = "A few times," **4** = "Most days," **5** = "Every day".

Which category best describes the focus of your student's CQL project?		
	Freq.	**%**
Science	15	79%
Technology	0	0%
Engineering	4	21%
Mathematics	0	0%
Total	**19**	**100%**

AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Knowledge of a STEM topic or field in depth	0 (0%)	0 (0%)	2 (11%)	9 (47%)	8 (42%)	19	**4.32**	0.67

Knowledge of research conducted in a STEM topic or field	0 (0%)	0 (0%)	5 (26%)	7 (37%)	7 (37%)	19	**4.11**	0.81
Knowledge of research processes, ethics, and rules for conduct in STEM	0 (0%)	0 (0%)	4 (21%)	8 (42%)	7 (37%)	19	**4.16**	0.76
Knowledge of how professionals work on real problems in STEM	0 (0%)	0 (0%)	3 (16%)	8 (42%)	8 (42%)	19	**4.26**	0.73
Knowledge of what everyday research work is like in STEM	0 (0%)	0 (0%)	1 (6%)	10 (56%)	7 (39%)	18	**4.33**	0.59

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Asking questions based on observations of real-world phenomena	0 (0%)	1 (7%)	5 (33%)	4 (27%)	5 (33%)	15	**3.87**	0.99
Asking a question (about a phenomenon) that can be answered with one or more investigations	0 (0%)	1 (7%)	4 (27%)	5 (33%)	5 (33%)	15	**3.93**	0.96
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	0 (0%)	0 (0%)	3 (20%)	7 (47%)	5 (33%)	15	**4.13**	0.74
Making a model to represent the key features and functions of an observed phenomenon	1 (7%)	0 (0%)	5 (33%)	5 (33%)	4 (27%)	15	**3.73**	1.10
Deciding what type of data to collect in order to answer a question	0 (0%)	1 (7%)	3 (20%)	6 (40%)	5 (33%)	15	**4.00**	0.93
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	0 (0%)	1 (7%)	2 (13%)	8 (53%)	4 (27%)	15	**4.00**	0.85
Identifying the limitations of data collected in an investigation	1 (7%)	0 (0%)	6 (40%)	3 (20%)	5 (33%)	15	**3.73**	1.16
Carrying out procedures for an investigation and recording data accurately	0 (0%)	0 (0%)	3 (20%)	5 (33%)	7 (47%)	15	**4.27**	0.80
Testing how changing one variable affects another variable, in order to understand relationships between variables	1 (7%)	0 (0%)	4 (27%)	4 (27%)	6 (40%)	15	**3.93**	1.16
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	5 (33%)	2 (13%)	5 (33%)	1 (7%)	2 (13%)	15	**2.53**	1.41

Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	1 (7%)	1 (7%)	5 (33%)	5 (33%)	3 (20%)	15	**3.53**	1.13
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	1 (7%)	1 (7%)	3 (21%)	3 (21%)	6 (43%)	14	**3.86**	1.29
Using mathematics or computers to analyze numeric data	1 (7%)	1 (7%)	4 (27%)	5 (33%)	4 (27%)	15	**3.67**	1.18
Supporting a proposed explanation (for a phenomenon) with data from investigations	0 (0%)	0 (0%)	5 (33%)	5 (33%)	5 (33%)	15	**4.00**	0.85
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	0 (0%)	4 (27%)	6 (40%)	5 (33%)	15	**4.07**	0.80
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	0 (0%)	1 (7%)	5 (33%)	4 (27%)	5 (33%)	15	**3.87**	0.99
Using data or interpretations from other researchers or investigations to improve an explanation	1 (7%)	0 (0%)	5 (33%)	4 (27%)	5 (33%)	15	**3.80**	1.15
Asking questions to understand the data and interpretations others use to support their explanations	0 (0%)	0 (0%)	5 (33%)	5 (33%)	5 (33%)	15	**4.00**	0.85
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	1 (7%)	1 (7%)	3 (20%)	6 (40%)	4 (27%)	15	**3.73**	1.16
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	1 (7%)	0 (0%)	5 (33%)	5 (33%)	4 (27%)	15	**3.73**	1.10
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	1 (7%)	5 (33%)	5 (33%)	4 (27%)	15	**3.80**	0.94
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	1 (7%)	0 (0%)	5 (33%)	4 (27%)	5 (33%)	15	**3.80**	1.15
Integrating information from multiple sources to support your explanations of phenomena	0 (0%)	1 (7%)	4 (29%)	5 (36%)	4 (29%)	14	**3.86**	0.95
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	0 (0%)	1 (7%)	4 (29%)	5 (36%)	4 (29%)	14	**3.86**	0.95

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Identifying real-world problems based on social, technological, or environmental issues	1 (25%)	1 (25%)	0 (0%)	1 (25%)	1 (25%)	4	**3.00**	1.83
Defining a problem that can be solved by developing a new or improved object, process, or system	0 (0%)	2 (50%)	0 (0%)	1 (25%)	1 (25%)	4	**3.25**	1.50
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Making a model that represents the key features or functions of a solution to a problem	0 (0%)	2 (50%)	1 (25%)	1 (25%)	0 (0%)	4	**2.75**	0.96
Deciding what type of data to collect in order to test if a solution functions as intended	0 (0%)	2 (50%)	0 (0%)	2 (50%)	0 (0%)	4	**3.00**	1.15
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	0 (0%)	2 (50%)	1 (25%)	1 (25%)	0 (0%)	4	**2.75**	0.96
Identifying the limitations of the data collected in an investigation	0 (0%)	1 (25%)	2 (50%)	1 (25%)	0 (0%)	4	**3.00**	0.82
Carrying out procedures for an investigation and recording data accurately	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	1 (25%)	1 (25%)	0 (0%)	2 (50%)	0 (0%)	4	**2.75**	1.50
Using computer-based models to investigate cause and effect relationships of a simulated solution	1 (25%)	1 (25%)	1 (25%)	1 (25%)	0 (0%)	4	**2.50**	1.29
Considering alternative interpretations of data when deciding if a solution functions as intended	0 (0%)	2 (50%)	0 (0%)	2 (50%)	0 (0%)	4	**3.00**	1.15
Displaying numeric data in charts or graphs to identify patterns and relationships	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Using mathematics or computers to analyze numeric data	0 (0%)	1 (25%)	0 (0%)	3 (75%)	0 (0%)	4	**3.50**	1.00
Supporting a proposed solution (for a problem) with data from investigations	0 (0%)	2 (50%)	0 (0%)	2 (50%)	0 (0%)	4	**3.00**	1.15

Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0 (0%)	2 (50%)	0 (0%)	1 (25%)	1 (25%)	4	**3.25**	1.50
Using data or interpretations from other researchers or investigations to improve a solution	0 (0%)	2 (50%)	1 (25%)	1 (25%)	0 (0%)	4	**2.75**	0.96
Asking questions to understand the data and interpretations others use to support their solutions	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Using data from investigations to defend an argument that conveys how a solution meets design criteria	0 (0%)	2 (50%)	1 (25%)	1 (25%)	0 (0%)	4	**2.75**	0.96
Deciding what additional data or information may be needed to find the best solution to a problem	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	1 (25%)	1 (25%)	2 (50%)	0 (0%)	4	**3.25**	0.96
Integrating information from multiple sources to support your solution to a problem	0 (0%)	2 (50%)	0 (0%)	2 (50%)	0 (0%)	4	**3.00**	1.15
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	0 (0%)	1 (25%)	0 (0%)	3 (75%)	0 (0%)	4	**3.50**	1.00

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

AS A RESULT OF THE CQL EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?

	1	2	3	4	5	n	Avg.	SD
Learning to work independently	0 (0%)	2 (11%)	6 (32%)	6 (32%)	5 (26%)	19	**3.74**	0.99
Setting goals and reflecting on performance	0 (0%)	2 (11%)	5 (26%)	8 (42%)	4 (21%)	19	**3.74**	0.93
Sticking with a task until it is completed	0 (0%)	2 (11%)	3 (16%)	7 (37%)	7 (37%)	19	**4.00**	1.00
Making changes when things do not go as planned	0 (0%)	2 (11%)	3 (16%)	8 (42%)	6 (32%)	19	**3.95**	0.97

Patience for the slow pace of research	0 (0%)	1 (5%)	5 (26%)	8 (42%)	5 (26%)	19	**3.89**	0.88
Working collaboratively with a team	1 (5%)	1 (5%)	2 (11%)	7 (37%)	8 (42%)	19	**4.05**	1.13
Communicating effectively with others	0 (0%)	1 (5%)	3 (16%)	8 (42%)	7 (37%)	19	**4.11**	0.88
Including others' perspectives when making decisions	1 (5%)	0 (0%)	6 (32%)	6 (32%)	6 (32%)	19	**3.84**	1.07
Sense of being part of a learning community	0 (0%)	1 (5%)	4 (21%)	7 (37%)	7 (37%)	19	**4.05**	0.91
Sense of contributing to a body of knowledge	0 (0%)	1 (5%)	4 (21%)	6 (32%)	8 (42%)	19	**4.11**	0.94
Building relationships with professionals in a field	0 (0%)	1 (5%)	2 (11%)	7 (37%)	9 (47%)	19	**4.26**	0.87
Connecting a topic or field and their personal values	0 (0%)	2 (11%)	5 (26%)	8 (42%)	4 (21%)	19	**3.74**	0.93

Note. Response scale: **1** = "No gain," **2** = "A little gain," **3** = "Some gain," **4** = "Large gain," **5** = "Extreme gain".

Which of the following statements describe YOUR STUDENT(S) after participating in the CQL program?							
	1	**2**	**3**	**4**	**n**	**Avg.**	**SD**
More confident in STEM knowledge, skills, and abilities	0 (0%)	0 (0%)	13 (68%)	6 (32%)	19	**3.32**	0.48
More interested in participating in STEM activities outside of school requirements	1 (5%)	2 (11%)	9 (47%)	7 (37%)	19	**3.16**	0.83
More aware of other AEOPs	3 (16%)	1 (5%)	13 (68%)	2 (11%)	19	**2.74**	0.87
More interested in participating in other AEOPs	4 (21%)	1 (5%)	10 (53%)	4 (21%)	19	**2.74**	1.05
More interested in taking STEM classes in school	1 (5%)	1 (5%)	10 (53%)	7 (37%)	19	**3.21**	0.79
More interested in attending college	1 (5%)	5 (26%)	4 (21%)	9 (47%)	19	**3.11**	0.99
More interested in earning a STEM degree in college	1 (5%)	2 (11%)	8 (42%)	8 (42%)	19	**3.21**	0.85
More interested in pursuing a STEM career	1 (5%)	3 (16%)	7 (37%)	8 (42%)	19	**3.16**	0.90
More aware of Department of Defense (DoD) STEM research and careers	0 (0%)	0 (0%)	8 (42%)	11 (58%)	19	**3.58**	0.51
Greater appreciation of DoD STEM research and careers	0 (0%)	0 (0%)	7 (37%)	12 (63%)	19	**3.63**	0.50
More interested in pursuing a STEM career with the DoD	4 (21%)	0 (0%)	8 (42%)	7 (37%)	19	**2.95**	1.13

Note. Response scale: **1** = "Disagree – This did not happen," **2** = "Disagree – This happened but not because of CQL," **3** = "Agree – CQL contributed," **4** = "Agree – CQL was the primary reason".

Appendix D

FY14 CQL Student Focus Group Protocol

2014 Army Educational Outreach Program

Student Focus Group

Facilitator: "Thank you for meeting with us today so that we can learn more about your experiences in [X] program. We'd like to suggest some basic ground rules to help the group's discussion proceed smoothly and respectfully for everyone:

- What is shared in the room stays in the room.
- Only one person speaks at a time.
- It is important for us to hear everyone's ideas and opinions. If you disagree, be respectful.
- It is important for us to hear all sides of an issue—both the positive and negative.
- Your participation is voluntary--you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for notetaking purposes and will delete the email after the notes have been taken."

Key Questions

1. Why did you choose to participate in [X] this year?
    - How did you hear about [X]?

2. One AEOP objective is to increase your awareness of the AEOP's pipeline of STEM programs. Did you learn about other AEOPs in [X]?
    - Which ones did you learn about?
    - How did you learn about them?
    - Which AEOPs are you interested in pursuing?

3. One AEOP objective is to increase your awareness of STEM research and career opportunities within the Department of Defense. Did you learn about DoD STEM research and careers in [X]?
    - Which ones did you learn about?
    - How did you learn about them?
    - Which AEOPs are you interested in pursuing?

4. Overall, were you happy that you chose to participate in [X]?
    - How have you benefited from participating in [X]?

5. What would you suggest for improving [X] in the future?

Ending questions:

6. Have we missed anything? Tell us anything you want us to know that we didn't ask about.

Appendix E

FY14 CQL Mentor Focus Group Protocol

2014 Army Educational Outreach Program
Adult Focus Group

Facilitator: "Thank you for meeting with us today so that we can learn more about your experiences in [X] program. We'd like to suggest some basic ground rules to help the group's discussion proceed smoothly and respectfully for everyone:

- What is shared in the room stays in the room.
- Only one person speaks at a time--we'll call on sites, if you have something to add or wish to build on another's idea, just type 'add' in the chat window and we'll come back to you.
- It is important for us to hear everyone's ideas and opinions. If you disagree, be respectful.
- It is important for us to hear all sides of an issue—both the positive and negative.
- Your participation is voluntary--you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for notetaking purposes and will delete the email after the notes have been taken."

Key Questions

1. What do you perceive as the value of [X]?
   - How do you think students benefit from participating?
   - How have you benefited?

2. One AEOP objective is to increase participation of underserved and underrepresented populations in STEM. What strategies have you used this year to increase the diversity of participants in [X]?
   - What strategies seem to work the best?
   - What do you need in order to achieve greater success?

3. One AEOP objective is to increase participants' awareness of the AEOP's pipeline of STEM programs. What strategies have you used this year to educate participants about other AEOP initiatives?
   - What strategies seem to work the best?
   - What do you need in order to achieve greater success?

4. One AEOP objective is to increase participants' awareness of STEM research and career opportunities within the Department of Defense. What strategies have you used this year to expose participants to DoD STEM research and careers?
   - What strategies seem to work the best?
   - What do you need in order to achieve greater success?

5. What suggestions do you have for improving [X]?

Ending questions:

6. Have we missed anything? Tell us anything you want us to know that we didn't ask about.

Appendix F

APR Template

Program Overview

Provide a one or two paragraph overview of your program.

Accomplishments

Provide the following for *each* program objective listed in the Proposed Work section of the FY14 Annual Program Plan.

1. **What were the major activities conducted to accomplish the FY14 target for the objective. Report major activities undertaken by of the program adninistrator as well as a selection of 3-5 different site-level activities.**

2. **What were the results of those activities? Specifically, what progress was made toward achieving the FY14 target for the objective?**

3. **What is the proposed FY15 target for for the objective, considering the 5-year target?**

4. **What is planned to accomplish the FY15 target for the objective?**

The following structure can be used for each program objective (replicate as needed). Information in the top two rows ("Objective" and "FY14 Target") should be copied directly from the approved FY14APP.

Objective: [STATE OBJECTIVE] (**Supports AEOP Goal** [STATE GOAL #], **Objectives** [STATE OBJECTIVE LETTERS]) **Proposed Plan:** [STATE PROPOSED PLAN]
FY14 Target: [STATE TARGET]
Major activities: [REPORT ACTIVITIES OF PROGRAM ADMISTRATOR] [REPORT SELECTED SITE-LEVEL ACTIVITIES]
Results: [REPORT RESULTS] [REPORT PROGROSS TOWARD ACHEIVEING FY14 TARGET]
FY15 Target: [STATE TARGET]
FY15 Plan: [STATE PLAN TO ACCOMPLISH FY15 TARGET]

Changes / Challenges

1. What changes (if any) were made to the plan for meeting FY14 targets for each objective? What were the reasons for the changes?

2. Do any of these changes have significant impact on budget/expenditures?

3. What challenges or delays (if any) prevented the program from meeting FY14 targets for each objective? What actions or plans were implemented to resolve those challenges or delays?

4. Do any of these challenges or delays require the assistance of the Army, the Consortium, or the Lead Organization to resolve? Please specify.

Products

1. **For all programs, list and briefly describe any products resulting from the administration of the program (program administrator or site coordinator) during FY14.**
   - Websites and social media (provide website urls, social media handles, etc.)
   - Instructional materials and other educational aids or resources
   - Audio or video products
   - Guiding documents
   - Marketing or promotional materials
   - Presentations[26] (provide citations)
   - Publications[27] (provide citations)
   - Educational research or evaluation assessments
   - Other
2. **In addition to the above, how many of each product resulted from the Army/AEOP-sponsored research conducted by students participating in apprenticeship programs?**
   - Abstracts
   - Presentations
   - Publications
   - Patents
   - Other

Participants

[26] Presentations include things like conference contributions (oral or poster) or presentations to the public, news media, educational agencies, and other associations. Conference booths may also be reported.

[27] Publications include things like peer reviewed articles, technical papers and reports, books or book chapters, news media releases.

Recruitment and selection of participants

1. **Who is the audience(s) targeted by your program and how was the program was marketed to the audience(s)? Report major activities undertaken by of the program administrator as well as a selection of 3-5 different site-level activities toward marketing and recruitment.**

2. **What criteria were used to select participants for the program? Report any efforts of the program administrator (including guidance provided to sites) as well as a selection of 3-5 different site-level criteria.**

3. **AEOP Pipeline: Explain any efforts that were made to specifically recruit alumni of other AEOP initiatives into your program? Explain any efforts to specifically recruit alumni of your program into other AEOP initiatives?**

Participant numbers and demographic characteristics

1. **How many of each participant group enrolled in the program? How many of each group applied and/or were selected/invited to participate? Report data using the following categories and enter "NA" where not applicable.**

	Applied	Selected	Enrolled
Participant Group	**No.**	**No.**	**No.**
Elementary school students (grades K-5)			
Middle school students (grades 6-8)			
High school students (grades 9-12)			
Undergraduate students (including community college)			
Graduate students (including post-baccalaureates)			
In-service K-12 teachers			
Pre-service K-12 teachers			
College/university faculty or other personnel			
Army/DoD Scientists & Engineers			
Other volunteers (e.g., if a competition program)			

2. **For the target audience(s) listed in the previous section (replicate the table as needed), how many were enrolled in the program per program site? How many of each group applied and/or were selected/invited to participate per program site?**

[Identify Participant Group]	Applied	Selected	Enrolled
Site	**No.**	**No.**	**No.**
(List each site by name)			

3. **For the target audience(s) listed in the previous section (replicate the table as needed), what are the demographic characteristics of the <u>applicants</u> and <u>enrolled participants</u>? Report data using the following categories:**

Identify Participant Group]	Applied		Enrolled	
Demographic Category	**No.**	%	**No.**	%
Gender				
Male				
Female				
Choose not to report				
Race/ethnicity				
Native American or Alaskan Native				
Asian				
Black or African American				
Hispanic or Latino				
Native Hawaiian or Other Pacific Islander				
White				
Choose not to report				
School setting (students and teachers)				
Urban (city)				
Suburban				
Rural (country)				
Frontier or tribal School				
DoDDS/DoDEA School				
Home school				
Online school				
Choose not to report				
Receives free or reduced lunch (students only)				
Yes				
No				
Choose not to report				
English is a first language (students only)				
Yes				
No				

Choose not to report				
One parent/guardian graduated from college (students only)				
Yes				
No				
Choose not to report				
Documented disability (students only)				
Yes				
No				
Choose not to report				

4. **For the target audience(s) listed in the previous section (replicate the table as needed), what are the rates of past AEOP participation of the applicants and enrolled participants? Report data using the following categories:**

[Identify Participant Group]	Applied		Enrolled	
AEOP element	**No.**	%	**No.**	%
Camp Invention				
Junior Solar Sprint				
eCYBERMISSION				
West Point Bridge Design Competition				
Junior Science & Humanities Symposium				
Gains in the Education of Mathematics and Science				
UNITE				
Science and Engineering Apprentice Program				
Research and Engineering Apprenticeship Program				
High School Apprenticeship Program				
College Qualified Leaders				
Undergraduate Research Apprenticeship Program				
STEM Teachers Academy				
SMART Scholarship				
NDSEG Fellowship				

Organizations participating or served

1. How many of each organization are served by the program? Report data in the following categories:

Organizations	No.
K-12 schools	
Title 1 K-12 schools	
Colleges/universities (including community colleges)	
Army/DoD laboratories	
Other collaborating organizations (educational agencies, professional associations, external sponsors, etc.)	

2. Please list all colleges/universities served by the program.

3. Please list all Army/DoD laboratories served by the program.

4. Please list other collaborating organizations served by the program.

Other Impacts

Have the FY14 program activities impacted human and/or infrastructure resources in any additional areas beyond the primary objectives of the program? If so, please describe any activities and results of those activities, especially pertaining to the following:

- **Engagement opportunities for the public (beyond those persons typically considered program participants) to increase interest in STEM, perception of STEM's value to their lives, or their ability to participate in STEM**
- **Professional development for pre-service or in-service STEM teachers to improve their content knowledge and pedagogical skills**
- **Development and/or dissemination of instructional materials or educational resources**
- **Support for the development or advancement of STEM personnel (i.e., Army Scientists & Engineers, Army-sponsored university faculty and other personnel), programs, or other physical infrastructure**
- **Contributions having intellectual merit or broader impact to the field of informal science education and outreach**

If any of these activities are conducted through websites and/or social media, the summary of results should include the analysis of key website or social media analytics.

Funding, Budget, and Expenditures

1. Provide an overview of FY14 funding

FY14 Funding Overview	Amount
Carry-forward funding from FY13	
New funding received in FY14	
Total budget for FY14 (FY13 carry-over plus FY14 new funding)	
Total FY14 expenses (estimate for 30 Sept)	
Carry-forward funding from FY14 into FY15 (total FY14 budget minus estimate of total FY14 expenses)	

2. Funding to the cooperative agreement comes from a variety of sources (general purpose funds, laboratory specific stipend funds, and Navy and Air Force funds for JSHS, etc.). The type of funding is indicated on AEOP CA modifications. What type of funds supported your program in FY14 (include funding carried over from FY13 in your totals)?

FY14 AEOP CA Funding Type/Source	Amount
General purpose funds	
Laboratory specific stipend funds - [Indicate Laboratory and replicate row as needed so that each contributing laboratory is represented on a separate line]	
Total laboratory specific stipend funds	
Air Force/ Navy JSHS funds	
Total FY14 funding (add types of funding, should be equivalent to “Total budget for FY14” in table above)	

3. **How do your actual FY14 expenditures (estimate for 30 Sept cut-off) compare with your approved FY14 budget? Report totals in the following categories:**

	Approved FY14 Budget (includes FY13 carry-over and new FY14 funding)	Actual FY14 Expenditures (estimate through 30 Sept)	Carry-over from FY14 into FY15
Marketing & Outreach (include additional funding received through special AEOP Cross-Marketing RFP process)			
National Event (where applicable)			
Scholarships/awards			
Stipends			
Other direct costs (including salary & fringe); Number of FTEs =[Indicate number of FTEs including PT wage workers]			
Overhead – Indirect Rate= [Indicate Indirect Rate and to which costs the indirect applies (i.e. labor, direct costs, etc.)]			
TOTALS (should match totals provided in tables above)			

4. Calculate average cost per student and explain how the calculation was made.

Fast Facts

Complete the summary chart below. Report data using the following categories and enter "NA" where not applicable.

FY14 [Enter Program Name]	**No.**
Applications & Participants	
Student Applications	
Student Participants	
Student Participation Rate (no. participants/no. applications x 100)	%
Teacher Applications	
Teacher Participants	
Teacher Participation Rate	**%**
Near-Peer Mentor Applications	
Near-Peer Mentor Participants	
Near-Peer Mentor Participation Rate	**%**
Partners	
Participating Colleges/Universities (including community colleges)	
Participating Army/DoD Laboratories	
Science & Engineer Participants	
Apprenticeships, Awards & Stipends	
Apprenticeships Provided	
Scholarships/Awards Provided	
Expenses Toward Scholarships/Awards	**$**
Expenses Toward Stipends	**$**
Budget & Expenses	
FY14 Total Budget (including carry-over from FY13 and new FY14 funding)	**$**
FY14 Total Expenses (estimate through 30 Sept)	**$**
Carry-Over from FY14 to FY15	**$**
Average cost per student	**$**

Appendix G

American Society for Engineering Education (ASEE) Evaluation Report Response

ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

2014 CQL Evaluation Report Response

In the participant commentary included in the 2014 CQL Evaluation Report there were many instances in which the participants were unhappy about the timeliness of their stipend payments. It is ASEE policy to only pay stipends when we have confirmation from the labs. It is also ASEE policy to have payments made on the first of the month for the work done in the previous month. ASEE will not pay any individuals that are not listed by the labs for payments on the first of the month, so when the labs forget to add a CQL participant to the first of the month stipend list, a mid-month payment is initiated.

While stipend payment for most CQL labs went without issue in 2014, there were a few outliers. For example, one lab had habitually left CQL participants off of their first of the month stipend lists. Out of 21 non-first of the month stipend runs, 16 were for this particular lab. It is something that continues in FY15 and only gets worse in the summer months. There are now more people supervising the program at this location, but the same coordinator is still in charge of the stipend runs and there are still many missed stipends. In FY15, there have been 15 non-first of the month stipends for CQL and 13 of them were for this particular lab. When a lab has this type of issue and it affects many participants, the problem will come to the surface during program evaluation. While there are countless CQL participants who never have a stipend issue, ASEE still strives for perfection in our stipend payments. While we have tried to end these issues with this particular lab, the problem persists, but we at ASEE will continue to expedite the mid-month stipends so that we can minimize the pain felt by the participants. When we get word that there were unpaid participants, we work as fast as possible to get verification from the labs and process them as fast as possible.

In addition to the stipend issue, there were remarks in CQL participant commentary that the participants did not know how long they had to wait in order to get paid. ASEE was told by the Army that protocol was that participants gets paid for work done, not for future work, so that should have been communicated to the participants. If that was not communicated to the participants, and that particular participant also had their stipend left off of the first of the month stipend list, then they could have gone over a month without getting paid. The lab needs to communicate the program's stipend policy to the participants more clearly so that they understand the timeline in which they will be paid.