Army Educational Outreach Program

eCYBERMISSION

2016 Annual Program Evaluation Report

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Executive Summary

eCYBERMISSION (eCM) is sponsored by the U.S Army and managed by the National Science Teachers Association (NSTA). Since the program's inception in 2002, more than 176,000 students form across the U.S., U.S. territories, and Department of Defense Educational Activities (DoDEA)'s schools worldwide have participated in the program. eCYBERMISSION is a web-based science, technology, engineering, and mathematics (STEM) competition free to students in grades six through nine that promotes self-discovery and enables all students to recognize the real-life applications of STEM. Teams of three or four students are instructed to ask questions (for science) or define problems (for engineering), and then construct explanations (for science) or design solutions (for engineering) based on identified problems in their community. Students compete for State, Regional, and National Awards.

This report documents the evaluation of the FY16 eCM 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 eCM included questionnaires for students and Team Advisors; two focus groups with eCM NJ&EE student participants and two with their Team Advisors; observations of the NJ&EE event, and an annual program report compiled by eCM.

There were 20,607 students that entered state competitions in FY16 (Table 1 displays the number of participants per State/DoDEA/Territories). The top 12 teams from each of the 5 regions advanced to regional competitions for a total of 60 teams that compete in the virtual regional judging. Judging is done via Blackboard. This year a total of 216 students participated in the regional judging. The highest score in each region for each grade determines the national finalists. The STEM in Action Grant recipient teams are selected from the regional finalist teams that submit a proposal to implement their solution in their community. Up to 5 STEM in Action Grants are given each year. This year 2 of the 5 teams were also national finalists. A total of 86 students participated in NJ&EE, 20 from the national finalist teams and 3 additional STEM in Action Grant recipient teams.

2016 eCM Fast Facts	
Description	STEM Competition - Nationwide (incl. DoDEA schools), state-level competition, regional competition and winners advancing to NJ&EE.
Participant Population	6th-9th grade students
No. of Applicants	23,323 students registered
No. of Participants	20,607 State, 216 Regional Participants (of whom 86 were selected to attend the NJ&EE) with a total of 15,710 that submitted completed folders (76.2%)
Placement Rate	N/A all that apply are permitted to participate
No. of Adults (Team Advisors and Volunteers – including S&Es and Teachers)	3,389

Team Advisors (with complete teams)	802
Number of Volunteers (Ambassadors, CyberGuides, Virtual Judges)	2,047
Number of Army S&Es	540
Number of Army/DoD Research Laboratories	37
Number of K-12 Teachers (including preservice)	727
Number of K-12 Schools (home, private, public, DoDEA)	547
Number of K-12 Schools Title 1	294
Number of Colleges/Universities	153
Number of DoDEA Students	417
Number of DoDEA Teachers	21
Number of DoDEA Schools	15
Number of Other Collaborating Organizations	19
Total Awards	Second-Place State Winners: $500 U.S. Savings Bonds/student First-Place State Winners: $1,000 U.S. Savings Bonds/student All Regional Finalists: $1,000 U.S. Savings Bonds/student First-Place Regional Winners: $2,000 U.S. Savings Bonds/student, all expense paid trip to NJ&EE First-Place National Winners: $5,000 U.S. Savings Bonds/student
Total Cost	$3,038,180
NJ&EE Cost	$335,599
Scholarship/Award Cost	$747,194
Cost Per Student Participant	$147

Summary of Findings

The FY16 evaluation of eCYBERMISSION included collection of data about participants, their perceptions of program processes, resources, and activities, and indicators of achievement related to AEOP's and eCM's objectives and intended outcomes. A summary of findings is provided in the following table.

2016 eCM Evaluation Findings	
Participant Profiles	
Participation in eCM decreased in FY16 by 18%.	In 2016, there were 20,607 State Participants, and 216 Regional Participants (of whom 86 were selected to attend the NJ&EE). This represents an 18% decrease in student participants from 2015.

	Eighty-four percent of national eCM students and 55% of regional eCM students reported being "somewhat" or "very much" satisfied with the submission process. Over 90% of Team Advisors reported being "very much" or "somewhat" satisfied the submission process.
	Participation in eCM for FY16 included nearly equally distributed representation of males (49%) and females (51%). In regards to other underrepresented groups, the group included predominantly White participants (49%). However, there were 18% Hispanic or Latino participants, and 8% Black or African American eCM participants.
	There were more White and Asian Participants that progressed to regionals. Of the regional finalists (n=216), there were slightly more females (51%) than males. Proportionally, a slightly higher percentage of White students proceeded to the regional finals (56%), followed by 24% of students identifying as Asian, and 8% identifying as Hispanic or Latino/a. Only 8% of Black or African American students progressed to the regional finals, and .4% of Native Americans or Alaskans and .4% of Native Hawaiians or other Pacific Islanders were regional finalists
	Demographic data collected from Team Advisors on the evaluation survey indicated more responding Team Advisors were female than male (64% vs. 35%). As with the responding students, most of the responding Team Advisors identified themselves as White (73%).
Actionable Program Evaluation	
The most effective means of recruitment in FY16 were personal contacts and the eCM website. However, some Team Advisors learned about eCM at professional conferences.	Forty-eight percent of students learned about eCM from someone who works at the school or university they attend, followed by 36% of students learning about eCM from a school or university newspaper or website. Less than 10% of students learned from other sources and 18% chose not to respond to this question.
	The most frequent responses were personal contacts, including a past eCM participant (33%), a colleague (20%), or a supervisor (14%). In addition, 17% learned from a STEM or STEM education conference and 12% learned from an email or newsletter from a school, university, or a professional organization.
Students are motivated to participate in eCM via teacher encouragement and/or requiring students to participate, desire to have fun, learn something new, and overall interest in STEM.	For the eCM-R responders, the top two motivating factors were interest in teacher or professor encouragement (51%), and equal factors include an academic requirement (36%) and having fun (36%). Other factors include a desire to learn something new or interesting (27%) and an interested in STEM (22%).

National eCM students learned more about DoD/STEM careers than regional participants.	Sixty-nine percent of National participants reported learning about five or more DoD/STEM careers and 66% of Regional students reported learning about at least one DoD STEM job/career during their eCM experience. However only 13% of regional participants reported learning about 5 or more different STEM jobs/careers in the DoD. This finding reveals the NJ&EE does a much more effective job of introducing participants to DoD opportunities than the regional events.
	Participants in the NJ&EE focus groups reported that that they had not learned much about STEM jobs/careers with the DoD in eCM before they came to the national event. Participants shared that the field day (visiting congressional leaders and national monuments) and the AEOP STEM Challenge Day at the national event did a great deal to expose them to STEM careers in the DoD.
The eCM experience and competition overall is valued by both students and Team Advisors. However, many participants did not experience the Cyber Guide live chat, feedback, and forum.	Roughly half of responding NJ&EE participants were very much satisfied with the eCM registration (54%), submission (51%), and eCM website (49%). Many National eCM students reported that they did not experience the eCM Cyber Guide live chat (23%), Cyber Guide feedback (24%), and Cyber Guide forum (29%). Regional eCM students reported similar satisfaction rates. Highest satisfaction rates were reported for the eCM registration (26%), submission (26%), and eCM website (36%) for eCM Regional students. Also similar to the NJ&EE students, the Regional competition participants also reported little experience with eCM Cyber Guide live chat (50%), Cyber Guide feedback (39%), and Cyber Guide forum (39%).
	Over 90% of Team Advisors reported being "very much" or "somewhat" satisfied the submission process (91%) and the eCM website (91%). Also, 83% of Team Advisors reported being "very much" or "somewhat" satisfied with variety of STEM mission folders available, and 61% reported being "very much" or "somewhat" satisfied with communication with NSTA. However, many Team Advisors reported that they did not experience several of the components such as Cyber Guide live chats, feedback or forums.
Outcomes Evaluation	
eCM participants are engaged in solving STEM problems, and recognize that they can impact their communities through STEM activities.	More than 50% of NJ&EE participants experienced *all* STEM practices in eCM, which were reported on the survey except for building or making a computer model. Regional students reported having engaged in fewer of the STEM practices reported on the survey and spent less time than the National students in doing STEM practices. Although this is a difference, it is expected as the National participants spent more time preparing their projects for the NJ&EE.

	Significant group differences were found in terms of Engaging with STEM Practices in eCM for both competition level and race/ethnicity. National eCM participants reported significantly higher levels of engagement with STEM practices in eCM compared to regional participants and minority students reported significantly higher levels compared to White students.
	Eighty-nine percent of Team Advisors helped students understand the role of STEM in their community, and one of the major open-ended responses to the benefits of eCM by both Regional and National participants included an understanding of how solving problems in the STEM field can help their community and the global community.
	Students reported greater "Learning about STEM" in eCM than in school for both Regional and National students. Similar results were found for the "Engaging in STEM Practices" composite for Regional and National students.
eCM had positive impacts on students' perceptions of their 21st Century Skills.	More than 80% of NJ&EE participants reported "medium" or "large" gains on all 21st Century skills listed on the survey. Between 60% and 75% of Regional participants reported "medium" or "large" gains on all 21st Century skills listed on the survey.
NJ&EE participants reported positive gains in student confidence and identity in STEM, as well as their interest in future STEM engagement. Regional findings were mixed.	The survey data strongly suggest that the program has had a positive impact on student confidence and identify in STEM for the National group. A large majority of NJ&EE participants reported "medium" or "large" gains in every category.
	Regional participants were mixed in their reporting of gains in the eCM program, with roughly an equal spread across the responses "no gain," "little gain," "medium gain," and "large gain" for all categories.
According to Team Advisors, eCM succeeded in raising students' education and future STEM career aspirations.	Mentors reported that participation in eCM (63%) and the eCM website (56%) were most often rated as "very much" useful in influencing students' educational aspirations.
eCM participants and Team Advisors were aware of only a few of the other AEOP programs, and many only knew about eCM. However, many participants indicated interest in other AEOP	Although about a quarter of the Team Advisors discussed other AEOP programs in general, less than 10% of Team Advisors discussed any other AEOP program with the eCM students.
	Half to over three-quarters of Team Advisors did not utilize the Army Educational Outreach Program (AEOP) website, AEOP on Facebook, Twitter, Pinterest or other social media, AEOP brochure, It Starts Here! Magazine, or Invited speakers or "career" events.

programs.	Regional participants reported being unaware of the various AEOP programs at a much higher rate (between 7% and 64% for all programs listed in the survey) than the NJ&EE participants (between 2% and 46% for all programs listed in the survey). This was likely attributed to the AEOP alumni panel that was part of the programming at the NJ&EE in FY16. However, many students (both regional and NJ&EE) expressed that they would be "very much" or "somewhat" interested in future programs. For example, eCM (N-89%; R-38%) and GEMS (N-70%; R-13%).

Responsiveness to FY15 Evaluation Recommendations

The primary purpose of the AEOP program evaluation is to serve as a vehicle to inform future programming and continuous improvement efforts with the goal of making progress toward the AEOP priorities. In previous years the timing of the delivery of the annual program evaluation reports has precluded the ability of programs to use the data as a formative assessment tool. However, beginning with the FY16 evaluation, the goal is for programs to be able to leverage the evaluation reports as a means to target specific areas for improvement and growth. In this report, we will highlight recommendations made in FY15 to programs and summarize efforts and outcomes reflected in the FY16 APR toward these areas.

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

Finding: Team Advisor Assessment data regarding quality of eCYBERMISSION program supports also identified socio-economic challenges of program participation that continue to place lower income student competitors at a disadvantage.

eCM FY16 Efforts and Outcomes: This issue has been addressed by offering Mini-Grants to help implement the competition into a classroom. Teachers or district administrators apply for the Mini-Grant, and awardees are selected based on economic need, using as one of the first criteria funding going to Title I applications. Last year 70.7% of Mini-Grant students were from Title I schools.

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

Finding: Introduce mechanisms to enhance Team Advisors' interactions and peer-to-peer support.

eCM FY16 Efforts and Outcomes: A pilot program was established beginning in January 2016 to pair a new Team Advisor (first year) with a veteran Team Advisor to serve in the role of a Team Advisor. Additional mechanisms included encouraging Team Advisors to participate in the Team Advisor Forum on the website. This information was shared via the newsletters sent to all Team Advisors by their eCM POC.

Finding: Introduce an appropriate buddy system to the FY16 NJ&EE competition to enable students more freedom of movement and reduce Team Advisor strain.

eCM FY16 Efforts and Outcomes: Our teams are made up of students in grades 6 through 9. We are responsible for their safety 24/7. It is the Team Advisor's responsibility to chaperone their students from the time the students meet their Team Advisor to leave for NJ&EE until the students are returned to their parents at the end of NJ&EE. Students from the same team were to select a fellow teammate of the same gender to be a buddy during the week. If the students needed to leave for the bathroom, they were able to do so with their buddy (and not the Team Advisor as in previous years) as long as they let their Team Advisor, NCO, or Team Advisor know they were doing so. At all other times during the week, the Team Advisors were expected to be with their students except at night in their rooms. All Team Advisors did have their sleeping room in very close proximity to the student rooms at the NCC.

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

Finding: Increase eCYBERMISSION participants' awareness of program resources by embedding a brief introductory video into the online registration.

eCM FY16 Efforts and Outcomes: A video was produced in 2015, edited to 4 minutes 19 seconds (originally it was 10 minutes) and was added to the home page of the eCYBERMISSION website (originally found in teacher resources). The video is titled "eCYBERMISSION Website Tutorial" and is a brief overview of the features and pages available at www.ecybermission.com. Information for the video is part of the "welcome letter" each Team Advisor receives once registered. A link to all eCM resources is included in the welcome letter.

Finding: Improve the eCYBERMISSION experience by addressing current issues with the Mission Folder auto-save and multi-user functionality.

eCM FY16 Efforts and Outcomes: The following message was sent to every Team Advisor via an email newsletter sent from the Team Advisor's Point of Contact (POC):

"*MISSION FOLDER TIMEOUT!*
Students can only be logged in to their Mission Folder for 30 minutes before it will timeout. There may be no change on the screen, but students will not be able to save information. Let them know to save and log out every 25 minutes or so to ensure they avoid this problem and don't lose any work!"

The problem with the auto-save and the multi-user functionality was discussed in detail with our team, so if any phone calls came into Mission Control, everyone would be giving the same information to help support the Team Advisors. There was discussion with our IT web developer and it was decided to not allow "cookies" to be enabled. The reason behind this decision, which would solve the problem, is that most students may be doing work either on a school computer or at a public library. If the student does not log out, and someone else begins

to use the computer, the second person could totally overwrite the original work and the first student would lose all of their work.

Finding: Either extend the length of NJ&EE or reduce the number of its activities to ensure participants have longer activity transitions and time designated specifically to their presentation preparation and practice.

eCM FY16 Efforts and Outcomes: A concerted effort was made in the scheduling of NJ&EE to ensure teams had more time to prepare for their presentations. The following changes were incorporated into the schedule for 2016:

- All teams were required to be on-site by 2 p.m. on Monday. This allowed time for students to prepare for the opening activity at 4 p.m. In putting this requirement in place (previously it had been 3 p.m.), six of the 23 teams flew in on Sunday, to allow their teams extra time to get ready for the event due to the length of time for travel from their origin.
- The 2016 venue, the National Conference Center (NCC) in Leesburg, Virginia, was selected for its proximity to Washington, D.C., to help facilitate less travel time on Tuesday when teams travel to Washington, D.C., for their visits to their congressional leaders and tour of the city.
- Due to the change of venue, the schedule for each day was put together to facilitate ease of movement between sessions (a dedicated area was allotted for our group with all rooms within very close proximity of each other allowing for much easier and less time consuming transitions).
- A change to Tuesday's schedule included adjusting the order of events to take full advantage of time. The tour of Washington, D.C., was changed to the morning to avoid some of the crowds that occur later in the day. A limit of two congressional visits was requested. The buses left Washington, D.C., by 3:45 p.m. and returned to NCC by 5:00 p.m. (in 2015 this time was closer to 6 p.m. with one bus arriving back at 6:30 p.m.). There were no scheduled activities for the remainder of the day besides a 15-minute synch-up with the teams after dinner for announcements.

Finding: Assessment of meals at Hunt Valley in 2015 for NJ&EE was the only logistical item that demonstrated a statistically significant decrease in satisfaction when compared to FY14.

eCM FY16 Efforts and Outcomes: National Conference Center has a buffet with many choices for meals, which provided many more options for participants along with break service as part of the "complete meeting package" that we negotiated as part of the contract.

Finding: Qualitative descriptions of why students participated in eCYBERMISSION revealed that many students felt "forced" to participate because of a mandatory classroom requirement or grade.

eCM FY16 Efforts and Outcomes: This is an issue that is classroom-driven and not one that eCYBERMISSION can control. Our program is targeted to teachers, and our Mini-Grant program is set up for at least 50 students participating in order for a teacher to get a grant to support the implementation of eCYBERMISSION into the classroom.

Finding: Student assessment data regarding eCYBERMISSION program resources gave participants 10 program resources and asked them to rate them as: Very useful, Useful, Somewhat Useful, Slightly Useful, Not at All Useful, or Did not Use. CyberGuide Chats prompted the weakest assessment, followed by Mission Control Help Desk.

eCM FY16 Efforts and Outcomes: During the competition year, every Team Advisor receives communication via a newsletter delivered via email from the Team Advisor's Point of Contact. Cyber Guide Chats were promoted in these newsletters.

During FY16, the use of a Point of Contact to communicate more frequently with Team Advisors resulted in overall fewer phone calls from students and Team Advisors into Mission Control with questions about the program. Students can call/email Mission Control, but the frequency of such communication was not high since most often Team Advisors call/email on behalf of their team.

Finding: Team Advisor Assessment data regarding quality of eCYBERMISSION program supports also identified CyberGuides as a resource in need of improvement. Specifically in the evaluation the following is mentioned: "CyberGuides should be more visible" and that their responses to students "could be more timely and detailed."

eCM FY16 Efforts and Outcomes: In an effort to make the CyberGuides more visible to students, eCYBERMISSION staff collected short bios and photos of the CyberGuides and posted them on the student website by Mission Challenge area (see Appendix A for an example). Students use the bios to learn more about the CyberGuides' areas of expertise and to pick out which CyberGuide to connect with for a specific question. The bios also help students get to know the CyberGuides as people, too.

After registering, all CyberGuides are asked to review the CyberGuide User Guide, which outlines eCYBERMISSION's expectations around timeliness of communications with students. Using Team Talk, students can directly connect with a specific CyberGuide to ask a Mission Folder question. If a team does not receive a response within 24 hours after a reminder, eCYBERMISSION contacts the CyberGuide to correct the situation.

CyberGuides are asked to visit the Discussion Forums regularly and to respond to questions, starting with the oldest post and working up to the most recent. eCM staff monitors the Discussion Forums as well and will encourage CyberGuides to get on the boards if there are posts waiting for a reply.

Finding: Open-ended survey remarks from students who participated in NJ&EE for the item regarding initial notification of their finalist status indicated the item's rating could be improved by earlier notification.

eCM FY16 Efforts and Outcomes: This year, an effort was made to notify winning teams earlier than in the past. In FY15 teams were notified May 4–6 with NJ&EE beginning on Monday, June 15. This year, phone calls were made on May 3–4 and NJ&EE began on June 20.

Finding: Open-ended survey remarks from Team Advisors who participated in NJ&EE for the item regarding initial notification of their finalist status indicated the item's rating could be improved by allocation of more time for the completion of pre-NJ&EE paperwork.

eCM FY16 Efforts and Outcomes: This year in an effort to honor this request, the initial email with information went out to Team Advisors on May 6, 2016. The Team Advisors had until May 19 to submit the necessary documents. In FY15, Team Advisors were notified on May 7 with a request to have all paperwork turned in within one week on May 14

FY16 Recommendations

Evaluation findings indicate that FY16 was a success overall for the eCM program. Notable successes for the year include high levels of Team Advisor and student satisfaction with the program, and equal number of male and female participants, the majority of National students learning about five or more DoD/STEM careers, student reports that eCM helped them recognize how STEM activities can help them solve problems in their community, minority students had a significantly higher reported engagement with STEM than White students, all students reported learning more STEM at eCM than in their schools, a majority of students reporting gains on 21st Century skills, and the majority of Team Advisors reporting the participation and eCM website were very useful. While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. Additionally, there were proportionally more White and Asian students who advanced to the national level as compared to Hispanic and Latino/a students and Black and African American students. Another marked difference was between the numbers of DoD/STEM careers of which students became aware during the eCM experience. Regional students reported much lower numbers than National students, and National students reported during the focus group interviews that is was during the field trip when they encountered engagement with a variety of DoD/STEM careers. Similarly, the Regional students reported that eCM had significantly less of an impact on confidence and identify in STEM than the National students. Although NSTA has improved outreach to the Team Advisors and subsequently students through emails and the eCM website, the results of the survey indicate that few participants use the CyberGuide live chat, feedback, or forum. Finally, most Team Advisors were unfamiliar with other AEOP materials such as It Starts Here! Magazine and only a quarter of Team Advisors discussed other AEOP programs with their students. Subsequently, students were mostly unaware of other AEOP programs, although they indicated on the surveys that they would be interested in participating. The evaluation team therefore offers the following recommendations for FY17 and beyond:

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

1. The AEOP objective of broadening, deepening, and diversifying the pool of STEM talent continues to be a challenge for eCM. The majority of students participating in the regional competition were White, and proportionally more White and Asian students proceeded to the NJ&EE than Hispanic and Latino/a and Black and African American students. It is recommended for the program to consider doing more to recruit students from schools serving historically underrepresented and underserved groups and to find ways to support these students so that they can potentially progress to the National competition.
2. Participation in eCM overall declined largely in FY16. Nearly 13% of potential participants were not retained through the registration process. Additionally, there was an 18% decrease in the participants from 2015. Retention/attrition through the registration process is something that should be focused on in FY17. It is recommended that there is a concerted effort in FY17 to increase participation in the program overall.

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

Mentors and participants expressed overall satisfaction with the resources available to them through participation in eCM and the eCM website. At the same time, however, both Team Advisors and students reported little familiarity with Army resources such as the AEOP website, the It Starts Here! magazine, and the AEOP brochure. This suggests that participants may not make connections between eCM and some AEOP resources. Interestingly, it was clear in the national student surveys and focus group interviews that the NJ&EE participants recognized the connection between eCM and Army sponsorship – so the lack of familiarity of AEOP resources did not hinder their awareness of eCM being an Army/DoD focused effort. However, better marketing and use of the website, brochure, and other AEOP resources may assist with recruitment for other AEOPs and retention of participants in the AEOP pipeline. Although recent efforts of NSTA to improve the eCM website to make clear the association of eCM with the AEOP, it may be useful to provide AEOP brochures electronically to teams at all state and regional eCM events, and to consider ways in addition to the "Volunteer Spotlight" to communicate a variety of STEM careers available in the DoD, particularly to the state and regional students.

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

Students continue to report having little knowledge of other programs in the AEOP. This is an area of concern due to the overarching goal of creating an AEOP pipeline and retention of participants in additional AEOPs. Although students at the national level and to a lesser extent at the regional level reported gains in their STEM knowledge, confidence and identity, students were largely unaware of programs for which they are or will soon be eligible. Only a quarter of the Team Advisors discussed other AEOP programs with their students. Although NSTA responded appropriately to earlier recommendations by connecting the AEOP logo with the AEOP website and explaining this connection in the video tutorial, the evaluation results suggest that more should be done to make the connection and to inform students of future opportunities in AEOP. In addition, since Team Advisors are an important source of student information, additional efforts should be made to educate Team Advisors about the AEOP and programs for which their students are eligible. One suggestion would be to include a dedicated webinar for Team Advisors and students using the eCM website.

Introduction

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

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.

This report documents the evaluation of one of the AEOP elements, the eCYBERMISSION program (eCM), which is administered on behalf of the Army by the National Science Teachers Association (NSTA). The evaluation study was performed by Purdue University in cooperation with Battelle, the Lead Organization (LO) in the AEOP CA consortium.

Program Overview

eCM is sponsored by the U.S. Army, and managed by the National Science Teachers Association (NSTA). Since the program's inception in 2002, more than 176,000 students from across the United States, U.S. territories, and Department of Defense Educational Activities (DoDEA) schools worldwide have participated in eCYBERMISSION. The program is a web-based science, technology, engineering, and mathematics (STEM) competition designed to engage sixth- to ninth-grade students in real-world, problem-solving Mission Challenges that address local community needs through the use of either scientific practices or the engineering design process. eCYBERMISSION teams work collaboratively to research and implement their projects, which are documented and judged via the submission of Mission Folders hosted on the eCYBERMISSION website.

The five eCM-R sites received applications from 20,607 students and were able to accommodate 100% of the applications. This represents a 18% decrease in participants from FY15 when 24,268 students participated. Table 1 summarizes final participation by site.

Table 1. FY16 eCM State-Level Participation

State/DoDEA/ Territories	No. of Participants	State/DoDEA/ Territories	No. of Participants
AA	0	**NH**	10
AE-E	72	**NJ**	1769
AK	33	**NM**	98
AL	265	**NV**	380
AP	209	**NY**	217
AR	210	**OH**	735
AS	0	**OK**	41
AZ	1187	**OR**	18
CA	2228	**PA**	187
CO	124	**PR**	270
CT	281	**RI**	30
DC	0	**SC**	111
DE	4	**SD**	0
FL	3921	**TN**	742
GA	851	**TX**	1991
GU	115	**UT**	206
HI	103	**VA**	602
IA	43	**VT**	110
ID	30	**WA**	346
IL	360	**WI**	290
IN	127	**WV**	171
KS	45	**WY**	24
KY	156	**China**	4
LA	52	TOTALS	20607
MA	181		
MD	160		
ME	48		
MI	354		
MN	82		
MO	265		
MS	140		

MT	33		
NC	341		
ND	235		
NE	0		

Table 2. 2016 eCM Participation

Participant Group	No. of total Participants	No. of regional Participants	No. of national Participants
Students Grade 6	4804	54	19
Students Grade 7	6107	55	19
Students Grade 8	8248	55	26
Students Grade 9	1448	52	22
Team Advisors from Community	20	4	4
Team Advisors from DoDEA	21	2	1
Team Advisors from Home School	3	1	1
Team Advisors from Other	31	3	3
Team Advisors from Private	81	8	1
Team Advisors from Public	636	39	13
Total	**Team Advisors 808 Participants 20,607**	**Team Advisors 57 Participants 216**	**Team Advisors 23 Participants 86**

Regional participation data (20,607 participants, self-reported) indicate that 51% of participants were female and 49% were male. Eighteen regions reported data on race/ethnicity. Nearly half (49%) of students identified themselves as White with another 18% identifying themselves as Hispanic or Latino/a. While 8% of students chose not to report their race/ethnicity, 8% identified themselves as Black or African American and 11% as Asian. Native American students comprised 1% of the students reporting their race/ethnicity, while .7% was reported as Native Hawaiian or Pacific Islanders.

Of the regional finalists (n=216), there were slightly more females (51%) than males. Proportionally, a slightly higher percentage of White students proceeded to the finals for regional (56%), followed by 24% of students identifying as Asian, and 8% identifying as Hispanic or Latino/a. Only 2% of Black or African American students progressed to the regional finals, and .4% of Native Americans or Alaskans and .4% of Native Hawaiians or other Pacific Islanders were regional finalists.

National finalists consisted of 45% males. The race/ethnicity demographics for national finalists were, from highest percentage to lowest, 47% Asian, 31% White, 7% Hispanic or Latino/a, 7% choose not to report, 5% identified as other, 2% Black or African American, and 1% Native Hawaiian or other Pacific Islander. As the competitions progressed, a

proportionally higher percent of Asians participated in both regionals and nationals, while a higher population of Whites participated in regionals, but not nationals. After an initial dip in the percentage of Hispanic or Latino/a students to regionals, the percentage of this category of race/ethnicity remained the same for nationals. The opposite trend occurred for Black or African American students, who stayed constant for regional competition, but decreased for national competition.

The total cost of the 2016 eCM program was $2,886,022, including $747,194 provided in scholarships and awards. Undergraduate tuition scholarships to winners at the eCM-R and eCM-N events are payable to the students' college of enrollment upon matriculation. The average cost per student participant for 2016 eCM was $140.00.

Table 3. 2016 eCM Program Costs	
2016 eCM – Summative Cost Breakdown	
Total Cost	$3,038,180
Scholarship/Awards Cost	$747,194
STEM Research Kits/Supplies Cost	$168,435
Travel	$61,983
Indirect Cost	$437,344
Materials and Supplies	$187,233
National Event Cost	$335,599
Administrative Cost	$950,234
Cost Per Student Participant	$147

Evidence-Based Program Change

The AEOP had three key priorities for programs in FY16: (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. The FY16 eCM Program Objectives and associated actions/tasks which were developed in light of programmatic recommendations from the Army and LO, the key AEOP priorities, site visits conducted by NSTA and the LO, and the FY15 eCM evaluation study are listed below:

I. Increase number of student and Team Advisor registrants and folder submissions.

Activities:

a. Exhibited and presented at 45 national, state, and regional education conferences/meetings with a total attendance of 98,402.
b. Launched telemarketing campaign with purchased lists primarily targeted to previous participants and middle-level science educators.
c. Sent recruiting e-blasts to past Team Advisors (TAs) and leads from conferences.

d. Distributed STEM kits for Team Advisors and students as incentive to register early.
e. Refined customer service by assigning a Point of Contact (POC) for each competition region, a POC to work with just the Mini-Grant Team Advisors, and a POC for the state of Florida and launched a completion campaign.
f. Supported Ambassadors with training and materials in their efforts to recruit participants from local schools.

II. Increase the number of paricipants from Title I schools:

Activities:

a. Targeted Mini-Grant outreach to Title I schools/districts.
b. Set up meetings with district leadership and curriculum specialists in Title I districts.

III. Increase number of volunteers and Army volunteers:

Activities:

a. Conducted 16 Roadshows at Army Installations to promote volunteer participation as Ambassadors, CyberGuides, and Virtual Judges. In total, 32 Army Labs and Organizations supported eCYBERMISSION and participated in the Army Volunteer Incentive Program.
b. Promoted volunteer opportunities at targeted conferences, via social media and telemarketing/email campaigns, and through outreach to universities and colleges.
c. Supported and further engaged registered volunteers with monthly Mission Minutes newsletters, bimonthly Live CyberGuide Chats and Discussion Forum, online training materials, and personal contact via phone and email.
d. Managed the competition judging process including the training and support of Pre-Screeners, Virtual Judges, Regional Judges, and National Judges. The relationship established during judging is imperative to volunteer retention and recruitment.

IV. Increase Team Advisor retention rate and implement programs to exceed our target rate:

Activities:

a. Use new Team Advisor mentoring program.
b. Updated TA resources on the website.
c. Reached out to TAs from previous competition years to re-engage them as TAs, volunteers, or Team Advisors.
d. Distributed five TA newsletters to help TAs guide their teams to successful submission.
e. Provided a TA STEM activity kit to all registered TAs.
f. Provided personalized customer service with a specific POC for each region, Florida, and Mini-Grants.

V. Increase number of classroom integrated programs:

Activities:

a. Promoted Mini-Grant opportunity to schools, districts, and at national conferences.
b. Administered award program.
c. Awarded 95 Mini-Grants to Team Advisors from 48 schools with 8,916 students.
d. Met with school district officials to promote district-wide or grade-level adoption of eCYBERMISSION.
e. Assigned a POC for Mini-Grant awardees to support them throughout the competition.

VI. Increase number of students from DoDEA schools:

Activities:

a. Reached out to stateside DoDEA principals via email.
b. Telemarketing and e-marketing outreach to previous TAs included TAs at DoDEA schools.

VII. Increase participants' awareness of other AEOP and DoD STEM opportunities and Army/DoD technologies; and increase stduent interest in STEM learning and pursuit of STEM-related degrees:

Activities:

a. Hosted 14 CyberGuide Live Chats with STEM professionals.
b. Encouraged student and TA use of Discussion Forums and Team Talk to connect with CyberGuides.
c. During NJ&EE, AEOP Alumni panel and Sci/Tech Keynote as well as the S/E Team Advisors and STEM Challenge Workshop leaders exposed students to breadth and depth of AEOP and DoD/Army research and career opportunities.

FY16 Evaluation At-A-Glance

Purdue University, in collaboration with NSTA, collected the FY16 evaluation data for the eCM program. The eCM logic model below presents a summary of the expected outputs and outcomes for the eCM program in relation to the AEOP and eCM-specific priorities. This logic model provided guidance for the overall eCM evaluation strategy.

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• NSTA providing oversight for all aspects of the competition. • Students participating in state, regional and national levels • STEM professionals and educators serving as Team Advisors, judges, CyberGuides, and Ambassadors • Awards for student competitors, and teams. All students who submit a mission folder also receive recognition. • Centralized branding and comprehensive marketing • Centralized evaluation	• Students conduct "authentic" STEM research. • Students recognize the real-life applications of STEM. • Teams of three or four students are instructed to ask questions or define problems and then construct explanations or design solutions based on identified problems in their community. • Team Advisors oversee the student led projects. • STEM professionals judge the top 60 teams during the regional judging. • Regional winners advance to the NJ&EE. • Program activities that expose students to AEOP programs and/or STEM careers in the Army or DoD.	• Number and diversity of student participants engaged in programs • Number and diversity of STEM professionals and educators serving as research Team Advisors, CyberGuides, Ambassadors, and Judges. • Number and diversity of DoD scientists and engineers and other military personnel engaged in programs • Number and Title 1 status of 6-9 grade schools served through participant engagement • Students, Team Advisors and NSTA contributing to evaluation	• Increased participant knowledge, skills and abilities, and confidence in STEM • Increased student interest in future STEM engagement • Increased participant awareness of and interest in other AEOP opportunities • Increased participant awareness of and interest in DoD STEM research and careers • Implementation of evidence-based recommendations to improve eCM regional and national programs	• Increased student participation in other AEOP and DoD-sponsored programs • Increased student pursuit of STEM coursework in secondary and post-secondary schooling • Increased student pursuit of STEM degrees • Increased student pursuit of STEM careers • Increased student pursuit of DoD STEM careers • Continuous improvement and sustainability of eCM

The eCM evaluation gathered information from multiple participant groups about eCM 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 eCM program objectives.

Key Evaluation Questions

- What aspects of regional and national eCM programs motivate participation?
- What aspects of regional and national eCM program structure and processes are working well?
- What aspects of the regional and national eCM programs could be improved?
- Did participation in eCM programs:
  - Increase student competencies in STEM?
  - Increase student interest in or motivation for future engagement in STEM?
  - Increase student awareness of and interest in other AEOP opportunities?
  - Increase student awareness of and interest in DoD STEM careers?
- To what extent were there differences in student experiences and benefits between Regional and National eCM?

The assessment strategy for eCM included student and Team Advisor questionnaires, two focus groups with eCM students at NJ&EE; two focus group interviews with Team Advisors at NJ&EE, observations at NJ&EE; and the Annual Program Report (APR) prepared by NSTA. Tables 4-9 outline the information collected in student and Team Advisor questionnaires, and focus groups, as well as information from the APR that is relevant to this evaluation report.

Table 4. 2016 Student Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, age, grade level, race/ethnicity, and socioeconomic status indicators
	Education Intentions: Degree level, confidence to achieve educational goals, field sought
AEOP Goal 1	**Capturing the Student Experience:** In-school vs. In-program experience; Team Advisored research experience and products (students)
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	STEM Identity: Gains in STEM identity, intentions to participate in STEM, and STEM-oriented education and career aspirations; contribution of AEOP
	Future STEM Engagement: Gains in interest/intent for future STEM engagement (informal activities, education, career)
	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 Team Advisor/teaching strategies (students respond to a subset)
	Comprehensive Marketing Strategy: How students learn about AEOP, motivating factors for participation, impact of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers
	Program Specific Online Resources: Usefulness of online resources for participating in AEOP
Satisfaction & Suggestions	Benefits to participants, suggestions for improving programs, overall satisfaction

Table 5. 2016 Team Advisor Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, race/ethnicity, occupation, past participation
Satisfaction & Suggestions	Awareness of eCM, motivating factors for participation, satisfaction with and suggestions for improving eCM programs, benefits to participants
AEOP Goal 1	**Capturing the Student Experience:** In-program experience
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	AEOP Opportunities: Past participation, awareness of other AEOP programs; efforts to expose students to AEOPs, impact of AEOP resources on efforts; contribution of AEOP in changing student AEOP metrics
	Army/DoD STEM: attitudes toward Army/DoD STEM research and careers, efforts to expose students to Army/DoD STEM research/careers, impact of AEOP resources on efforts; contribution of AEOP in changing student Army/DoD career metrics
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of Team Advisor/teaching strategies
	Comprehensive Marketing Strategy: How Team Advisors learn about AEOP, usefulness of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers
	Program Specific Online Resources: Usefulness of online resources for supporting students in participating in AEOP

Table 6. 2016 Student Focus Group	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in eCM, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of eCM, motivating factors for participation, involvement in other science competitions in addition to eCM, satisfaction with and suggestions for improving eCM programs, benefits to participants
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Extent to which students were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Extent to which students were exposed to STEM and Army/DoD STEM jobs

Table 7. 2016 Team Advisor Focus Group	
Category	**Description**
Profile	Gender, race/ethnicity, occupation, organization, role in eCM, past participation in eCM, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of eCM, benefits to participants suggestions for improving eCM programs
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Efforts to expose students to AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Efforts to expose students to STEM and Army/DoD STEM jobs
	Mentor Capacity: Local Educators – Strategies used to increase diversity/support diversity in eCM

Table 8. 2016 Annual Program Report	
Category	**Description**
Program	Description of symposia categories and activities
AEOP Goal 1 and 2 Program Efforts	**Underserved Populations:** mechanisms for marketing to and recruitment of students from underserved populations
	Army STEM: Army/DoD STEM Careers – Exposure to Army STEM research and careers (varies by regional, national event); Participation of Army engineers and/or Army research facilities in event activities (varies by regional, national event)
	Mentor Capacity: Local Educators - University faculty and student involvement, teacher 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. Focus group protocols are provided in Appendix B (students) and Appendix C (Team Advisors); questionnaires are provided in Appendix D (regional students), Appendix E (national students), and Appendix F (Team Advisors). Major trends in data and analyses are reported herein.

Study Sample

Questionnaire responses were received from 2,926 eCM students, 79 NJ&EE participants, and 178 Team Advisors participating in eCM. Table 9 shows the number of student and Team Advisor respondents by site.

Table 9. 2016 eCM Site Survey Respondent Numbers						
2016 eCM Site	**eCM Student Participants**		**eCM-NJ&EE Student Participants**		**Adults (Team Advisors, etc.)**	
	No. of Participants	**No. of Survey Respondents**	**No. of Participants**	**No. of Survey Respondents**	**No. of Participants**	**No. of Survey Respondents**
Alabama	265	53	0	0	9	2
Alaska	33	1	0	0	2	0
Arizona	1,187	85	0	2	23	4
Arkansas	210	1	3	0	8	3
Armed Forces Pacific	209	12	0	0	7	1
Armed Forces Europe	72	0	0	0	6	0
California	2,228	429	7	4	50	14
Colorado	124	18	0	0	4	0
Connecticut	281	1	0	0	24	2
Delaware	4	0	0	0	5	0
District of Colombia	0	0	0	0	1	0
Florida	3,921	47	4	4	94	12
Georgia	851	101	4	3	38	4
Guam	115	0	0	0	3	0
Hawaii	103	0	0	0	7	1
Idaho	30	20	0	0	1	1
Illinois	360	10	11	8	27	6
Indiana	127	28	0	0	5	1
Iowa	43	0	4	1	4	0
Kansas	45	1	0	0	11	5
Kentucky	156	0	0	0	5	0
Louisiana	52	0	0	0	6	0
Maine	48	6	4	0	4	1
Maryland	160	58	0	0	7	0
Massachusetts	181	0	0	0	12	0
Michigan	354	12	0	0	13	2
Minnesota	82	0	0	0	6	0
Mississippi	140	0	0	0	3	2
Missouri	265	7	0	0	16	3
Montana	33	7	3	2	5	5
Nebraska	0	0	0	0	1	0
Nevada	380	17	4	2	14	2
New Hampshire	10	0	0	0	2	0
New Jersey	1,769	150	0	0	56	7

New Mexico	98	0	3	3	3	1
New York	217	8	4	4	24	5
North Carolina	341	3	0	0	20	6
North Dakota	235	1	0	0	5	2
Ohio	735	117	4	3	14	5
Oklahoma	41	0	0	0	5	1
Oregon	18	0	0	0	4	1
Pennsylvania	187	12	0	0	22	4
Puerto Rico	270	0	4	1	10	0
Rhode Island	30	1	0	0	1	1
South Carolina	111	32	0	0	10	4
Tennessee	742	60	4	4	19	5
Texas	1,991	201	7	3	91	9
Utah	206	39	0	0	10	0
Vermont	110	5	0	0	4	1
Virginia	602	8	12	10	44	7
Washington	346	16	0	0	13	1
West Virginia	171	60	0	0	3	2
Wisconsin	290	3	0	0	16	4
Wyoming	24	0	0	0	3	1
Did Not Provide Regional Site in Survey		1,383		29		42
International	4	0	4	0	2	0
Total	**20,607**	**1,630**	**86**	**83**	**802**	**180**

Table 10 provides an analysis of student and Team Advisor participation in the eCM 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 student and Team Advisor surveys is larger than generally acceptable, indicating that the samples may not be representative of their respective populations.

Focus groups were conducted at the NJ&EE in Leesburg, Virginia. The two student focus groups included 28 students ranging from grades 6 to 9. Two Team Advisor focus groups were also conducted at the NJ&EE, which included 23 Team Advisors. 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 eCM's efforts and impact, and highlight areas for future exploration in programming and evaluation.

Table 10. 2016 eCM Questionnaire Participation				
Participant Group	**Respondents (Sample)**	**Total Participants (Population)**	**Participation Rate**	**Margin of Error @ 95% Confidence[1]**
eCM Students	2,926	20,607	14%	1.68±%
eCM NJ&EE Students	79	86	92%	3.16±%
Team Advisors	82	802	10%	10.26±%

Respondent Profiles

Student Demographics

Table 11 illustrates demographic information collected from FY16 eCM questionnaire respondents. In regard to gender, total survey respondents for participants in eCM n=2,910 (42% female, 38% male, 20% no report); for participants in the eCM-NJ&EE n = 86 (44% female, 49% male, 7% no report). Slightly more females than males completed the questionnaire. Among eCM respondents, more participants identified with the race/ethnicity category of White (60%) than any other single race/ethnicity category. Survey participants who competed at the NJ&EE were predominantly Asian (47%) and White (34%). However, there is some representation of Hispanic or Latino populations overall (11%) and also for those who participated at the NJ&EE and completed the survey (8%). Participation in the survey by grade was highest for 9th graders (36%). Most of eCM survey respondents reported that they did not qualify for free or reduced-price lunch (FRL)—a common indicator of low-income status (86% overall and 71% of NJ&EE participants). A majority of respondents overall attended public schools (68%) and respondents at NJ&EE were comprised of 23% public school students. Finally, nearly half of the participants in the survey attended schools in suburban areas (eCM-R 51%; eCM-N 43%).

Survey respondent demographics had a somewhat different distribution from the overall respondents as compared to the NJ&EE respondents. Students reporting an Asian race/ethnicity had an increased representation from overall (13%) to NJ&EE (47%), whereas Native American or Alaska Native, and Native Hawaiian or Other Pacific Islander representation stayed somewhat the same comparing overall to NJ&EE (0.5% to 1%, and 0.5% to 1%, respectively). Students reporting as being Black or African American, Hispanic or Latino/a, and White experienced decreased participation from overall to NJ&EE (5% to 3%, 11% to 8% and 60% to 34%, respectively). In FY16 there were no eCM participants who reported past participation in other AEOPs. However, two NJ&EE participants and three overall participants reported past participation in eCM.

Based upon demographic information provided by eCM overall questionnaire respondents, it appears that eCM was successful in attracting participation from female students—a population that is historically underrepresented in some STEM fields. These data suggest that eCM had limited success in providing outreach to students from historically

[1] "Margin of error @ 95% confidence" means that 95% of the time, the true percentage of the population who would select an answer

underserved and underrepresented race/ethnicity and low-income groups, however the number of Hispanic and Latino/a students participating in regionals was encouraging. Consistent use of Cvent as a centralized registration tool may more accurately capture eCM's success at serving students from historically underserved and underrepresented populations. Questionnaire respondent data suggest that regional symposia engage larger proportions of underserved and underrepresented groups than the eCM-N. In particular, 5% of eCM-R respondents identified themselves as Black or African American as compared to only 3% of eCM-N students. Likewise, 11% of eCM-R respondents identified themselves as Hispanic or Latino as compared to only 8% of eCM-N students.

Table 11. 2016 eCM Student Respondent Profile

Demographic Category	eCM Questionnaire Respondents		eCM-NJ&EE Questionnaire Respondents	
Respondent Gender (eCM n = 2,910 eCM NJ&EE n =86)				
Female	1,245	42%	35	44%
Male	1,121	38%	39	49%
Choose not to report	567	20%	6	7%
Respondent Race/Ethnicity (eCM n = 2,910, eCM NJ&EE n = 78)				
Asian	368	13%	37	47%
Black or African American	149	5%	2	3%
Hispanic or Latino	315	11%	6	8%
Native American or Alaska Native	15	0.5%	0	0%
Native Hawaiian or Other Pacific Islander	17	0.5%	1	1%
White	1,744	60%	27	34%
Other race or ethnicity (specify):[†]	117	4%	3	4%
Choose not to report	185	6%	2	3%
Respondent Grade Level (eCM n = 2,926, eCM NJ&EE n = 79)				
6th	101	4%	5	6%
7th	705	24%	13	17%
8th	892	30%	18	23%
9th	1,054	36%	27	34%
Other	174	6%	16	20%
Respondent Eligible for Free/Reduced-Price Lunch (eCM n = 2,935, eCM NJ&EE n = 82)				
Yes	593	20%	8	10%
No	2,073	71%	71	86%
Choose not to report	269	9%	3	4%

[†] Other = "White-Asian," "Latina-Asian," "Asian (Thailand)," "Middle Eastern," "White and Indian," "Hindu," "Haitian," "Jewish," "Mixed (Asian/White)"

Team Advisor/Adult Participant (Mentor) Demographics

Table 12 summarizes the 2016 Mentor demographic information. With regard to gender, more responding Team Advisors were female than male (64% vs. 35%). As with the responding students, most of the responding Team Advisors identified themselves as White (73%). The majority of the Team Advisors were teachers (85%) while scientist, engineer,

or mathematics professionals made up 4% of the Team Advisors. Many Team Advisors responded in more than one category for the question about their role, resulting in teachers being the most frequent response (68%), followed by competition advisor (48%), and research Team Advisor (13%). For additional characteristics of the Team Advisors, please see Appendix C.

Table 12. 2016 eCM Mentor Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 176)		
Female	113	64%
Male	62	35%
Choose not to report	1	1%
Respondent Race/Ethnicity (n = 177)		
Asian	15	8%
Black or African American	10	6%
Hispanic or Latino	9	5%
Native American or Alaska Native	1	1%
Native Hawaiian or Other Pacific Islander	2	1%
White	129	73%
Other race or ethnicity, (specify):[†]	2	1%
Choose not to report	9	5%
Respondent Occupation (n = 176)		
Teacher	151	85%
Other school staff	1	1%
University educator	2	1%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	1	1%
Scientist, Engineer, or Mathematics professional	7	4%
Other, (specify):[‡]	14	8%
Respondent Role in eCM (n = 178)*		
Research Mentor	24	13%
Competition advisor	86	48%
Other, (specify)[§]	10	6%
Teacher	116	65%

*Note: Some Team Advisors selected more than one option for this response, resulting in than 100% response rate for this item.

‡ No responses provided.

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 4-9. A focus of the Actionable Program Evaluation is efforts toward the long-term goal of eCM 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. eCM Team Advisors and volunteers are engaged in outreach efforts to identify underrepresented populations who are capable of succeeding in eCM. Thus, it is important to consider how eCM is marketed and the factors that motivate students to participate in eCM, 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 student and Team Advisor perceptions that pertain to current programmatic efforts and recommend evidence-based improvements to help eCM achieve outcomes related to AEOP programs and objectives—specifically, to help eCM continue to expand participation from and support STEM education for students from underrepresented groups.

Marketing and Recruiting Underrepresented Populations

eCM recruits Team Advisors who engage in outreach activities specifically targeted to recruiting populations underrepresented in STEM careers. These efforts are largely developed and implemented at a local level. Other recruitment methods in 2016 included:

- Personal contact and networking with individual teachers and high school administration;
- Presentations at statewide teachers association meetings and national conferences;
- Advertising via listserves and newsletters reaching science teachers;
- Advertising in journals targeted to 6^{th}-9^{th} grade educators;
- - Telemarketing campaign targeted to teachers in 6-9 grade that are in STEM fields;
- Promotions on social media.

Students were asked to respond to an evaluation questionnaire item asking students to select all of the different ways they heard about eCM in order to determine what recruitment methods are most effective. As seen in Table 13, 48% of students learned about eCM from someone who works at the school they attend, followed by 36% of students learning about eCM from a school newspaper or website. Less than 10% of students learned from other sources and 18% chose not to respond to this question.

Table 13. How Students Learned About eCM (n=19,402

	Response Percent	Response Total
AEOP on Facebook, Twitter, Pinterest, or other social media	0.64%	124
Army Educational Outreach Program (AEOP) website	1.35%	261
Choose not to respond	17.90%	3,472
Community group or program	2.11%	410
Family member	1.91%	371

Friend	7.20%	1,396
Friend or co-worker of a family member	0.77%	149
Part participant of program	5.93%	1,150
School or university newsletter email or website	36.05%	6,994
Someone who works at the school or university I attend	47.81%	9,277
Someone who works with program	2.30%	446
Someone who works with the Department of Defense (Army, Navy, Air Force)	0.84%	163

Team Advisors/Adults were also asked how they learned about eCM in the evaluation questionnaire (see Table 14). The most frequent responses were personal contacts, including a past eCM participant (33%), a colleague (20%), or a supervisor (14%). In addition, 17% learned from a STEM or STEM education conference and 12% learned from an email or newsletter from a school, university, or a professional organization.

Table 14. How Adults/Team Advisors Learned About eCM (n=177)

	Response Percent	Response Total
Academy of Applied Science (AAS) website	0.56 %	1
Army Educational Outreach Program (AEOP) website	6.78 %	12
AEOP on Facebook, Twitter, Pinterest, or other social media	0.00 %	0
A STEM conference or STEM education conference	16.95 %	30
An email or newsletter from school, university, or a professional organization	11.86 %	21
Past eCybermission participant	32.77 %	58
A student	2.82 %	5
A colleague	19.77 %	35
My supervisor or superior	14.12 %	25
A eCybermission site host or director	3.95 %	7
Workplace communications	9.04 %	16
Someone who works with the Department of Defense (Army, Navy, Air Force)	2.26 %	4
Other, (specify):	15.25 %	27

Factors Motivating Student Participation

Table 15 conveys the motivating factors for students to participate in eCM. For the eCM participants, the top two motivating factors were interest in teacher encouragement (18%), and equal factors include an academic requirement (13%) and having fun (13%). The other highest ranked factor was an interest in STEM (10%).

Table 15. Motivating Factors for Students to Participate in eCM

Item	eCM Participants (n = 20,607)
Teacher encouragement	17.73%
Interest in science, technology, engineering, or mathematics (STEM)	9.88%
Learning in ways that are not possible in school	2.39%
Desire to expand laboratory or research skills	2.04%
Figuring out education or career goals	2.03%
Desire to learn something new or interesting	10.40%
Building college application or resume	3.25%
Opportunity to use advanced laboratory technology	1.70%
Having fun	12.96%
Networking opportunities	1.11%
Recommendations of past participants	0.89%
Serving the community or country	4.28%
The program Team Advisor(s)	0.19%
An academic requirement or school grade	12.34%
Opportunity to do something with friends	3.94%
Earning stipends or awards for doing STEM	1.22%
Interest in STEM careers with the Army	1.32%
Exploring a unique work environment	2.40%
Seeing how school learning applies to real life	3.02%
Choose not to report	6.84%

Student focus group participants mentioned several motivators that were not on the questionnaire, although most focus group participants indicated that they were motivated to participate by their teachers and the course requirement that they participate in eCM. Other motivating factors included family members encouraging the students to take the opportunities that eCM offered. As students replied:

> *My friends and I, we really like STEM. One of our friends' mom actually suggested that we do the eCYBERMISSION project, so we just had to do it. We had a lot of fun.* (eCM-N Student)

I have an older brother who did eCYBERMISSION in previous years. He told me it was a good opportunity to research and create something. (eCM-N Student).

The eCM Experience

Team Advisors were asked questions about the nature of their students' experiences (Table 16 and 17). Overall, their responses more closely resembled eCM overall students' responses than eCM-NJ&EE students' responses, however Team Advisors' reports of interactions with STEM professionals (36% reported students doing this most days or every day) and learning about STEM careers (33% reported students doing this most days or every day) were substantially lower than students' report.

Table 16. Nature of Student Activities for eCM-N Respondents (n=82)

	Not at all	At least once	A few times	Most days	Every day	Response Total
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	1.2%	3.7%	12.2%	39.0%	43.9%	
	1	3	10	32	36	**82**
Apply STEM learning to real-life situations	1.2%	3.7%	15.9%	35.4%	43.9%	
	1	3	13	29	36	**82**
Learn about new discoveries in STEM	1.2%	9.9%	8.6%	46.9%	33.3%	
	1	8	7	38	27	**81**
Learn about different careers that use STEM	1.2%	11.0%	15.9%	39.0%	32.9%	
	1	9	13	32	27	**82**
Interact with scientists or engineers	3.7%	17.1%	15.9%	26.8%	36.6%	
	3	14	13	22	30	**82**
Communicate with other students about STEM	2.4%	8.5%	12.2%	24.4%	52.4%	
	2	7	10	20	43	**82**

Table 17. Nature of Student Activities for eCM-R Respondents (n = 2,912)

	Not at all	At least once	A few times	Most days	Every day	Response Total
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	12.5%	14.5%	27.1%	27.5%	18.3%	
	364	422	787	799	532	**2,904**
Apply STEM learning to real-life situations	18.5%	20.3%	29.7%	20.0%	11.4%	
	532	586	857	578	330	**2,883**
Learn about new discoveries in STEM	20.4%	21.2%	31.1%	18.6%	8.6%	
	583	607	891	533	247	**2,861**
Learn about different careers that use STEM	23.2%	23.3%	30.6%	15.9%	7.0%	
	663	665	875	454	200	**2,857**
Interact with scientists or engineers	39.8%	23.8%	20.8%	8.7%	6.8%	
	1,143	684	598	249	195	**2,869**
Communicate with other students about STEM	22.4%	18.4%	24.0%	20.2%	15.0%	
	646	532	692	585	434	**2,889**

Increasing both the number and diversity of students who pursue STEM careers is one goal of the AEOP. Therefore, the student questionnaire asked participants to report how many STEM jobs/careers in general as well as DoD STEM jobs/careers they learned about during their eCM experience. Table 18 and Table 19 illustrates that 14% of overall students reported learning about at least one STEM job/career, and 14% of the overall students reported learning about five or more. 3% of NJ&EE reported learning about at least one DoD STEM job/career, however 67% reported learning about 5 or more different STEM jobs/careers in the DoD. It is clear that participation in NJ&EE yielded great learning for participants about DoD STEM jobs/careers.

Table 18. Number of DoD STEM Jobs/Careers Learned About During eCM Overall (n =2,835)

Number of DoD/STEM Careers	Response Percent	Response Total
None	33.69 %	955
1	14.00 %	397
2	18.91 %	536
3	15.10 %	428
4	4.94 %	140
5 or more	13.37 %	379

Table 19. Number of DoD STEM Jobs/Careers Learned About During eCM NJ&EE (n =77)

Number of DoD/STEM Careers	Response Percent	Response Total
None	1.30 %	1
1	2.60 %	2
2	5.19 %	4
3	9.09 %	7
4	12.99 %	10
5 or more	68.83 %	53

To further explore students' exposure to STEM career opportunities in the DoD, student participants in the focus groups at NJ&EE were asked whether they had learned about these opportunities during eCM. Participants in the eCM-NJ&EE responded that that they had not learned much about STEM jobs/careers with the DoD in eCM before they came to the national conference. The field trips to Washington, DC and workshops with STEM professionals from Army/DoD laboratories for the NJ&EE participants did a great deal to inform students about STEM careers in the DoD, but little was done prior to the national event, implying that students who did not make it to nationals heard little about STEM careers in DoD. For instance:

> *Before we came to Washington, we had a basic knowledge of STEM careers and the Defense but after and during we've been here, I think we've learned a lot more.* (eCM-NJ&EE student)

> *I didn't know a lot about defense and didn't learn a whole lot, but with STEM, I knew about it and I was very involved with it. When the alumni panel came in, I learned a lot more about more opportunities that you can have when you're older*. (eCM-NJ&EE student)

> *My team knew quite a bit about STEM careers before we came here. Once we came here, we learned a lot and we also learned about how the Department of Defense uses a lot of STEM. We didn't really know how much STEM it actually uses*. (eCM-NJ&EE student)

Students were also asked how often they engaged in various STEM practices in eCM. Table 20 shows that more than 90% of eCM-NJ&EE students participated in *all* STEM practices reported on the survey at least once except for building or making a computer model. eCM overall participants reported having engaged in fewer of the STEM practices reported on the survey and less time than the eCM-NJ&EE students. Table 21 shows that the following percentages of eCM overall students participated in the STEM practices everyday: using laboratory procedures and tools (7%); analyzing data from an investigation (16%); and coming up with creative explanations or solutions (13%). Additionally, for each of the activities listed, between 4% and 54% of eCM overall students reported that they had not engaged in the activity at all in eCM.

Table 20. Participant Engagement in STEM Practices in eCM-NJ&EE (n = 81)

	Not at all	At least once	A few times	Most days	Every day	Response Total
Use laboratory procedures and tools	3.7%	2.5%	46.9%	38.3%	8.6%	
	3	2	38	31	7	**81**
Participate in hands-on STEM activities	7.4%	7.4%	46.9%	28.4%	9.9%	
	6	6	38	23	8	**81**
Work as part of a team	0.0%	0.0%	23.8%	51.3%	25.0%	
	0	0	19	41	20	**80**
Identify questions or problems to investigate	0.0%	7.4%	30.9%	35.8%	25.9%	
	0	6	25	29	21	**81**
Design an investigation	6.2%	16.0%	42.0%	27.2%	8.6%	
	5	13	34	22	7	**81**
Carry out an investigation	3.7%	13.6%	44.4%	30.9%	7.4%	
	3	11	36	25	6	**81**
Analyze data or information	1.2%	6.2%	28.4%	49.4%	14.8%	
	1	5	23	40	12	**81**
Draw conclusions from an investigation	1.2%	12.3%	33.3%	40.7%	12.3%	
	1	10	27	33	10	**81**
Come up with creative explanations or solutions	1.2%	9.9%	32.1%	30.9%	25.9%	
	1	8	26	25	21	**81**

Build or make a computer model	37.0%	24.7%	27.2%	9.9%	1.2%	
	30	20	22	8	1	**81**

Table 21. Participant Engagement in STEM Practices in eCM overall (n = 2,928)

	Not at all	At least once	A few times	Most days	Every day	Response Total
Use laboratory procedures and tools	10.0%	14.3%	45.9%	23.3%	6.6%	
	292	416	1,337	678	191	**2,914**
Participate in hands-on STEM activities	15.9%	21.4%	36.1%	20.1%	6.5%	
	460	620	1,045	581	189	**2,895**
Work as part of a team	4.0%	6.3%	27.9%	40.4%	21.4%	
	115	183	804	1,166	617	**2,885**
Identify questions or problems to investigate	7.3%	14.2%	33.9%	29.5%	15.1%	
	211	411	981	856	439	**2,898**
Design an investigation	14.5%	25.1%	35.6%	17.8%	6.9%	
	421	728	1,030	515	201	**2,895**
Carry out an investigation	13.7%	23.6%	34.6%	20.3%	7.8%	
	397	681	999	587	224	**2,888**
Analyze data or information	5.6%	11.6%	34.3%	32.6%	15.8%	
	163	337	994	945	457	**2,896**
Draw conclusions from an investigation	9.4%	15.6%	36.9%	27.4%	10.6%	
	272	450	1,067	793	307	**2,889**
Come up with creative explanations or solutions	7.9%	16.5%	34.9%	27.9%	12.7%	
	229	477	1,007	806	368	**2,887**
Build or make a computer model	54.2%	19.7%	15.6%	6.8%	3.6%	
	1,574	573	454	198	105	**2,904**

A composite score was calculated for this set of items, titled "Engaging in STEM Practices in eCM."[2] 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 score was used to test whether there were differences in student experiences by overall or eCM NJ&EE participation, race/ethnicity group (minority vs. non-minority students), and gender. Significant group differences were found in terms of Engaging with STEM Practices in eCM for both competition level, race/ethnicity, and gender. National eCM participants reported significantly higher levels of engagement with STEM practices in eCM compared to regional participants[3] (small effect of d = 0.263 standard deviations). Minority students reported significantly higher levels compared to White students[4] (very small effect of d = 0.091 standard deviations). Females reported significantly higher levels compared to males[5] (very small effect size of d = .105).

To examine how the eCM experience compares to their typical school experience, students were asked how often they engaged in the same activities in school. The responses were combined into composites[6] that are parallel to the ones asking about eCM. Students reported greater "Learning about STEM" in eCM than in school[7] for both overall (small effect of d = 0.440 standard deviations) and NJ&EE (large effect of d = 1.657 standard deviations) students. Similar results were found for the "Engaging in STEM Practices" composite[8] for overall participants (small effect of d = 0.431 standard deviations) and NJ&EE students (large effect of d = 1.344 standard deviations) (see Chart 1).

[2] The Cronbach's alpha reliability for these 10 items was 0.937.

[3] Two-tailed independent samples t-test: $t(2,965) = 7.16$, $p < 0.001$.

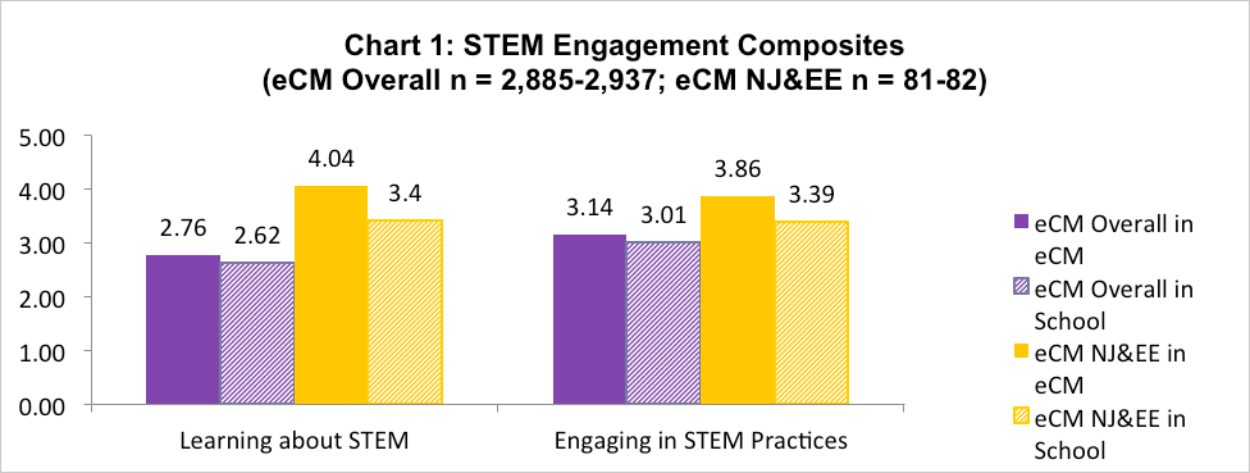
[4] Two-tailed independent samples t-test: $t(2,924) = 2.47$, $p = 0.014$.

[55] Two-tailed independent samples t-test: $t(2,315) = 2.52$, $p = .012$.

[6] "Learning about STEM in School" had a Cronbach's alpha reliability of 0.904. "Engaging in STEM Practices in School" had a Cronbach's alpha reliability of 0.931.

[7] Two-tailed dependent samples t-tests: eCM-R, $t(2,910) = 11.88$, $p < 0.001$; eCM-N, $t(81) = 7.45$, $p < 0.001$.

[8] Two-tailed dependent samples t-tests: eCM-R, $t(2,879) = 11.55$, $p < 0.001$; eCM-N, $t(80) = 6.01$, $p < 0.001$.



The Role of Team Advisors (Mentors)

Team Advisors and other adults that serve as informal Team Advisors play a critical role in the eCM program. Adults/Team Advisors/Mentors provide one-on-one support to students, chaperone students, advise students on educational and career paths, may provide opportunities for students to use laboratory space and/or equipment, and generally serve as STEM role models for eCM students. Over 70% of Team Advisors responding to the adult questionnaire reported working with 5 or fewer students, with a range of 0 to 50 students. Adults were asked whether or not they used a number of strategies when working with students. These strategies comprised five main areas of effective Team Advising: [9]

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.

Table 22 indicates that a majority of responding adults used multiple strategies to establish relevance of learning activities to students. For example, more than three-quarters of the Team Advisors tried to learn about the students and their interests at the beginning of the program (76%), gave students real-life problems to solve (89%), encouraged students to suggest new reading, activities, or projects (87%), helped students become aware of the role(s) of STEM in

[9] 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.

their everyday lives (86%), helped students understand the role of STEM in their community (89%), and asked students to relate real-life situations to eCM. More than half of the Team Advisors also selected readings or activities that related to students' backgrounds (56%).

Table 22. Team Advisors Using Strategies to Establish the Relevance of Learning Activities (n = 174)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Become familiar with my student(s) background and interests at the beginning of the eCM experience	75.9%	24.1%	
	132	42	**174**
Giving students real-life problems to investigate or solve	88.5%	11.5%	
	154	20	**174**
Selecting readings or activities that relate to students' backgrounds	55.8%	44.2%	
	96	76	**172**
Encouraging students to suggest new readings, activities, or projects	87.4%	12.6%	
	152	22	**174**
Helping students become aware of the role(s) that STEM plays in their everyday lives	85.6%	14.4%	
	149	25	**174**
Helping students understand how STEM can help them improve their own community	89.0%	11.0%	
	154	19	**173**
Asking students to relate real-life events or activities to topics covered in eCybermission	90.2%	9.8%	
	157	17	**174**

Adults/Team Advisors also reported using a variety of strategies to support the diverse needs of students as learners. As can be seen in Table 23, 94% of Team Advisors reported using a variety of teaching and/or Team Advising activities to meet the needs of students while 81% directed students to additional resources as needed and 81% interacted with students and other personnel the same way regardless of their backgrounds. More than half of adults (63%) reported providing extra readings, activities, or learning support for students who lacked essential skills and 61% integrated ideas from education literature to reach students from typically underrepresented groups in STEM. Nearly half of responding adults also reported using strategies such as identifying different learning styles students may have at the beginning of

their eCM experience (55%) and highlighting under-representation of women and racial and ethnic minority populations in STEM (48%).

Table 23. Team Advisors Using Strategies to Support the Diverse Needs of Learners (n = 174)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Identify the different learning styles that my student (s) may have at the beginning of the eCM experience	54.6%	45.4%	
	95	79	**174**
Interact with students and other personnel the same way regardless of their background	82.1%	17.9%	
	142	31	**173**
Use a variety of teaching and/or Team Advisoring activities to meet the needs of all students	93.6%	6.4%	
	161	11	**172**
Integrating ideas from education literature to teach/Team Advisor students from groups underrepresented in STEM	61.3%	38.7%	
	106	67	**173**
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	63.2%	36.8%	
	110	64	**174**
Directing students to other individuals or programs for additional support as needed	81.0%	19.0%	
	141	33	**174**
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	48.0%	52.0%	
	83	90	**173**

Team Advisors used a variety of strategies to support students' development of collaboration and interpersonal skills (see Table 24). For example, 90% of respondents had students listen to the ideas of others with an open mind, 89% of Team Advisors had students give and receive constructive feedback with others, 85% had students explain difficult ideas to others, and 83% had students exchange ideas with others whose backgrounds or viewpoints are different from their own.

Table 24. Team Advisors Using Strategies to Support Participant Development of Collaboration and Interpersonal Skills (n = 170)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Having participant(s) tell other people about their backgrounds and interests	50.3%	49.7%	
	85	84	**169**
Having participant(s) explain difficult ideas to others	84.7%	15.3%	
	144	26	**170**
Having participant(s) listen to the ideas of others with an open mind	90.0%	10.0%	
	153	17	**170**
Having participant(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	82.9%	17.1%	
	141	29	**170**
Having participant(s) give and receive constructive feedback with others	88.8%	11.2%	
	150	19	**169**

Team Advisors were also asked to indicate what strategies they used to support student engagement in authentic STEM activities (Table 25). Over three-quarters of respondents indicated that employed most of the strategies on the survey. For example, they allowed students to work independently to improve their self-management skills (92%), provided students with constructive feedback to improve their STEM competencies (92%), supervised students while they practices STEM research skills (88%), and had students search for and review technical research to support their work (79%). Over half of Team Advisors (68%) also reported teaching (or assigning readings) about specific STEM subject matter.

Table 25. Team Advisors Using Strategies to Support Participant Engagement in Authentic STEM Activities (n = 171)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Teaching (or assigning readings) about specific STEM subject matter	68.0%	32.0%	
	115	54	**169**
Having participant(s) search for and review technical research to support their work	88.8%	11.2%	
	151	19	**170**
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	78.8%	21.2%	
	134	36	**170**
Supervising participant(s) while they practice STEM research skills	87.7%	12.3%	
	150	21	**171**
Providing participant(s) with constructive feedback to improve their STEM competencies	91.8%	8.2%	
	157	14	**171**
Allowing participant(s) to work independently to improve their self-management abilities	91.7%	8.3%	
	155	14	**169**

Finally, Team Advisors were asked to report on the Advising strategies they used to support students' STEM educational and career pathways (see Table 26). The majority of responding Team Advisors reported using strategies such as asking students about their educational and career interests (64%), providing guidance to students about educational pathways that would prepare them for a STEM career (62%), and discussed STEM career opportunities in private industry or academia (53%).

Given the AEOP goal of increasing participants' awareness of DoD STEM career opportunities, it is noteworthy that roughly only a quarter of adults (28%) reported discussing STEM career opportunities with the DoD or other government agencies. Likewise, although an AEOP goal is to increase participants' awareness of AEOP opportunities, only 22% of adults reported recommending other AEOPs that align with student goals.

Table 26. Team Advisors Using Strategies to Support Participant STEM Educational and Career Pathways (n = 172)

	Yes - I used this strategy	No - I did not use this strategy	Response Total
Asking participant(s) about their educational and/or	64.3%	35.7%	

career goals	110	61	**171**
Recommending extracurricular programs that align with participants' goals	44.8%	55.2%	
	77	95	**172**
Recommending Army Educational Outreach Programs that align with participants' goals	21.6%	78.4%	
	37	134	**171**
Providing guidance about educational pathways that will prepare participant(s) for a STEM career	62.0%	38.0%	
	106	65	**171**
Discussing STEM career opportunities within the DoD or other government agencies	27.9%	72.1%	
	48	124	**172**
Discussing STEM career opportunities in private industry or academia	52.9%	47.1%	
	91	81	**172**
Discussing the economic, political, ethical, and/or social context of a STEM career	49.4%	50.6%	
	84	86	**170**
Recommending student and professional organizations in STEM to my student(s)	44.4%	55.6%	
	76	95	**171**
Helping participant(s) build a professional network in a STEM field	32.6%	67.4%	
	56	116	**172**
Helping participant(s) with their resume, application, personal statement, and/or interview preparations	28.5%	71.5%	
	49	123	**172**

Another item on the questionnaire asked Team Advisors which of the AEOP programs they explicitly discussed with their students during eCM (see Table 27). Not surprisingly, the most frequently discussed program was eCM (91%). Few responding Team Advisors indicated discussing other specific AEOPs with students, and only 27% of Team Advisors discussed AEOP programs in general. Of those Team Advisors who did report discussing specific AEOPs, the most frequently discussed programs were UNITE (7%) and JSHS (8%).

Table 27. Team Advisors Responses to AEOP Programs that were Explicitly Discussed with Participants (n = 171)

	Yes - I discussed this program with my student(s)	No - I did not discuss this program with my student(s)	Response Total
UNITE	7.0%	93.0%	
	12	159	**171**
Junior Science & Humanities Symposium (JSHS)	7.6%	92.4%	
	13	158	**171**
Science & Engineering Apprenticeship Program (SEAP)	4.7%	95.3%	
	8	162	**170**
Research & Engineering Apprenticeship Program (REAP)	5.3%	94.7%	
	9	162	**171**
High School Apprenticeship Program (HSAP)	2.9%	97.1%	
	5	166	**171**
College Qualified Leaders (CQL)	2.9%	97.1%	
	5	166	**171**
GEMS Near Peer Mentor Program	4.2%	95.8%	
	7	161	**168**
Undergraduate Research Apprenticeship Program (URAP)	2.9%	97.1%	
	5	166	**171**
Science Mathematics, and Research for Transformation (SMART) College Scholarship	5.8%	94.2%	
	10	161	**171**
National Defense Science & Engineering Graduate (NDSEG) Fellowship	3.6%	96.4%	
	6	163	**169**
I discussed AEOP with participant(s) but did not discuss any specific program	26.5%	73.5%	
	45	125	**170**

eCybermission	90.7%	9.3%	
	156	16	**172**

In an effort to understand what resources are most valuable to eCM participants, Team Advisors were asked to respond to a questionnaire item asking them how useful various resources were in their efforts to expose students to other AEOPs. Table 28 illustrates that participation in eCM (63%) and the eCM website (56%) were most often rated as "very much" useful. Most responding adults were unfamiliar with AEOP materials such as the It Starts Here! Magazine, which 90% of responding Team Advisors had not experienced. Likewise, 78% of Team Advisors had not experienced AEOP on social media, and 63% had not experienced the AEOP website.

Table 28. Usefulness of Resources for Exposing Students to AEOPs (n = 173)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
eCybermission website	4.7%	0.0%	10.0%	29.4%	55.9%	
	8	0	17	50	95	**170**
Army Educational Outreach Program (AEOP) website	63.0%	4.0%	8.7%	11.0%	13.3%	
	109	7	15	19	23	**173**
AEOP on Facebook, Twitter, Pinterest or other social media	77.2%	4.1%	9.9%	6.4%	2.3%	
	132	7	17	11	4	**171**
AEOP brochure	77.6%	5.3%	7.6%	5.3%	4.1%	
	132	9	13	9	7	**170**
It Starts Here! Magazine	89.5%	5.8%	2.3%	1.7%	0.6%	
	154	10	4	3	1	**172**
eCybermission Program administrator or site coordinator	50.6%	3.5%	6.4%	15.1%	24.4%	
	87	6	11	26	42	**172**
Invited speakers or "career" events	79.7%	2.3%	7.0%	5.2%	5.8%	
	137	4	12	9	10	**172**
Participation in	7.5%	1.2%	5.2%	23.1%	63.0%	

eCybermission	13	2	9	40	109	**173**

Another questionnaire item asked Team Advisors how useful these resources were for exposing students to DoD STEM careers (see Table 29). Again, adults were most likely to rate participation in eCM as useful, with 47% indicating this was "very much" useful. Likewise, 46% of adults found participation in the eCM program very useful in exposing students to DoD STEM careers. Large proportions (69-84%) of adults again reported not having experienced AEOP materials.

Table 29. Usefulness of Resources for Exposing Students to DoD STEM Careers (n = 174)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
eCybermission website	15.6%	2.3%	12.7%	22.0%	47.4%	
	27	4	22	38	82	**173**
Army Educational Outreach Program (AEOP) website	67.1%	3.5%	6.9%	13.3%	9.2%	
	116	6	12	23	16	**173**
AEOP on Facebook, Twitter, Pinterest or other social media	82.4%	5.3%	7.1%	4.1%	1.2%	
	140	9	12	7	2	**170**
AEOP brochure	82.0%	4.7%	6.4%	3.5%	3.5%	
	141	8	11	6	6	**172**
It Starts Here! Magazine	88.3%	4.1%	4.1%	2.3%	1.2%	
	151	7	7	4	2	**171**
eCybermission Program administrator or site coordinator	62.6%	3.5%	7.0%	14.0%	12.9%	
	107	6	12	24	22	**171**
Invited speakers or "career" events	77.1%	2.9%	7.6%	6.5%	5.9%	
	131	5	13	11	10	**170**
Participation in eCybermission	22.5%	2.3%	9.2%	19.7%	46.2%	
	39	4	16	34	80	**173**

Satisfaction with eCM

Both participants and Team Advisors were asked how satisfied they were with a number of features of the eCM program. Table 30 displays eCM-N participant responses to these questions and Table 31 displays eCM-R participant responses to these questions. Roughly half of responding eCM-N students were very much satisfied with the eCM registration (54%), submission (51%), and eCM website (49%). Many eCM-N students reported that they did not experience the eCM Cyber Guide live chat (23%), Cyber Guide feedback (24%), and Cyber Guide forum (29%). eCM-R students reported similar satisfaction rates. Highest satisfaction rates which were "very much satisfied" were reported for the eCM registration (26%), submission (26%), and eCM website (36%) for eCM-R students. Also similar to the eCM-N students, the eCM-R students also reported the least experience with eCM Cyber Guide live chat (50%), Cyber Guide feedback (39%), and Cyber Guide forum (39%)

Table 30. Student Satisfaction with eCM-N Program Features (n = 79)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Applying or registering for the program	9.0%	2.6%	10.3%	24.4%	53.8%	
	7	2	8	19	42	**78**
Submission process	3.9%	2.6%	9.1%	32.5%	51.9%	
	3	2	7	25	40	**77**
Value of Cyber Guide live chat	23.1%	6.4%	17.9%	26.9%	25.6%	
	18	5	14	21	20	**78**
Variety of STEM mission folder challenges available	9.0%	3.8%	20.5%	23.1%	43.6%	
	7	3	16	18	34	**78**
Value of Cyber Guides feedback	23.7%	2.6%	19.7%	15.8%	38.2%	
	18	2	15	12	29	**76**
Value of Cyber Guides forum	28.6%	6.5%	20.8%	18.2%	26.0%	
	22	5	16	14	20	**77**
Educational materials (e.g., workbooks, online resources, etc.) used during program activities	10.5%	2.6%	17.1%	25.0%	44.7%	
	8	2	13	19	34	**76**
eCybermission website	2.6%	0.0%	19.5%	28.6%	49.4%	

	2	0	15	22	38	**77**
Mission control (phone) response time	28.6%	3.9%	10.4%	20.8%	36.4%	
	22	3	8	16	28	**77**
Mission control (email) response time	26.0%	5.2%	9.1%	26.0%	33.8%	
	20	4	7	20	26	**77**

Table 31. Student Satisfaction with eCM-R Program Features (n = 2,887)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Applying or registering for the program	7.7%	10.4%	24.9%	31.3%	25.8%	
	220	298	715	900	742	**2,875**
Submission process	6.0%	13.1%	25.5%	29.8%	25.5%	
	173	375	730	854	729	**2,861**
Value of Cyber Guide live chat	49.7%	13.4%	16.1%	10.5%	10.4%	
	1,420	384	460	299	297	**2,860**
Variety of STEM mission folder challenges available	15.5%	13.8%	25.1%	23.7%	22.0%	
	442	395	718	677	628	**2,860**
Value of Cyber Guides feedback	39.0%	12.5%	19.0%	15.9%	13.7%	
	1,108	355	541	451	389	**2,844**
Value of Cyber Guides forum	39.2%	13.9%	20.0%	15.1%	11.7%	
	1,116	397	571	430	334	**2,848**
Educational materials (e.g., workbooks, online resources, etc.) used during program activities	15.7%	10.1%	23.9%	23.7%	26.6%	
	450	289	686	681	764	**2,870**
eCybermission website	5.2%	10.2%	22.1%	26.8%	35.7%	
	150	291	634	768	1,022	**2,865**
Mission control (phone) response time	50.0%	11.4%	16.2%	12.2%	10.2%	
	1,432	327	464	350	291	**2,864**

Mission control (email) response time	47.0%	12.1%	16.6%	12.5%	11.8%	
	1,348	347	477	357	337	**2,866**

An open-ended item on the questionnaire asked student about their overall satisfaction with their eCM experience. Of the 2,887 eCM-R students and 84 eCM-N students who provided a response to this question, 76% of eCM-R respondents and 82 (98%) eCM-N respondents commented on only positive aspects of the program. Many of these responses were simple affirmations of the student's experience in the program such as "Parts of ecyber was fun and pushed me to do things I didn't feel comfortable doing. I made new friends along the way. It showed me how many parts of the world need help and showed me how I could help." (eCM overall student) or "I loved and enjoyed everything about eCybermission from the instant challenges to dc. I loved staying here and can't wait to try again next year!" (eCM-NJ&EE student). Other students were more specific about what they enjoyed about the program. The most frequently mentioned source of satisfaction was connecting with other students interested in STEM. Other areas of particular satisfaction included time management, increased knowledge about subject matter, and helping the community through STEM projects. For example:

> *I feel that it was great, but at times very stressful. I liked the overall process of making our product and or idea and it allowed us to see that the first idea doesn't always work. All in all I think this program really allows kids to think and work by themselves and really see what it's like to work in the real world.* (eCM overall participant)

> *Incredibly unique opportunity- It was an amazing project which I plan to take in with me in my high school years as a baseline for my continued years of education in the STEM fields. I also gained/used creativity and leadership which are lifelong skills to have always.* (eCM overall participant)

> *It was really fun and I really loved working on this contest. But overall it was a great experiment for me. I got to meet so many new people while working in this program. I learned a lot about green crabs.* (eCM overall participant)

> *It was an eye opening experience; it helped me develop my social, academic, and creativity skills. I was able to gain more knowledge and was exposed to multiple varying ideas from people that came from various backgrounds. I am glad my team and I were able to attend this competition, and we hope to be able to attend something similar in our future.* (eCM NJ&EE participant)

> *I have found a new appreciation for STEM career jobs. I have always wanted to be a surgeon but I also want to create new ideas and be more a part of the research program. The schedule was organized, the tours were life experiencing, and the overall experience was wonderful and breathtaking.* (eCM NJ&EE participant)

Most other respondents also included positive comments but offered some caveats (504 eCM overall, or 17%; 2 eCM-NJ&EE, or 2%) while a small number of students offered no positive comments in their responses (182 eCM overall, or 7%; 0 eCM-NJ&EE, or 0%). These caveats were focused on time management issues and dissatisfaction with the length of time given for the survey. Three hundred and two eCM overall students (10%) had concerns about having to complete the project in a rush to make the deadline and difficulties with their group members. At the National level, concerns and suggestions included lack of congruence of the judge's background with the project.

> *I was pretty impressed it was actually sort of fun but my team wasn't into it and one person didn't collaborate at all. But overall I love the program but I don't think this is the career for me.* (eCM NJ&EE participant)

> *I am somewhat satisfied with the ecybermission experience. The timeline was a little stressful, but other than that I enjoyed the experience.* (eCM overall participant)

> *My experience with eCybermission has been generally good, however there are definitely some ways in which to improve the overall experience. There were a lot of times during the national event when I felt that nothing pertinent to the competition was happening. Being judged was also difficult, primarily due to the fact that most judges were not fit to judge our project. As such, we were being questioned on topics that only vaguely related to our project.* (eCM-NJ&EE participant)

Students were also asked to respond to an open-ended questionnaire item asking how the program could be improved. Of the eCM overall respondents, 82% offered at least one suggestion and 98% of eCM-NJ&EE offered at least one suggestion for improvement. The majority of comments from eCM overall participants were focused on the Mission Folder completion process and emphasized that they would like more time to complete the mission. The students who participated in regional eCM also indicated that they would like more guidance or tips on how to answer the question, more space in the Mission Folders to add pictures or larger files, reducing the number of problems with saving files to the website (many indicated there were bugs with the website), and a shorter survey. By far the majority of responses from eCM-NJ&EE students (89%) referred to the agenda during the Washington, DC trip. The eCM-NJ&EE students responded that there should be more free time during the DC trip, a later curfew, a longer trip, and consideration of the time it takes to get over jet lag and adjusting to the time change.

Table 32 summarizes satisfaction as reported by the Team Advisors with eCM program features. Many adults reported being "very much" or "somewhat" satisfied with the program features they experienced. For example, regarding application or registration process, 89% of Team Advisors reported they were "very much" or "somewhat" satisfied. Over 90% of Team Advisors reported being "very much" or "somewhat" satisfied the submission process (91%) and the eCM website (91%). Also, 83% of adults reported being "very much" or "somewhat" satisfied with variety of STEM mission folders available, and 61% reported being "very much" or "somewhat" satisfied with communication with NSTA.

However, many Team Advisors reported that they did not experience several of the components such as Cyber Guide live chats, feedback or forums.

Table 32. Team Advisor Satisfaction with eCM Program Features (n = 176)

	Did not experience	Not at all	A little	Somewhat	Very much	Response Total
Application or registration process	1.1%	2.3%	7.4%	26.9%	62.3%	
	2	4	13	47	109	**175**
Communication with National Science Teachers Association (NSTA)	28.6%	0.6%	9.7%	21.1%	40.0%	
	50	1	17	37	70	**175**
Submission process	2.3%	1.7%	5.1%	25.1%	65.7%	
	4	3	9	44	115	**175**
Value of Cyber Guide live chat	69.3%	2.8%	4.0%	10.2%	13.6%	
	122	5	7	18	24	**176**
The variety of STEM mission folder challenges available	8.0%	0.0%	9.1%	29.7%	53.1%	
	14	0	16	52	93	**175**
Value of Cyber Guides feedback	59.8%	1.7%	6.3%	14.4%	17.8%	
	104	3	11	25	31	**174**
Value of Cyber Guides forum	63.0%	1.2%	6.4%	12.1%	17.3%	
	109	2	11	21	30	**173**
eCybermission website	0.6%	0.0%	8.5%	30.7%	60.2%	
	1	0	15	54	106	**176**
Educational materials	14.9%	1.7%	9.8%	29.9%	43.7%	
	26	3	17	52	76	**174**
Mission control (phone) response time	60.9%	0.6%	2.3%	8.0%	28.2%	
	106	1	4	14	49	**174**

Mission control (email) response time	28.6%	0.6%	4.0%	14.3%	52.6%	
	50	1	7	25	92	**175**

Like the student questionnaire, the adult questionnaire included open-ended items asking Team Advisors for their opinions about the program. In one item, adults were asked to the three most important strengths of eCM; 174 Team Advisors/other adults responded to this question. Almost half of the respondents (43%) mentioned that a strong benefit of eCM is the ability of students to do authentic STEM work and/or relate STEM to real-life situations. Another 25% of discussed that eCM was an excellent opportunity for students to practice 21st Century skills such as teamwork (25%), communication (18%) and organization (7%). Other benefits (mentioned by fewer than 5% of respondents) discussed that the competition was well organized, aligned with NGSS and also great appreciation for the program. These themes were echoed in focus groups. As three adult participants said:

> *eCybermission did start a Team Advisor program this year. I was assigned a new team advisor that I Team Advisored. Granted she was in Virginia and I was in California, but it was a nice relationship for her to ask questions and have somebody who'd been through the program a couple of times.* (eCM Team Advisor)

> *I can go, and I just print off the page* [provided by eCM website]*, and I hand it to our principal and say, "This is what we're doing for our Common Core and NGSS this year. Thank you very much." I go back and get to work.* (eCM Team Advisor)

> *One of my girls, one from a rural school in Arkansas, made the comment, the first night we were here, and that this was the biggest thing that had ever happened to her. I think the thing is it's lit a fire under those kids that they can see their possibilities, that potential of things that they can do.* (eCM Team Advisor)

> *I can honestly say that the kids have learned so much about how their active involvement in problem solving in their community can make a difference. One the projects that scored really horribly for eCybermission, but what was great for our school was, we had solar panels that didn't work. That was their project. They got them working. It scored horribly with eCybermission, but they will never forget that they got these solar panels working in our school again. There's all kinds of examples like that throughout the 10 years. I don't know what other project I wouldn't do with these kids, that would have the same far reaching implications that eCybermission does.* [eCM Team Advisor]

Adults were also asked to respond to an open-ended item asked them to describe three ways eCM could be improved for future participants. Of the 114 out of 181 Team Advisors who responded to this question, there were a variety of responses, with no one category being more than 10% of the responses. The following categories of suggestions represent the Team Advisor responses for this question: overwhelming amount of information on website (a fact sheet

would be helpful), teacher training, allow mixed grade teams, less paperwork for TA, more outreach to more students to participate, create a larger variety of categories, provide examples, allow video uploads, make data entry easier, change the timeline so that it is longer, allow spreadsheets for registration, and leave registration entirely in the hands of the students. Focus group participants spoke of improvements regarding communication of overall information. For example:

> *"Last year we didn't have the feedback before they had the interviews for regional, this year we did. They read what the judges wrote at state, and used that to prepare for regional. That was really beneficial to them.* (eCM Team Advisor)

Team Advisors were also asked to comment on their overall satisfaction with their eCM experience. Of the 152 adults who responded to this question, nearly all of the responses included a positive comment about the program. For example:

> *"I love the focus on Science and Engineering. Our school is CTE focused and STEM driven. It fits well with what we do. It would be wonderful to have more examples of past student work to share. Possibly a documentary following a student group."* (eCM Team Advisor)

> *Whether it's just a little hands on project that may be very practical, may be very simple, they can still be competitive here. There is just a range of acceptability here of all kinds of projects that make a difference."* (eCM Team Advisor)

> *"I think the acknowledgment of actually completing something and being acknowledged for it by an actual organization is major. That is a major draw even for the program. That's how I get kids to participate is, 'You may come from a small town, but you have big dreams.' Here they're actually being acknowledged."* (eCM Team Advisor)

> *"I would be honest and say that, at least, eCybermission acknowledges the team advisors and that there's actual adult assistance on the sidelines. Many of the larger science fairs don't even acknowledge that adults exist.* (eCM Team Advisor)

> *"I think it takes the routine away, if you're a teacher, from what you sometimes have to do. It's really refreshing. Each year I'm like, 'All right, I'm going to take a break maybe,' because it's a lot of work. But you see the interest growing, and people hearing about it and it just re-energizes you. You've got different topics. You've got kids thinking in different ways".* (eCM Team Advisor)

Outcomes Evaluation

The evaluation of eCM included measurement of several outcomes relating to AEOP and program objectives, including impacts on students' 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.[10] 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 eCM measured students' 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.

STEM Knowledge and Skills

A vast majority of responding eCM students reported gains in their STEM knowledge as a result of the eCM program as summarized in Tables 33 and 34. However, National students tended to report greater impacts than Regional students which may be explained by the inherent differences between overall and NJ&EE participants. For example, "large" gains were reported by 72% of NJ&EE students on knowledge of research conducted in a STEM topic or field, but only 22% of Regional students. Similarly, 62% of NJ&EE students reported large gains on their knowledge of what everyday research work is like in STEM, yet only 23% of overall students reported large gains on the same topic. Students reported similar patterns of impact on their knowledge of how scientists and engineers work on real problems in STEM (eCM-N 63%; eCM-R 23%) and their knowledge of research processes, ethics, and rules for conduct in STEM (eCM-N 63%; eCM-R 22%).

[10] 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.

Table 33. eCM-NJ&EE Participant Reports of Impact on STEM Knowledge (n = 79)

	No gain	Small gain	Medium gain	Large gain	Response Total
In depth knowledge of a STEM topic(s)	0.0%	1.3%	26.0%	72.7%	
	0	1	20	56	**77**
Knowledge of research conducted in a STEM topic or field	0.0%	8.9%	19.0%	72.2%	
	0	7	15	57	**79**
Knowledge of research processes, ethics, and rules for conduct in STEM	1.3%	8.9%	26.6%	63.3%	
	1	7	21	50	**79**
Knowledge of how scientists and engineers work on real problems in STEM	0.0%	7.7%	29.5%	62.8%	
	0	6	23	49	**78**
Knowledge of what everyday research work is like in STEM	1.3%	10.5%	26.3%	61.8%	
	1	8	20	47	**76**

Table 34. eCM-Overall Participant Reports of Impact on STEM Knowledge (n = 2,853)

	No gain	Small gain	Medium gain	Large gain	Response Total
In depth knowledge of a STEM topic(s)	15.2%	29.8%	36.9%	18.1%	
	431	846	1,050	516	**2,843**
Knowledge of research conducted in a STEM topic or field	14.3%	29.4%	34.5%	21.8%	
	402	827	971	612	**2,812**
Knowledge of research processes, ethics, and rules for conduct in STEM	16.4%	28.6%	33.0%	22.0%	
	466	809	934	624	**2,833**
Knowledge of how scientists and engineers work on real problems in STEM	18.4%	27.4%	31.5%	22.8%	
	522	777	893	646	**2,838**
Knowledge of what everyday research work is like in STEM	19.3%	26.7%	30.8%	23.3%	
	547	756	873	660	**2,836**

These Impacts on STEM Knowledge student questionnaire items were combined into a composite variable[11] to test for differences between subgroups of students. Significant differences were found between eCM-NJ&EE and eCM overall students with eCM-NJ&EE students on average reporting greater gains in eCM impacts on their STEM knowledge (small effect size, d = 0.372 standard deviations).[12] There were also significant race/ethnicity differences with minority students reporting greater increases in STEM knowledge compared to White students (small effect size, d = 0.125 standard deviations)[13]. However, there were no gender differences related to STEM knowledge.

Tables 35 and 36 show the percentage of responding students reporting medium or large in STEM competencies – science and engineering related practices. Over 50% of the responding students reported medium or large gains on most items, although the NJ&EE students reported higher gains than overall students; for example, asking a scientific question (eCM-NJ&EE 90%; eCM overall 59%); using knowledge and creativity (eCM-NJ&EE 91%; eCM overall 64%); making a model of an object of system (eCM-NJ&EE 83%; eCM overall 55%); carrying out procedures (eCM NJ&EE 91%; eCM overall 66%); organizing data with charts or graphs (eCM-NJ&EE 80%; eCM overall 53%); considering different interpretations of data (eCM-N-83%; eCM-R-55%); supporting an explanation with data (eCM-NJ&EE 88%; eCM overall 60%); defending an argument (eCM-NJ&EE 87%; eCM overall 52%); integrating scientific text (eCM-NJ&EE 83%; eCM overall 52%); and finally, communicating (eCM-NJ&EE 94%; eCM overall 61%). One category that did not reach the 50% medium or large gain threshold for both groups was using computer models (eCM-NJ&EE 59%; eCM overall 41%).

Table 35. eCM-NJ&EE Participant Gains in their STEM Competencies – Science and Engineering Practices (n =78)

	No gain	Small gain	Medium gain	Large gain	Response Total
Asking a question that can be answered with one or more scientific experiments	1.3%	9.0%	37.2%	52.6%	
	1	7	29	41	**78**
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	0.0%	9.0%	35.9%	55.1%	
	0	7	28	43	**78**
Making a model of an object or system showing its parts and how they work	5.1%	11.5%	29.5%	53.8%	
	4	9	23	42	**78**
Carrying out procedures for an experiment and recording data accurately	1.3%	7.8%	28.6%	62.3%	
	1	6	22	48	**77**
Using computer models of	15.8%	25.0%	19.7%	39.5%	

[11] The Cronbach's alpha reliability for these 5 items was 0.917.

[12] Two-tailed independent samples *t*-test, $t(2,928) = 10.06$, $p < 0.001$.

[13] Two-tailed independent samples *t*-test, $t(2,887) = 3.37$, $p < 0.001$.

objects or systems to test cause and effect relationships	12	19	15	30	**76**
Organizing data in charts or graphs to find patterns and relationships	2.6%	16.9%	28.6%	51.9%	
	2	13	22	40	**77**
Considering different interpretations of data when deciding how the data answer a question	3.9%	13.0%	28.6%	54.5%	
	3	10	22	42	**77**
Supporting an explanation for an observation with data from experiments	0.0%	11.7%	28.6%	59.7%	
	0	9	22	46	**77**
Defending an argument that conveys how an explanation best describes an observation	2.6%	10.4%	32.5%	54.5%	
	2	8	25	42	**77**
Integrating information from technical or scientific texts and other media to support your explanation of an observation	1.3%	15.6%	22.1%	61.0%	
	1	12	17	47	**77**
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	0.0%	6.6%	22.4%	71.1%	
	0	5	17	54	**76**

Table 36. eCM Overall Participant Gains in their STEM Competencies – Science and Engineering Practices (n =2,874)

	No gain	Small gain	Medium gain	Large gain	Response Total
Asking a question that can be answered with one or more scientific experiments	12.1%	29.1%	39.3%	19.5%	
	346	834	1,127	558	**2,865**
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	9.3%	27.2%	39.6%	23.9%	
	265	777	1,128	682	**2,852**
Making a model of an object or system showing its parts and how they work	19.8%	24.9%	32.3%	23.0%	
	565	712	921	656	**2,854**
Carrying out procedures for an	9.5%	24.5%	38.2%	27.8%	

experiment and recording data accurately	270	700	1,089	794	**2,853**
Using computer models of objects or systems to test cause and effect relationships	32.7%	26.4%	26.9%	14.0%	
	932	753	768	400	**2,853**
Organizing data in charts or graphs to find patterns and relationships	16.6%	30.5%	33.2%	19.7%	
	475	869	948	561	**2,853**
Considering different interpretations of data when deciding how the data answer a question	15.0%	29.7%	36.4%	18.9%	
	428	845	1,038	538	**2,849**
Supporting an explanation for an observation with data from experiments	11.5%	28.1%	38.1%	22.2%	
	328	800	1,084	633	**2,845**
Defending an argument that conveys how an explanation best describes an observation	15.9%	32.0%	33.6%	18.4%	
	455	912	960	526	**2,853**
Integrating information from technical or scientific texts and other media to support your explanation of an observation	17.1%	30.5%	34.3%	18.1%	
	485	868	975	516	**2,844**
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	11.7%	27.7%	35.1%	25.5%	
	335	792	1,004	728	**2,859**

For gains in STEM competencies in Science and Engineering composite scores were calculated.[14] These composites were used to assess if the eCM program had differential impacts depending on student group membership. Significant differences by Regional and National grouping were found with NJ&EE students reporting greater impacts on their STEM Competencies (small effect of d = 0.330)[15]. There was also a significant difference in STEM Competencies by race/ethnicity with minority participants reporting significantly greater impact (small effect of d = 0.156 standard deviations)[16] and by gender with female reporting significantly more impact (small effect of d = 0.082)[17] The student

[14] The STEM Competencies composite (11 items) has a Cronbach's alpha reliability of 0.931.

[15] Two-tailed independent samples t-test: $t(2,950) = 8.96$, $p < .001$.

[16] Two-tailed independent samples t-test, $t(2,910) = 4.20$, $p < .001$.

questionnaire also asked students about the impact of eCM on their "21st Century Skills". As can be seen in Table 37 and Table 38, more than 80% of NJ&EE participants reported "medium" or "large" gains on all 21st Century skills listed on the survey. Between 60% and 75% of overall participants reported "medium" or "large" gains on all 21st Century skills listed on the survey. More than 70% of student respondents reported "medium" or "large" gains for making changes when things did not go as planned (eCM-NJ&EE 95%; eCM overall 72%); including others' perspectives (eCM-NJ&EE 89%; eCM overall71%), and communicating effectively (eCM-NJ&EE 87%; eCM overall 71%). Over 60% of eCM-N and eCM-R students reported "medium" or "large" gains in sticking with a task (eCM-NJ&EE 94%; eCM overall 68%). A majority also reported "medium" or "large" gains in working well with people (eCM-N-88%; eCM-R-68%), and viewing failure as an opportunity to learn (eCM-NJ&EE 88%; eCM overall 63%).

A composite variable of these 6 items focusing on 21st Century Skills[18] was created to test for differences between student subgroups. Significant differences were found by participation level and race/ethnicity. Students participating in NJ&EE reported significantly greater eCM impacts on their 21st Century Skills than overall students (small effect size, d = 0.230)[19]. And minority students reported significantly greater eCM impacts compared to White students (very small effect size, d = 0.084)[20].

Table 37. eCM-NJ&EE Participant Reports of Impacts on 21st Century Skills (n = 76)

	No gain	Small gain	Medium gain	Large gain	Response Total
Sticking with a task until it is finished	1.3%	5.3%	22.4%	71.1%	
	1	4	17	54	**76**
Making changes when things do not go as planned	0.0%	5.3%	26.3%	68.4%	
	0	4	20	52	**76**
Working well with students from all backgrounds	2.6%	9.2%	28.9%	59.2%	
	2	7	22	45	**76**
Including others' perspectives when making decisions	1.3%	9.2%	27.6%	61.8%	
	1	7	21	47	**76**
Communicating effectively with others	0.0%	13.2%	23.7%	63.2%	
	0	10	18	48	**76**

[17] Two-tailed independent samples t-test, $t(2,315) = 1.98$, $p = .048$.

[18] The 21st Century Skills composite had a Cronbach's alpha reliability of .905.

[19] Two-tailed independent samples t-test, $t(2,943) = 6.25$, $p < .001$.

[20] Two-tailed independent samples t-test, $t(2,902) = 2.27$, $p = .023$.

Viewing failure as an opportunity to learn	1.3%	10.5%	28.9%	59.2%	
	1	8	22	45	**76**

Table 38. eCM Overall Participant Reports of Impacts on 21st Century Skills (n = 2,870)

	No gain	Small gain	Medium gain	Large gain	Response Total
Sticking with a task until it is finished	10.5%	20.9%	32.9%	35.8%	
	299	596	940	1,023	**2,858**
Making changes when things do not go as planned	8.3%	19.5%	33.7%	38.5%	
	238	555	960	1,099	**2,852**
Working well with students from all backgrounds	11.9%	20.5%	32.2%	35.4%	
	337	584	915	1,006	**2,842**
Including others' perspectives when making decisions	9.0%	20.4%	34.3%	36.3%	
	256	581	976	1,031	**2,844**
Communicating effectively with others	9.5%	19.6%	32.9%	38.1%	
	270	558	937	1,085	**2,850**
Viewing failure as an opportunity to learn	14.7%	21.7%	30.7%	32.9%	
	419	619	876	939	**2,853**

STEM Identity and Confidence

The student questionnaire included a series of items intended to measure the impact of eCM on students' STEM identity. Students are unlikely to purse STEM further in their education and/or careers if they do not see themselves as capable of succeeding in STEM[21], so, deepening students' STEM knowledge and skills is important for increasing the likelihood. These data are shown in Tables 39 and 40 strongly suggest that the program has had a positive impact in this area for the National group. A large majority of National students reported "medium" or "large" gains in every category. However, the Regional group reported roughly an equal spread across the responses "no gain," "little gain," "medium gain," and "large gain" for all categories. For example, sense of accomplishment in a STEM endeavor (eCM-NJ&EE 93%

[21] 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.

eCM overall 49%); thinking creatively (eCM-NJ&EE 92%; eCM overall 53%); and feeling more prepared for more challenging STEM activities (eCM-NJ&EE 92%; eCM overall 50%).

Table 39. eCM-NJ&EE Participant Reports on Impacts on STEM Identity (n = 74)

	No gain	Small gain	Medium gain	Large gain	Response Total
Interest in a new STEM topic	2.7%	13.5%	27.0%	56.8%	
	2	10	20	42	**74**
Deciding on a path to pursue a STEM career	6.8%	13.5%	27.0%	52.7%	
	5	10	20	39	**74**
Sense of accomplishing something in STEM	0.0%	6.8%	24.3%	68.9%	
	0	5	18	51	**74**
Feeling prepared for more challenging STEM activities	1.4%	6.8%	27.0%	64.9%	
	1	5	20	48	**74**
Thinking creatively about a STEM project or activity	0.0%	8.1%	24.3%	67.6%	
	0	6	18	50	**74**
Desire to build relationships with Team Advisors who work in STEM	4.1%	16.2%	25.7%	54.1%	
	3	12	19	40	**74**
Connecting a STEM topic or field to my personal values	4.1%	10.8%	25.7%	59.5%	
	3	8	19	44	**74**

Table 40. eCM Overall Participant Reports on Impacts on STEM Identity (n = 2,842)

	No gain	Small gain	Medium gain	Large gain	Response Total
Interest in a new STEM topic	30.5%	28.6%	25.5%	15.5%	
	863	810	723	438	**2,834**
Deciding on a path to pursue a STEM career	35.1%	27.7%	23.9%	13.3%	
	992	781	675	376	**2,824**

Sense of accomplishing something in STEM	22.9%	28.0%	29.1%	20.0%	
	645	787	820	563	**2,815**
Feeling prepared for more challenging STEM activities	23.0%	26.9%	30.2%	19.9%	
	649	759	851	561	**2,820**
Thinking creatively about a STEM project or activity	20.4%	26.3%	31.7%	21.5%	
	575	742	894	606	**2,817**
Desire to build relationships with Team Advisors who work in STEM	32.0%	26.8%	25.2%	16.0%	
	904	756	711	450	**2,821**
Connecting a STEM topic or field to my personal values	30.5%	27.7%	24.8%	17.0%	
	862	783	700	482	**2,827**

Composite scores were generated for the STEM identity composite[22] to assess whether the eCM program had differential impacts on subgroups of students. Students participating in NJ&EE reported significantly greater eCM impacts on their STEM Identity than overall students (small effect size, d = 0.384)[23]. Minority students reported significantly greater eCM impacts compared to White students (small effect size, d = 0.232)[24].

Interest and Future Engagement in STEM

The questionnaire asked students to reflect on if the likelihood of their engaging in STEM activities outside of school changed as a result of their experience. As a key goal of the AEOP program is to develop a STEM-literate citizenry, students need to be engaged, both in and out of school, with high-quality STEM activities. The Regional students (Table 41) reported they were "about the same likelihood before and after eCM" (about 40%) to engage in every activity outside of school, although about 30% reported that they were "more likely". However, over 70% of the National students reported on most categories that they were "more likely" to engage in STEM activities outside of school (Table 42). For example, students reported being more likely to engage in community service (eCM-NJ&EE 80%; eCM overall 34%); participate in a STEM camp (eCM-NJ&EE 80%; eCM overall 27%); and take a STEM elective (eCM-NJ&EE 76%; eCM overall 28%). Between 30% and 50% of NJ&EE participants reported "about the same amount" of likelihood to engage in reading about STEM nonfiction (46%), talking with family about STEM (33%), and engaging in STEM puzzles (30%) after eCM.

[22] The Cronbach's alpha reliability for these 7 items was 0.942.

[23] Two-tailed independent samples t-test, $t(2,913) = 10.38$, $p < .001$.

[24] Two-tailed independent samples t-test, $t(2,872) = 6.22$, $p < .001$.

Table 41. eCM-NJ&EE Impact on Participants' Intent to Engage in STEM Out of School (n = 76)

	Much less likely	Less likely	About the same before and after	More likely	Much more likely	Response Total
Watch or read non-fiction STEM	2.6%	2.6%	46.1%	31.6%	17.1%	
	2	2	35	24	13	**76**
Tinker (play) with a mechanical or electrical device	5.3%	1.3%	23.7%	48.7%	21.1%	
	4	1	18	37	16	**76**
Work on solving mathematical or scientific puzzles	0.0%	5.3%	30.3%	40.8%	23.7%	
	0	4	23	31	18	**76**
Use a computer to design or program something	2.6%	1.3%	27.6%	44.7%	23.7%	
	2	1	21	34	18	**76**
Talk with friends or family about STEM	0.0%	0.0%	32.9%	36.8%	30.3%	
	0	0	25	28	23	**76**
Mentor or teach other students about STEM	0.0%	0.0%	26.3%	38.2%	35.5%	
	0	0	20	29	27	**76**
Help with a community service project related to STEM	0.0%	1.3%	18.4%	42.1%	38.2%	
	0	1	14	32	29	**76**
Participate in a STEM camp, club, or competition	1.3%	3.9%	14.5%	36.8%	43.4%	
	1	3	11	28	33	**76**
Take an elective (not required) STEM class	2.6%	2.6%	18.4%	30.3%	46.1%	
	2	2	14	23	35	**76**
Work on a STEM project or experiment in a university or professional setting	1.3%	1.3%	15.8%	36.8%	44.7%	
	1	1	12	28	34	**76**

Table 42. eCM Overall Impact on Participants' Intent to Engage in STEM Out of School (n = 2,856)

	Much less likely	Less likely	About the same before and after	More likely	Much more likely	Response Total
Watch or read non-fiction STEM	21.2%	13.8%	44.6%	12.9%	7.5%	
	604	392	1,269	368	215	**2,848**
Tinker (play) with a mechanical or electrical device	12.9%	11.6%	37.0%	24.4%	14.2%	
	364	327	1,045	691	401	**2,828**
Work on solving mathematical or scientific puzzles	14.6%	13.1%	43.2%	19.3%	9.7%	
	413	370	1,222	546	275	**2,826**
Use a computer to design or program something	13.8%	12.2%	38.9%	21.8%	13.3%	
	392	346	1,103	618	376	**2,835**
Talk with friends or family about STEM	18.4%	13.8%	38.6%	17.8%	11.4%	
	520	391	1,090	503	322	**2,826**
Mentor or teach other students about STEM	19.8%	14.2%	38.5%	18.0%	9.5%	
	559	401	1,089	508	269	**2,826**
Help with a community service project related to STEM	16.0%	11.2%	39.2%	22.0%	11.5%	
	452	317	1,106	621	324	**2,820**
Participate in a STEM camp, club, or competition	22.5%	15.8%	34.8%	16.5%	10.5%	
	634	446	982	465	295	**2,822**
Take an elective (not required) STEM class	21.2%	14.0%	35.9%	17.7%	11.2%	
	601	397	1,018	500	316	**2,832**
Work on a STEM project or experiment in a university or professional setting	19.9%	12.4%	37.4%	17.6%	12.7%	
	566	352	1,061	500	360	**2,839**

These items were used to create a composite score[25] used for comparing subgroups of students. Students participating in NJ&EE reported significantly greater eCM impacts on their likelihood to engage in STEM activities than overall

[25] These 10 items had a Cronbach's alpha reliability of 0.946.

students (small effect size, d = 0.346)[26]. Minority students reported significantly greater eCM impacts compared to White students (small effect size, d = 0.170)[27].

The questionnaire also examined student interest level in participating in future AEOP programs. Table 43 and 44 summarize student responses. Very few students expressed that they would be "not at all" interested in future programs. In contrast, many students expressed that they would be "very much" or "somewhat" interested in future programs. For example, eCM (eCM-NJ&EE 89%; eCM overall 38%) and GEMS (eCM-NJ&EE 70%; eCM overall 13%). Overall students reported being unaware of the various programs at a much higher rate (between 7% and 64% for all programs listed in the survey) than the NJ&EE students (between 2% and 46% for all programs listed in the survey).

Table 43. eCM-NJ&EE Participant Interest in Future AEOP Programs (n = 77)

	I've never heard of this program	Not at all	A little	Somewhat	Very much	Response Total
Camp Invention	45.9%	4.1%	17.6%	16.2%	16.2%	
	34	3	13	12	12	**74**
eCYBERMISSION	2.6%	2.6%	5.3%	15.8%	73.7%	
	2	2	4	12	56	**76**
JSS	36.5%	8.1%	14.9%	21.6%	18.9%	
	27	6	11	16	14	**74**
GEMS	10.5%	3.9%	15.8%	23.7%	46.1%	
	8	3	12	18	35	**76**
UNITE	44.4%	2.8%	8.3%	25.0%	19.4%	
	32	2	6	18	14	**72**
JSHS	31.1%	1.4%	12.2%	25.7%	29.7%	
	23	1	9	19	22	**74**
SEAP	14.7%	5.3%	18.7%	24.0%	37.3%	
	11	4	14	18	28	**75**
REAP	31.1%	4.1%	12.2%	20.3%	32.4%	

[26] Two-tailed independent samples t-test, $t(2,929) = 9.36$, $p < .001$.

[27] Two-tailed independent samples t-test, $t(2,889) = 4.56$, $p < .001$.

	23	3	9	15	24	**74**
HSAP	32.9%	1.4%	9.6%	24.7%	31.5%	
	24	1	7	18	23	**73**
CQL	23.0%	8.1%	14.9%	20.3%	33.8%	
	17	6	11	15	25	**74**
GEMS Near Peer Mentor Program	32.9%	2.7%	13.7%	23.3%	27.4%	
	24	2	10	17	20	**73**
URAP	38.4%	5.5%	13.7%	19.2%	23.3%	
	28	4	10	14	17	**73**
SMART College Scholarship	32.4%	5.4%	12.2%	23.0%	27.0%	
	24	4	9	17	20	**74**
NDSEG Fellowship	37.8%	2.7%	12.2%	18.9%	28.4%	
	28	2	9	14	21	**74**

Table 44. eCM Overall Participant Interest in Future AEOP Programs (n = 2,858)

	I've never heard of this program	Not at all	A little	Somewhat	Very much	Response Total
Camp Invention	60.0%	14.0%	12.7%	7.3%	5.9%	
	1,702	398	361	207	167	**2,835**
eCYBERMISSION	7.6%	27.2%	27.0%	17.1%	21.1%	
	216	770	765	484	598	**2,833**
JSS	62.3%	14.8%	12.0%	6.3%	4.6%	
	1,751	417	337	176	130	**2,811**
Gains in the GEMS	59.8%	14.0%	13.3%	7.2%	5.6%	
	1,694	397	378	205	160	**2,834**
UNITE	66.4%	13.2%	10.6%	5.8%	4.0%	
	1,879	375	301	163	113	**2,831**

JSHS	64.5%	13.1%	12.0%	6.1%	4.4%	
	1,819	369	337	172	123	**2,820**
SEAP	60.9%	13.0%	13.1%	7.3%	5.7%	
	1,726	369	370	208	161	**2,834**
REAP	62.1%	13.5%	12.3%	6.9%	5.1%	
	1,755	382	348	196	145	**2,826**
HSAP	62.6%	12.6%	12.3%	7.7%	4.8%	
	1,768	357	347	217	137	**2,826**
CQL	61.9%	13.1%	12.2%	7.3%	5.6%	
	1,751	371	344	206	158	**2,830**
GEMS Near Peer Mentor Program	64.0%	13.8%	11.8%	5.9%	4.5%	
	1,803	389	332	165	128	**2,817**
URAP	63.8%	13.2%	11.7%	6.7%	4.5%	
	1,800	373	331	190	126	**2,820**
SMART College Scholarship	57.0%	12.0%	14.1%	8.6%	8.3%	
	1,615	341	399	243	236	**2,834**
NDSEG Fellowship	62.4%	12.7%	11.4%	7.3%	6.2%	
	1,762	360	321	206	176	**2,825**

Attitudes toward Research

The questionnaire also asked students about their opinions of what DoD researchers do and the value of DoD research more broadly as attitudes about the importance of DoD research are an important prerequisite to continued student interest in the field and potential involvement in the future. The data indicate that most responding students have favorable opinions (see Tables 45 and 46). A vast majority of eCM-NJ&EE students "strongly agree or agree" with each statement, and many eCM overall students "strongly agree or agree" with each statement, although eCM overall students reported "neither agree nor disagree" at higher rates than the eCM-NJ&EE students. The categories of statements that had the highest agreement among students include that DoD researchers advance fields (eCM-NJ&EE97%; eCM overall 44%); develop new cutting-edge technologies (eCM-NJ&EE 97%; eCM overall 46%); and DoD research is valuable to society (eCM-NJ&EE 94%; eCM overall 44%).

Table 45. eCM-NJ&EE Participant Opinions about DoD Researchers and Research (n = 72)

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Response Total
DoD researchers advance science and engineering fields	0.0%	0.0%	2.8%	32.4%	64.8%	
	0	0	2	23	46	**71**
DoD researchers develop new, cutting edge technologies	0.0%	0.0%	2.8%	32.4%	64.8%	
	0	0	2	23	46	**71**
DoD researchers solve real-world problems	0.0%	0.0%	4.2%	28.2%	67.6%	
	0	0	3	20	48	**71**
DoD research is valuable to society	0.0%	0.0%	5.6%	23.6%	70.8%	
	0	0	4	17	51	**72**

Table 46. eCM Overall Participant Opinions about DoD Researchers and Research (n = 2,828)

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Response Total
DoD researchers advance science and engineering fields	7.5%	4.9%	42.9%	30.7%	13.9%	
	212	138	1,207	864	392	**2,813**
DoD researchers develop new, cutting edge technologies	6.6%	5.6%	41.6%	30.8%	15.4%	
	185	157	1,172	867	434	**2,815**
DoD researchers solve real-world problems	6.5%	4.8%	40.0%	31.4%	17.3%	
	183	135	1,124	884	487	**2,813**
DoD research is valuable to society	6.3%	5.1%	40.5%	30.4%	17.6%	
	178	144	1,137	852	495	**2,806**

Education and Career Aspirations

Students were asked about their education aspirations both before and after eCM. As can be seen in Tables 47 and 48, when asked to think back on how far they wanted to go in school *before* participating in eCM, all but one National student aspired to finish college or extend their education beyond college prior to eCM-NJ&EE. After participating in eCM-NJ&EE, all respondents intended to continue their education after college, and 81% indicated wanting to earn an advanced degree compared to 76% of students before they participated in eCM-NJ&EE (Tables 49 and 50).

The eCM overall student responses remained largely the same before and after participation. For example, before eCM-R 48% students indicated they wanted to finish post-secondary study, and 38% wanted to get more education after completing their first college degree. After participation 45% indicated they wanted to finish post-secondary study, and 43% wanted to get more education after completing their first college degree, demonstrating a small shift toward advanced degrees after the eCM experience.

Table 47. Participant Education Aspirations Before eCM NJ&EE (n = 76)

Before Aspirations	Response Percent	Response Total
Graduate from high school	0.00 %	0
Go to a trade or vocational school	1.32 %	1
Go to college for a little while	0.00 %	0
Finish college (get a Bachelor's degree)	22.37 %	17
Get more education after college	76.32 %	58

Table 48. Participant Education Aspirations Before eCM Overall (n = 2,856)

Before Aspirations	Response Percent	Response Total
Graduate from high school	6.86 %	196
Go to a trade or vocational school	1.09 %	31
Go to college for a little while	5.50 %	157
Finish college (get a Bachelor's degree)	48.28 %	1379
Get more education after college	38.27 %	1093

Table 49. Participant Education Aspirations After eCM-NJ&EE (n = 76)

After Aspirations	Response Percent	Response Total

Graduate from high school	0.00 %	0
Go to a trade or vocational school	0.00 %	0
Go to college for a little while	0.00 %	0
Finish college (get a Bachelor's degree)	15.79 %	12
Get more education after college	84.21 %	64

Table 50. Participant Education Aspirations After eCM Overall (n = 2,851)

After Aspirations	Response Percent	Response Total
Graduate from high school	5.93 %	169
Go to a trade or vocational school	1.26 %	36
Go to college for a little while	5.40 %	154
Finish college (get a Bachelor's degree)	44.69 %	1274
Get more education after college	42.72 %	1218

In terms of career aspirations, students were asked what kind of work they expect to be doing at age 30, both reflecting on what their aspiration was before and after eCM (see Tables 51 and 52). Among each group, the most common aspirations before eCM were also most popular after eCM. For example, medicine (eCM overall 15% before and 16% after; eCM-NJ&EE 22% before and 15% after) and engineering (eCM overall 9% before and 9% after; eCM-NJ&EE 10% before and 11% after). Also notable was that slightly fewer students in each group selected "undecided" for their response (eCM overall 15% before and 14% after; eCM-NJ&EE 14% before and 13% after).

Table 51. Participant Career Aspirations Before and After Participation in eCM-NJ&EE (n = 73)

	Before Response Percent	Before Response Total	After Response Percent	After Response Total
Undecided	13.70 %	10	12.68 %	9
Scientist or researcher	21.92 %	16	23.94 %	17
Work in computers or technology	9.59 %	7	9.86 %	7
Engineer or architect	9.59 %	7	11.27 %	8
Work in the medical field	21.92 %	16	15.49 %	11
Teacher	1.37 %	1	1.41 %	1
Business person or manager	4.11 %	3	5.63 %	4
Lawyer	4.11 %	3	2.82 %	2

Military, police, or security	0.00 %	0	1.41 %	1
Artist (writer, dancer, painter)	1.37 %	1	0.00 %	0
Skilled craftsperson	0.00 %	0	1.41 %	1
Athlete or other work in sports	4.11 %	3	4.23 %	3
Other, (specify):	8.22 %	6	9.86 %	7

Table 52. Participant Career Aspirations Before and After Participation in eCM Overall (n = 2,745)

	Before Response Percent	Before Response Total	After Response Percent	After Response Total
Undecided	14.46 %	397	14.56 %	392
Scientist or researcher	3.86 %	106	4.49 %	121
Work in computers or technology	5.54 %	152	5.91 %	159
Engineer or architect	9.14 %	251	9.32 %	251
Work in the medical field	14.75 %	405	15.53 %	418
Teacher	3.61 %	99	3.97 %	107
Business person or manager	2.99 %	82	3.27 %	88
Lawyer	5.57 %	153	5.13 %	138
Military, police, or security	4.74 %	130	5.09 %	137
Artist (writer, dancer, painter)	6.27 %	172	5.57 %	150
Skilled craftsperson	0.73 %	20	0.67 %	18
Athlete or other work in sports	13.52 %	371	12.74 %	343
Other, (specify):	14.83 %	407	13.74 %	370

Career choices were identified as “STEM related” or “non-STEM related” in order to determine if the eCM program increased student interest specifically in STEM-related careers.

Tables 53 and 54 show that nearly all eCM overall students and all eCM NJ&EE students expect to use STEM somewhat in their career when they are age 30, with eCM NJ&EE students reporting using STEM at high rates than eCM overall students. Specifically, 17% of eCM overall students reported expecting to use STEM 76-100% of the time in their work and 44% of eCM NJ&EE students reported expecting to use STEM 76-100% of the time in their work. Thirteen percent of eCM overall students reported not expecting to use STEM in their work at all and only 1% of eCM NJ&EE students reported not expecting to use STEM in their work at all.

Table 53. Percentages of Time eCM-NJ&EE Participants that Expect to Use STEM in Their Career When They Are 30 (n = 75)

	Response Percent	Response Total
not at all	1.33 %	1
up to 25% of the time	4.00 %	3
up to 50% of the time	13.33 %	10
up to 75% of the time	37.33 %	28
up to 100% of the time	44.00 %	33

Table 54. Percentages of Time eCM Overall Participants that Expect to Use STEM in Their Career When They Are 30 (n = 2,868)

	Response Percent	Response Total
not at all	13.21 %	379
up to 25% of the time	21.30 %	611
up to 50% of the time	26.26 %	753
up to 75% of the time	22.70 %	651
up to 100% of the time	16.53 %	474

Overall Impact

Finally, students were asked their opinions about the overall impact of participating in eCM. Students thought the program had substantial impacts on them (see Table 55 and Table 56). The eCM NJ&EE students reported that eCM had higher impacts on the statements than eCM overall students. For example, respondents reported that eCM contributed to or was the primary reason for having a greater appreciation of DoD STEM research (eCM-NJ&EE77%; eCM overall 40%); more interest in STEM outside of school (eCM-NJ&EE 76%; eCM overall 41%); more confident (eCM-NJ&EE 83%; eCM overall 54%); more interested in STEM classes (eCM-NJ&EE 68%; eCM overall 42%); more interested in other AEOPs (eCM-NJ&EE 78%; eCM overall 39%); more interested in a STEM degree (eCM-NJ&EE 69%; eCM overall 40%). Also, 39% of eCM overall students and 68% of eCM-NJ&EE students reported that eCM contributed to or was the primary reason for more interested in a STEM career.

Table 55. Participant Opinion of eCM-NJ&EE Impacts (n = 71)

	Disagree - This did not happen	Disagree - This happened but not because of eCM	Agree - eCM contributed	Agree - eCM was primary reason	Response Total

I am more confident in my STEM knowledge, skills, and abilities	0.0%	17.1%	50.0%	32.9%	
	0	12	35	23	**70**
I am more interested in participating in STEM activities outside of school requirements	2.9%	21.4%	44.3%	31.4%	
	2	15	31	22	**70**
I am more aware of other AEOPs	1.4%	20.0%	35.7%	42.9%	
	1	14	25	30	**70**
I am more interested in participating in other AEOPs	7.1%	20.0%	37.1%	35.7%	
	5	14	26	25	**70**
I am more interested in taking STEM classes in school	4.3%	27.5%	40.6%	27.5%	
	3	19	28	19	**69**
I am more interested in earning a STEM degree	4.3%	27.1%	37.1%	31.4%	
	3	19	26	22	**70**
I am more interested in pursuing a career in STEM	2.9%	27.1%	37.1%	32.9%	
	2	19	26	23	**70**
I am more aware of Army or DoD STEM research and careers	1.4%	21.4%	34.3%	42.9%	
	1	15	24	30	**70**
I have a greater appreciation of Army or DoD STEM research	4.3%	15.9%	31.9%	47.8%	
	3	11	22	33	**69**
I am more interested in pursuing a STEM career with the Army or DoD	16.2%	16.2%	35.3%	32.4%	
	11	11	24	22	**68**

Table 56. Participant Opinion of eCM Overall Impacts (n = 2,823)

	Disagree - This did not happen	Disagree - This happened but not because of eCM	Agree - eCM contributed	Agree - eCM was primary reason	Response Total
I am more confident in my STEM knowledge, skills, and abilities	21.5%	24.6%	43.1%	10.8%	
	604	690	1,208	302	**2,804**

I am more interested in participating in STEM activities outside of school requirements	31.0%	27.6%	31.7%	9.7%	
	870	775	889	273	**2,807**
I am more aware of other AEOPs	37.3%	23.6%	30.1%	9.1%	
	1,038	657	838	253	**2,786**
I am more interested in participating in other AEOPs	39.8%	24.7%	26.5%	9.0%	
	1,108	687	739	252	**2,786**
I am more interested in taking STEM classes in school	31.3%	27.2%	31.1%	10.5%	
	872	758	867	293	**2,790**
I am more interested in earning a STEM degree	33.2%	27.0%	29.7%	10.1%	
	927	753	830	282	**2,792**
I am more interested in pursuing a career in STEM	33.7%	27.4%	28.9%	10.0%	
	938	764	806	279	**2,787**
I am more aware of Army or DoD STEM research and careers	37.1%	24.0%	29.6%	9.3%	
	1,033	667	824	258	**2,782**
I have a greater appreciation of Army or DoD STEM research	33.8%	23.9%	31.6%	10.7%	
	943	667	882	300	**2,792**
I am more interested in pursuing a STEM career with the Army or DoD	42.5%	24.3%	24.3%	8.9%	
	1,188	679	679	250	**2,796**

Overall eCM Impact survey items were combined into a composite variable[28] to assess differences between student subgroups. There were significant differences found by participation level and race/ethnicity. Minority students reported having significantly higher overall impact from eCM compared to White students (small effect of d = 0.130 standard deviations).[29] Additionally, males had significantly higher perceptions of overall eCM impact compared to females (small effect size, d = 0.157).[30] NJ&EE students reported having experienced significantly higher overall impact from eCM compared to overall students (moderate effect of d = 0.326 standard deviations).[31] This finding is not

[28] The Cronbach's alpha reliability for these 10 items was 0.955.

[29] Two-tailed independent samples t-test, $t(2,853) = 3.48$, $p < 0.001$.

[30] Two-tailed independent samples t-test, $t(2,267) = 3.73$, $p < 0.001$.

[31] Two-tailed independent samples t-test, $t(2,892) = 8.76$, $p < 0.001$.

surprising since NJ&EE students participated in both regional and national activities, allowing for greater exposure to eCM experiences.

An open-ended item on the questionnaire asked students to list the three most important ways they benefited from eCM; 3,005 out of 3,022 eCM overall survey respondents (99% response rate) and 69 out of 84 eCM NJ&EE students (82% response rate) provided at least one answer to the question. Student responses addressed a variety of themes. The two most often-cited benefits by all students were increased knowledge in STEM subject matter or STEM careers (62% of eCM overall and 37%% of eCM-NJ&EE respondents) and working in a group or building team work skills (43% of eCM overall and 67% of eCM-NJ&EE respondents). For example:

> *"Helped me understand what it means to be in a team."* (eCM overall student)

> *"I didn't really do STEM at my school, but after coming here, I think it could be a job possibility for me."* (eCM-NJ&EE student)

Other commonly mentioned benefits among overall students included building confidence and skills in communication (25%), learning time management skills (22%), helping the community with STEM projects (20%), and sticking with an idea over time (11%). NJ&EE students frequently cited increased communication skills (45%), and making a difference in their community through STEM projects (25%) as benefits of eCM.

Similar themes emerged from student focus groups. For example:

> *"The most important thing I learned was that you have to work with your team and you might not always get what you want, and you'll need to compromise."* (eCM-NJ&EE Student)

> *"I think the most important thing is getting out of your comfort zone. Most people here or, at least, two people in my group are really shy. Through all of this, they're talking more. We're doing a presentation and they were the first to talk. I was really surprised. I think that's really cool."* (eCM-NJ&EE Student)

> "*Definitely knowing that you can still make a difference, whatever age you are or wherever you are. It's one of the things that I learned. Also that all the technologies that we got to experience along the way."* (eCM-NJ&EE student)

> *"In science* [class in school], *we don't really learn as much as we do in eCYBERMISSION on targeted concepts, especially for at least my group, is programming. We don't really learn that at school. In science class in school, we have, I guess, occasionally we use buddies, but we don't really do that much teamwork*." (eCM alumnus)

Summary of Findings

The FY16 evaluation of eCM 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 Table 57.

Table 57. 2016 eCM Evaluation Findings	
Participant Profiles	
Participation in eCM decreased in FY16 by 18%.	In 2016, there were 20,607 State Participants, and 216 Regional Participants (of whom 86 were selected to attend the NJ&EE). This represents a 18% decrease in student participants from 2015.
	Eighty-four percent of national eCM students and 55% of regional eCM students reported being "somewhat" or "very much" satisfied with the submission process. Over 90% of Team Advisors reported being "very much" or "somewhat" satisfied the submission process.
	Participation in eCM for FY16 included nearly equally distributed representation of males (49%) and females (51%). In regards to other underrepresented groups, the group included predominantly White participants (49%). However, there were 18% Hispanic or Latino participants, and 8% Black or African American eCM participants.
	There were more White and Asian Participants that progressed to regionals. Of the regional finalists (n=216), there were slightly more females (51%) than males. Proportionally, a slightly higher percentage of White students proceeded to the regional finals (56%), followed by 24% of students identifying as Asian, and 8% identifying as Hispanic or Latino/a. Only 8% of Black or African American students progressed to the regional finals, and .4% of Native Americans or Alaskans and .4% of Native Hawaiians or other Pacific Islanders were regional finalists
	Demographic data collected from Team Advisors on the evaluation survey indicated more responding Team Advisors were female than male (64% vs. 35%). As with the responding students, most of the responding Team Advisors identified themselves as White (73%).
Actionable Program Evaluation	
The most effective means of recruitment in FY16 were personal contacts and the eCM website. However,	Forty-eight percent of students learned about eCM from someone who works at the school they attend, followed by 36% of students learning about eCM from a school newspaper or website. Less than 10% of students learned from other sources and 18% chose not to respond to this question.

some Team Advisors learned about eCM at professional conferences.	The most frequent responses were personal contacts, including a past eCM participant (33%), a colleague (20%), or a supervisor (14%). In addition, 17% learned from a STEM or STEM education conference and 12% learned from an email or newsletter from a school, university, or a professional organization.
Students are motivated to participate in eCM via teacher encouragement and/or requiring students to participate, desire to have fun, learn something new, and overall interest in STEM.	For the eCM-R responders, the top two motivating factors were interest in teacher or professor encouragement (51%), and equal factors include an academic requirement (36%) and having fun (36%). Other factors include a desire to learn something new or interesting (27%) and an interested in STEM (22%).
National eCM students learned more about DoD/STEM careers than regional participants.	Sixty-nine percent of National participants reported learning about five or more DoD/STEM careers and 66% of Regional students reported learning about at least one DoD STEM job/career during their eCM experience. However only 13% of regional participants reported learning about 5 or more different STEM jobs/careers in the DoD. This finding reveals the NJ&EE does a much more effective job of introducing participants to DoD opportunities than the regional events.
	Participants in the NJ&EE focus groups reported that that they had not learned much about STEM jobs/careers with the DoD in eCM before they came to the national event. Participants shared that the field day (visiting congressional leaders and national monuments) and the AEOP STEM Challenge Day at the national event did a great deal to expose them to STEM careers in the DoD.
The eCM experience and competition overall is valued by both students and Team Advisors. However, many participants did not experience the Cyber Guide live chat, feedback, and forum.	Roughly half of responding NJ&EE participants were very much satisfied with the eCM registration (54%), submission (51%), and eCM website (49%). Many National eCM students reported that they did not experience the eCM Cyber Guide live chat (23%), Cyber Guide feedback (24%), and Cyber Guide forum (29%). Regional eCM students reported similar satisfaction rates. Highest satisfaction rates were reported for the eCM registration (26%), submission (26%), and eCM website (36%) for eCM Regional students. Also similar to the NJ&EE students, the Regional competition participants also reported little experience with eCM Cyber Guide live chat (50%), Cyber Guide feedback (39%), and Cyber Guide forum (39%).

	Over 90% of Team Advisors reported being "very much" or "somewhat" satisfied the submission process (91%) and the eCM website (91%). Also, 83% of Team Advisors reported being "very much" or "somewhat" satisfied with variety of STEM mission folders available, and 61% reported being "very much" or "somewhat" satisfied with communication with NSTA. However, many Team Advisors reported that they did not experience several of the components such as Cyber Guide live chats, feedback or forums.
Outcomes Evaluation	
eCM participants are engaged in solving STEM problems, and recognize that they can impact their communities through STEM activities.	More than 50% of NJ&EE participants experienced *all* STEM practices in eCM, which were reported on the survey except for building or making a computer model. Regional students reported having engaged in fewer of the STEM practices reported on the survey and spent less time than the National students in doing STEM practices. Although this is a difference, it is expected as the National participants spent more time preparing their projects for the NJ&EE.
	Significant group differences were found in terms of Engaging with STEM Practices in eCM for both competition level and race/ethnicity. National eCM participants reported significantly higher levels of engagement with STEM practices in eCM compared to regional participants and minority students reported significantly higher levels compared to White students.
	Eighty-nine percent of Team Advisors helped students understand the role of STEM in their community, and one of the major open-ended responses to the benefits of eCM by both Regional and National participants included an understanding of how solving problems in the STEM field can help their community and the global community.
	Students reported greater "Learning about STEM" in eCM than in school for both Regional and National students. Similar results were found for the "Engaging in STEM Practices" composite for Regional and National students.
eCM had positive impacts on students' perceptions of their 21st Century Skills.	More than 80% of NJ&EE participants reported "medium" or "large" gains on all 21st Century skills listed on the survey. Between 60% and 75% of Regional participants reported "medium" or "large" gains on all 21st Century skills listed on the survey.
NJ&EE participants reported positive gains in student confidence and identity in STEM, as well as their interest in future STEM engagement. Regional findings were mixed.	The survey data strongly suggest that the program has had a positive impact on student confidence and identify in STEM for the National group. A large majority of NJ&EE participants reported "medium" or "large" gains in every category.
	Regional participants were mixed in their reporting of gains in the eCM program, with roughly an equal spread across the responses "no gain," "little gain," "medium gain," and "large gain" for all categories.

According to Team Advisors, eCM succeeded in raising students' education and future STEM career aspirations.	Mentors reported that participation in eCM (63%) and the eCM website (56%) were most often rated as "very much" useful in influencing students' educational aspirations.
eCM participants and Team Advisors were aware of only a few of the other AEOP programs, and many only knew about eCM. However, many participants indicated interest in other AEOP programs.	Although about a quarter of the Team Advisors discussed other AEOP programs in general, less than 10% of Team Advisors discussed any other AEOP program with the eCM students.
	Half to over three-quarters of Team Advisors did not utilize the Army Educational Outreach Program (AEOP) website, AEOP on Facebook, Twitter, Pinterest or other social media, AEOP brochure, It Starts Here! Magazine, or Invited speakers or "career" events.
	Regional participants reported being unaware of the various AEOP programs at a much higher rate (between 7% and 64% for all programs listed in the survey) than the NJ&EE participants (between 2% and 46% for all programs listed in the survey). This was likely attributed to the AEOP alumni panel that was part of the programming at the NJ&EE in FY16. However, many students (both regional and NJ&EE) expressed that they would be "very much" or "somewhat" interested in future programs. For example, eCM (N-89%; R-38%) and GEMS (N-70%; R-13%).

Responsiveness to FY15 Evaluation Recommendations

The primary purpose of the AEOP program evaluation is to serve as a vehicle to inform future programming and continuous improvement efforts with the goal of making progress toward the AEOP priorities. In previous years the timing of the delivery of the annual program evaluation reports has precluded the ability of programs to use the data as a formative assessment tool. However, beginning with the FY16 evaluation, the goal is for programs to be able to leverage the evaluation reports as a means to target specific areas for improvement and growth.

In this report, we will highlight recommendations made in FY15 to programs and summarize efforts and outcomes reflected in the FY16 APR toward these areas.

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

Finding: Team Advisor Assessment data regarding quality of eCYBERMISSION program supports also identified socio-economic challenges of program participation that continue to place lower income student competitors at a disadvantage.

eCM FY16 Efforts and Outcomes: This issue has been addressed by offering Mini-Grants to help implement the competition into a classroom. Teachers or district administrators apply for the Mini-Grant, and awardees are selected based on economic need, using as one of the first criteria funding going to Title I applications. Last year 70.7% of Mini-Grant students were from Title I schools.

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

Finding: Introduce mechanisms to enhance Team Advisors' interactions and peer-to-peer support.

eCM FY16 Efforts and Outcomes: A pilot program was established beginning in January 2016 to pair a new Team Advisor (first year) with a veteran Team Advisor to serve in the role of a Team Advisor. Additional mechanisms included encouraging Team Advisors to participate in the Team Advisor Forum on the website. This information was shared via the newsletters sent to all Team Advisors by their eCM POC.

Finding: Introduce an appropriate buddy system to the FY16 NJ&EE competition to enable students more freedom of movement and reduce Team Advisor strain.

eCM FY16 Efforts and Outcomes: Our teams are made up of students in grades 6 through 9. We are responsible for their safety 24/7. It is the Team Advisor's responsibility to chaperone their students from the time the students meet their Team Advisor to leave for NJ&EE until the students are returned to their parents at the end of NJ&EE. Students from the same team were to select a fellow teammate of the same gender to be a buddy during the week. If the students needed to leave for the bathroom, they were able to do so with their buddy (and not the Team Advisor as in previous years) as long as they let their Team Advisor, NCO, or Team Advisor know they were doing so. At all other times during the week, the Team Advisors were expected to be with their students except at night in their rooms. All Team Advisors did have their sleeping room in very close proximity to the student rooms at the NCC.

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

Finding: Increase eCYBERMISSION participants' awareness of program resources by embedding a brief introductory video into the online registration.

eCM FY16 Efforts and Outcomes: A video was produced in 2015, edited to 4 minutes 19 seconds (originally it was 10 minutes) and was added to the home page of the eCYBERMISSION website (originally found in teacher resources). The video is titled "eCYBERMISSION Website Tutorial" and is a brief overview of the features and pages available at www.ecybermission.com. Information for the video is part of the "welcome letter" each Team Advisor receives once registered. A link to all eCM resources is included in the welcome letter.

Finding: Improve the eCYBERMISSION experience by addressing current issues with the Mission Folder auto-save and multi-user functionality.

eCM FY16 Efforts and Outcomes: The following message was sent to every Team Advisor via an email newsletter sent from the Team Advisor's Point of Contact (POC):

"*MISSION FOLDER TIMEOUT!*
Students can only be logged in to their Mission Folder for 30 minutes before it will timeout. There may be no change on the screen, but students will not be able to save information. Let them know to save and log out every 25 minutes or so to ensure they avoid this problem and don't lose any work!"

The problem with the auto-save and the multi-user functionality was discussed in detail with our team, so if any phone calls came into Mission Control, everyone would be giving the same information to help support the Team Advisors. There was discussion with our IT web developer and it was decided to not allow "cookies" to be enabled. The reason behind this decision, which would solve the problem, is that most students may be doing work either on a school computer or at a public library. If the student does not log out, and someone else begins to use the computer, the second person could totally overwrite the original work and the first student would lose all of their work.

Finding: Either extend the length of NJ&EE or reduce the number of its activities to ensure participants have longer activity transitions and time designated specifically to their presentation preparation and practice.

eCM FY16 Efforts and Outcomes: A concerted effort was made in the scheduling of NJ&EE to ensure teams had more time to prepare for their presentations. The following changes were incorporated into the schedule for 2016:

- All teams were required to be on-site by 2 p.m. on Monday. This allowed time for students to prepare for the opening activity at 4 p.m. In putting this requirement in place (previously it had been 3 p.m.), six of the 23 teams flew in on Sunday, to allow their teams extra time to get ready for the event due to the length of time for travel from their origin.
- The 2016 venue, the National Conference Center (NCC) in Leesburg, Virginia, was selected for its proximity to Washington, D.C., to help facilitate less travel time on Tuesday when teams travel to Washington, D.C., for their visits to their congressional leaders and tour of the city.
- Due to the change of venue, the schedule for each day was put together to facilitate ease of movement between sessions (a dedicated area was allotted for our group with all rooms within very close proximity of each other allowing for much easier and less time consuming transitions).
- A change to Tuesday's schedule included adjusting the order of events to take full advantage of time. The tour of Washington, D.C., was changed to the morning to avoid some of the crowds that occur later in the day. A limit of two congressional visits was requested. The buses left Washington, D.C., by 3:45 p.m. and returned to NCC by 5:00 p.m. (in 2015 this time was closer to 6 p.m. with one bus arriving back at 6:30 p.m.).

There were no scheduled activities for the remainder of the day besides a 15-minute synch-up with the teams after dinner for announcements.

Finding: Assessment of meals at Hunt Valley in 2015 for NJ&EE was the only logistical item that demonstrated a statistically significant decrease in satisfaction when compared to FY14.

eCM FY16 Efforts and Outcomes: National Conference Center has a buffet with many choices for meals, which provided many more options for participants along with break service as part of the "complete meeting package" that we negotiated as part of the contract.

Finding: Qualitative descriptions of why students participated in eCYBERMISSION revealed that many students felt "forced" to participate because of a mandatory classroom requirement or grade.

eCM FY16 Efforts and Outcomes: This is an issue that is classroom-driven and not one that eCYBERMISSION can control. Our program is targeted to teachers, and our Mini-Grant program is set up for at least 50 students participating in order for a teacher to get a grant to support the implementation of eCYBERMISSION into the classroom.

Finding: Student assessment data regarding eCYBERMISSION program resources gave participants 10 program resources and asked them to rate them as: Very useful, Useful, Somewhat Useful, Slightly Useful, Not at All Useful, or Did not Use. CyberGuide Chats prompted the weakest assessment, followed by Mission Control Help Desk.

eCM FY16 Efforts and Outcomes: During the competition year, every Team Advisor receives communication via a newsletter delivered via email from the Team Advisor's Point of Contact. Cyber Guide Chats were promoted in these newsletters.

During FY16, the use of a Point of Contact to communicate more frequently with Team Advisors resulted in overall fewer phone calls from students and Team Advisors into Mission Control with questions about the program. Students can call/email Mission Control, but the frequency of such communication was not high since most often Team Advisors call/email on behalf of their team.

Finding: Team Advisor Assessment data regarding quality of eCYBERMISSION program supports also identified CyberGuides as a resource in need of improvement. Specifically in the evaluation the following is mentioned: "CyberGuides should be more visible" and that their responses to students "could be more timely and detailed."

eCM FY16 Efforts and Outcomes: In an effort to make the CyberGuides more visible to students, eCYBERMISSION staff collected short bios and photos of the CyberGuides and posted them on the student website by Mission Challenge area (see Appendix A for an example). Students use the bios to learn more about

the CyberGuides' areas of expertise and to pick out which CyberGuide to connect with for a specific question. The bios also help students get to know the CyberGuides as people, too.

After registering, all CyberGuides are asked to review the CyberGuide User Guide, which outlines eCYBERMISSION's expectations around timeliness of communications with students. Using Team Talk, students can directly connect with a specific CyberGuide to ask a Mission Folder question. If a team does not receive a response within 24 hours after a reminder, eCYBERMISSION contacts the CyberGuide to correct the situation.

CyberGuides are asked to visit the Discussion Forums regularly and to respond to questions, starting with the oldest post and working up to the most recent. eCM staff monitors the Discussion Forums as well and will encourage CyberGuides to get on the boards if there are posts waiting for a reply.

Finding: Open-ended survey remarks from students who participated in NJ&EE for the item regarding initial notification of their finalist status indicated the item's rating could be improved by earlier notification.

eCM FY16 Efforts and Outcomes: This year, an effort was made to notify winning teams earlier than in the past. In FY15 teams were notified May 4–6 with NJ&EE beginning on Monday, June 15. This year, phone calls were made on May 3–4 and NJ&EE began on June 20.

Finding: Open-ended survey remarks from Team Advisors who participated in NJ&EE for the item regarding initial notification of their finalist status indicated the item's rating could be improved by allocation of more time for the completion of pre-NJ&EE paperwork.

eCM FY16 Efforts and Outcomes: This year in an effort to honor this request, the initial email with information went out to Team Advisors on May 6, 2016. The Team Advisors had until May 19 to submit the necessary documents. In FY15, Team Advisors were notified on May 7 with a request to have all paperwork turned in within one week on May 14

FY16 Recommendations

Evaluation findings indicate that FY16 was a success overall for the eCM program. Notable successes for the year include high levels of Team Advisor and student satisfaction with the program, and equal number of male and female participants, the majority of National students learning about five or more DoD/STEM careers, student reports that eCM helped them recognize how STEM activities can help them solve problems in their community, minority students had a significantly higher reported engagement with STEM than White students, all students reported learning more STEM at eCM than in their schools, a majority of students reporting gains on 21st Century skills, and the majority of Team Advisors reporting the participation and eCM website were very useful. While these successes are commendable, there

are some areas that remain with potential for growth and/or improvement. Additionally, there were proportionally more White and Asian students who advanced to the national level as compared to Hispanic and Latino/a students and Black and African American students. Another marked difference was between the numbers of DoD/STEM careers of which students became aware during the eCM experience. Regional students reported much lower numbers than National students, and National students reported during the focus group interviews that is was during the field trip when they encountered engagement with a variety of DoD/STEM careers. Similarly, the Regional students reported that eCM had significantly less of an impact on confidence and identify in STEM than the National students. Although NSTA has improved outreach to the Team Advisors and subsequently students through emails and the eCM website, the results of the survey indicate that few participants use the CyberGuide live chat, feedback, or forum. Finally, most Team Advisors were unfamiliar with other AEOP materials such as It Starts Here! Magazine and only a quarter of Team Advisors discussed other AEOP programs with their students. Subsequently, students were mostly unaware of other AEOP programs, although they indicated on the surveys that they would be interested in participating.

The evaluation team therefore offers the following recommendations for FY17 and beyond:

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

1. The AEOP objective of broadening, deepening, and diversifying the pool of STEM talent continues to be a challenge for eCM. The majority of students participating in the regional competition were White, and proportionally more White and Asian students proceeded to the NJ&EE than Hispanic and Latino/a and Black and African American students. It is recommended for the program to consider doing more to recruit students from schools serving historically underrepresented and underserved groups and to find ways to support these students so that they can potentially progress to the National competition.
2. Participation in eCM overall declined largely in FY16. Nearly 13% of potential participants were not retained through the registration process. Additionally, there was an 18% decrease in the participants from 2015. Retention/attrition through the registration process is something that should be focused on in FY17. It is recommended that there is a concerted effort in FY17 to increase participation in the program overall.

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

Mentors and participants expressed overall satisfaction with the resources available to them through participation in eCM and the eCM website. At the same time, however, both Team Advisors and students reported little familiarity with Army resources such as the AEOP website, the It Starts Here! magazine, and the AEOP brochure. This suggests that participants may not make connections between eCM and some AEOP resources. Interestingly, it was clear in the national student surveys and focus group interviews that the NJ&EE participants recognized the connection between eCM and Army sponsorship – so the lack of familiarity of AEOP resources did not hinder their awareness of eCM being an Army/DoD focused effort. However, better marketing and use of the website, brochure, and other AEOP resources may assist with recruitment for other AEOPs and retention of participants in the AEOP pipeline. Although recent efforts

of NSTA to improve the eCM website to make clear the association of eCM with the AEOP, it may be useful to provide AEOP brochures electronically to teams at all state and regional eCM events, and to consider ways in addition to the "Volunteer Spotlight" to communicate a variety of STEM careers available in the DoD, particularly to the state and regional students.

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

Students continue to report having little knowledge of other programs in the AEOP. This is an area of concern due to the overarching goal of creating an AEOP pipeline and retention of participants in additional AEOPs. Although students at the national level and to a lesser extent at the regional level reported gains in their STEM knowledge, confidence and identity, students were largely unaware of programs for which they are or will soon be eligible. Only a quarter of the Team Advisors discussed other AEOP programs with their students. Although NSTA responded appropriately to earlier recommendations by connecting the AEOP logo with the AEOP website and explaining this connection in the video tutorial, the evaluation results suggest that more should be done to make the connection and to inform students of future opportunities in AEOP. In addition, since Team Advisors are an important source of student information, additional efforts should be made to educate Team Advisors about the AEOP and programs for which their students are eligible. One suggestion would be to include a dedicated webinar for Team Advisors and students using the eCM website.

Appendices

Appendix A

FY16 eCM Evaluation Plan

FY16 eCM Evaluation Plan

Questionnaires

Purpose:

As per the approved FY16 AEOP APP, the external evaluation of eCM (conducted by Purdue University) includes three post-program questionnaires:

1. AEOP Youth Questionnaire to be completed by student participants of the eCM regional events; and
2. AEOP Youth Questionnaire to be completed by student participants of the eCM national event; and
3. AEOP Team Advisor/Mentor Questionnaire to be completed by research Team Advisors, competition advisors, chaperones, teachers, or others who supported students as they prepared for or participated in eCM national and regional events.

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 were aligned 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 student and Team Advisor questionnaires provided for their program.

Site Visits/Onsite Focus Groups

Purpose:

As per the approved FY16 AEOP APP, the external evaluation of eCM includes site visit/onsite focus groups at three eCM regional events.

Site visits provide the evaluation team with first-hand opportunities to speak with students and their Team Advisors. 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, evaluators' findings are used to highlight program successes and inform program changes so that the AEOPs can be even better in the future.

Evaluation Activities during eCM Site Visits:

- One or two 45 minute focus group with 6-8 youth participants;
- One 45-minute focus group with 6-8 Team Advisors;
- 30-60 minutes to observe the program (specifically, to see students engaged in program activities, preferably with their Team Advisors); 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.

Selecting Focus Group Participants:

Evaluators appreciate event administrators' assistance in helping to assemble a diverse group of focus group participants who can provide information about a range of experiences possible in the eCM. Ideally, this assistance is in the form of pre-event notifications of the focus groups, including scheduled dates, times, and locations.

Ideally, each student focus group will be inclusive of

- males and females (equal representation if possible),
- range of grade levels of students,
- range of race/ethnicities of students served by the program, and
- range of STEM interests (if known).

We prefer that students volunteer themselves after receiving the invitation to participate in the focus group, but will pursue students nominated by program staff or Team Advisors. Participants may RSVP to evaluators privately or simply show up at the focus group location; however, sign-up sheets should not be used--if they are publically displayed, they breach participant confidentiality.

A number of different adult participants of eCM--regional directors, national judges, chaperones, and even parents. We encourage any of these groups to participate in the adult focus group and have geared questions to be applicable across groups.

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 eCM program and differences between students who participated only in eCM-R and students who participated in both eCM-R and eCM-N. 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

FY16 eCM Student Focus Group Protocol

2016 AEOP Evaluation Study
Student Focus Group Protocol, eCM

Facilitator: My name is [evaluator] and I'd like to thank you for meeting with us today! We are really excited to learn more about your experiences in eCM. In case you have not been in a focus group before, I'd like to give the group some ground rules that I like to use in focus groups. They seem to help the group move forward and make everyone a little more comfortable:

- What is shared in the room stays in the room.
- Only one person speaks at a time.
- If you disagree please do so respectfully.
- It is important for us to hear the positive and negative sides of an issue.
- This is voluntary - you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for note-taking purposes only. Audio will be destroyed.
- Do you have any questions before we begin?

Key Questions

1. **Why did you choose to participate in eCM this year?**
    - How did you hear about eCM?
    - Who did you hear about it from?

The Army Educational Outreach Program (AEOP) is a primary sponsor of eCM. We do these focus groups to help the AEOP create reports and defend funding for the program. They need specific information to defend the money for the program.

2. **We need to understand more about how eCM is teaching students about STEM career opportunities in the Army and Department of Defense.**
    - During eCM, did you learn about anything about STEM careers in the Army or Department of Defense?
    - How did you learn about them (e.g., field trips, invited speakers, other activities, etc.)?
    - Are you interested in pursuing a career in STEM with the Army or Department of Defense?
3. **The AEOP sponsors a wide range of national STEM outreach programs other than eCM. You are definitely eligible to participate in some of these programs and we need to know if you learned about them during eCM.**
    - During eCM, did you learn about any of the outreach programs that the AEOP sponsors? (REAP, SEAP, CQL, SMART, etc.)
    - How did you learn about them?
    - Do you think that you will try to participate in any of those programs?
4. **Were you happy that you chose to participate in eCM this year?**
    - What, specifically do you think you got out of participating in eCM?
    - Were there any other benefits of participating in eCM?
5. **Do you have any suggestions for improving eCM for other students in the future?**
6. **Last Chance - Have we missed anything? Tell us anything you want us to know that we didn't ask about.**

Appendix C

FY16 eCM Mentor Focus Group Protocol

2016 AEOP Evaluation Study

Adult/Mentor Focus Group Protocol, eCM

Facilitator: My name is [evaluator] and I'd like to thank you for meeting with us today! We are really excited to learn more about your experiences in eCM. In case you haven't been in a focus group before, I'd like to give you some ground rules that I like to use in focus groups. They seem to help the group move forward and make everyone a little more comfortable:

1. What is shared in the room stays in the room.
2. Only one person speaks at a time.
3. If you disagree please do so respectfully.
4. It is important for us to hear the positive and negative sides of all issues.
5. We will be audio recording the session for note-taking purposes only. Audio will be destroyed.
6. Do you have any questions about participating in the focus group?

Key Questions:

1. **When you think about eCM, what kind of value does this program add**?
    - How do you think students benefit from participating in eCM?
    - Can you think of a particular student or group of students that benefit the most from eCM?
    - How have you benefited from participating in eCM?

One of the primary sponsors of the eCM program is the Army Educational Outreach Program (AEOP). The AEOP needs specific information to create reports and defend funding for its outreach programs, eCM included.

2. **We need to understand more about how eCM is helping students know more about STEM career opportunities in the Department of Defense, especially civilian positions.**
    - Have you seen any efforts by eCM to educate participants about the Army, DoD, or careers in the DoD?
    - What strategies seem to be the most effective for eCM students?
    - Do you have any suggestions for helping eCM teach students about careers in the DoD?
3. The AEOP sponsors a wide range of national STEM outreach programs that these students qualify for. **The AEOP needs to know if eCM is teaching students the other STEM outreach programs that it sponsors.**
    - First, are you aware of the other programs offered by the AEOP? (e.g., REAP, SEAP, CQL, SMART, etc)
    - Have you seen any efforts at eCM to educate adults or students about the other AEOP programs?
    - What seems to work the best? The worst?
    - Any suggestions for helping the AEOP educate these students about the other programs?
4. **The AEOP is trying to make sure that its programs become more effective at reaching adult and youth participants from underserved and underrepresented groups (racial/ethnic groups, low SES, etc.).**
    - Have you seen any efforts by eCM to help engage underserved or underrepresented groups of adults and youth?
    - What strategies seem to work the best? The worst?
    - Any suggestions for helping eCM reach new populations of adult and youth participants?
5. **What suggestions do you have for improving eCM?**
6. **Last Chance - Have we missed anything?**

Appendix D

FY16 eCM Student Questionnaire

Contact Information		
Please verify the following information:		
*First Name:		
*Last Name:		
*Email Address:		
All fields with an asterisk (*) are required.		

*1. Do you agree to participate in this survey? (required)(*Required)		
Select one.		
○	Yes, I agree to participate in this survey	
○	No, I do not wish to participate in this survey	Go to end of chapter

7. How often did you do each of the following in STEM classes at school before eCybermission?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	○	○	○	○	○
Apply STEM learning to real-life situations	○	○	○	○	○
Learn about new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○

8. How often did you do each of the following in STEM classes at school during or after eCybermission this year?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	○	○	○	○	○
Apply STEM learning to real-life situations	○	○	○	○	○
Learn about new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○

9. How often did you do each of the following in STEM classes at school before eCybermission?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Use laboratory procedures and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

10. How often did you do each of the following in STEM classes at school during or after eCybermission this year?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Use laboratory procedures and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

11. The list below includes effective teaching and mentoring strategies. From the list, please indicate which strategies that your teacher/mentor(s) used when working with you in eCybermission:

Select one per row.

	Yes - my mentor used this strategy with me	*No - my mentor did not use this strategy with me*
Helped me become aware of STEM in my everyday life	○	○
Helped me understand how I can use STEM to improve my community	○	○
Used a variety of strategies to help me learn	○	○
Gave me extra support when I needed it	○	○
Encouraged me to share ideas with others who have different backgrounds or viewpoints than I do	○	○
Allowed me to work on a team project or activity	○	○
Helped me learn or practice a variety of STEM skills	○	○
Gave me feedback to help me improve in STEM	○	○
Talked to me about the education I need for a STEM career	○	○
Recommended Army Educational Outreach Programs that match my interests	○	○
Discussed STEM careers with the DoD or government	○	○

12. How much did each of the following resources help you learn about Army Educational Outreach Programs (AEOPs)?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My eCybermission teacher or mentor(s)	○	○	○	○	○
Invited speakers or "career" events during eCybermission	○	○	○	○	○
Participation in eCybermission	○	○	○	○	○

13. How much did each of the following resources help you learn about STEM careers in the Army or Department of Defense (DoD)?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My eCybermission teacher or mentor(s)	○	○	○	○	○
Invited speakers or "career" events during eCybermission	○	○	○	○	○
Participation in eCybermission	○	○	○	○	○

14. How SATISFIED were you with the following eCybermission features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Applying or registering for the program	○	○	○	○	○
Submission process	○	○	○	○	○
Value of Cyber Guide live chat	○	○	○	○	○
The variety of STEM mission folder challenges available	○	○	○	○	○
Value of Cyber Guides feedback	○	○	○	○	○
Value of Cyber Guides forum					
eCybermission website	○	○	○	○	○
Educational materials (e.g., workbooks, online resources, etc.) used during program activities	○	○	○	○	○
Mission control (phone) response time	○	○	○	○	○
Mission control (email) response time	○	○	○	○	○

15. As a result of your eCybermission experience, how much did you GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
In depth knowledge of a STEM topic(s)	○	○	○	○	○
Knowledge of research conducted in a STEM topic or field	○	○	○	○	○
Knowledge of research processes, ethics, and rules for conduct in STEM	○	○	○	○	○
Knowledge of how scientists and engineers work on real problems in STEM	○	○	○	○	○
Knowledge of what everyday research work is like in STEM	○	○	○	○	○

16. Which category best describes the focus of your eCybermission activities?

Select one.

○	Scientific Inquiry – using scientific practices	(
○	Engineering Design	(
○		(
○		(

17. As a result of your eCybermission experience, how much did you GAIN in the following areas?

Select one per row.

If answered, go to question number 19.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Asking a question that can be answered with one or more scientific experiments	○	○	○	○	○
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	○	○	○	○	○
Making a model of an object or system showing its parts and how they work	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of objects or systems to test cause and effect relationships	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Considering different interpretations of data when deciding how the data answer a question	○	○	○	○	○
Supporting an explanation for an observation with data from experiments	○	○	○	○	○
Defending an argument that conveys how an explanation best describes an observation	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your explanation of an observation	○	○	○	○	○
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	○	○	○	○	○

18. As a result of your eCybermission experience, how much did you GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Defining a problem that can be solved by developing a new or improved object, process, or system	○	○	○	○	○
Using knowledge and creativity to propose a testable solution for a problem	○	○	○	○	○
Making a model of an object or system to show its parts and how they work	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of an object or system to investigate cause and effect relationships	○	○	○	○	○
Considering different interpretations of the data when deciding if a solution works as intended	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Supporting a solution for a problem with data from experiments	○	○	○	○	○
Defend an argument that conveys how a solution best meets design criteria	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your solution to a problem	○	○	○	○	○
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	○	○	○	○	○

19. As a result of your eCybermission experience, how much did you GAIN in each of the skills/abilities listed below?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Sticking with a task until it is finished	○	○	○	○	○
Making changes when things do not go as planned	○	○	○	○	○
Working well with students from all backgrounds	○	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○	○
Communicating effectively with others	○	○	○	○	○
Viewing failure as an opportunity to learn	○	○	○	○	○

20. As a result of your eCybermission experience, how much did you GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Interest in a new STEM topic	○	○	○	○	○
Deciding on a path to pursue a STEM career	○	○	○	○	○
Sense of accomplishing something in STEM	○	○	○	○	○
Feeling prepared for more challenging STEM activities	○	○	○	○	○
Thinking creatively about a STEM project or activity	○	○	○	○	○
Desire to build relationships with mentors who work in STEM	○	○	○	○	○
Connecting a STEM topic or field to my personal values	○	○	○	○	○

21. As a result of your eCybermission experience, are you MORE or LESS likely to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?

Select one per row.

	Much less likely	*Less likely*	*About the same before and after*	*More likely*	*Much more likely*
Watch or read non-fiction STEM	○	○	○	○	○
Tinker (play) with a mechanical or electrical device	○	○	○	○	○
Work on solving mathematical or scientific puzzles	○	○	○	○	○
Use a computer to design or program something	○	○	○	○	○
Talk with friends or family about STEM	○	○	○	○	○
Mentor or teach other students about STEM	○	○	○	○	○
Help with a community service project related to STEM	○	○	○	○	○
Participate in a STEM camp, club, or competition	○	○	○	○	○
Take an elective (not required) STEM class	○	○	○	○	○
Work on a STEM project or experiment in a university or professional setting	○	○	○	○	○

22. Before you participated in eCybermission, how far did you want to go in school?

Select one.

○	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

23. After you have participated in eCybermission, how far do you want to go in school?

Select one.

○	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

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

Select one.

○	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

25. Before you participated in eCybermission, what kind of work did want to do when you are 30 years old? (select one)

Select one.

○	Undecided
○	Scientist or researcher
○	Work in computers or technology
○	Engineer or architect
○	Work in the medical field (doctor, nurse, lab technician)
○	Teacher
○	Business person or manager
○	Lawyer
○	Military, police, or security
○	Artist (writer, dancer, painter)
○	Skilled craftsperson (carpenter, electrician, machinist)
○	Athlete or other work in sports
○	Other, (specify)::

26. After you have participated in eCybermission, what kind of work do you want to do when you are 30 years old? (select one)

Select one.

○	Undecided
○	Scientist or researcher
○	Work in computers or technology
○	Engineer or architect
○	Work in the medical field (doctor, nurse, lab technician)
○	Teacher
○	Business person or manager
○	Lawyer
○	Military, police, or security
○	Artist (writer, dancer, painter)
○	Skilled craftsperson (carpenter, electrician, machinist)
○	Athlete or other work in sports
○	Other, specify::

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

Select one per row.

	I've never heard of this program	*Not at all*	*A little*	*Somewhat*	*Very much*
Camp Invention	○	○	○	○	○
eCYBERMISSION	○	○	○	○	○
Junior Solar Sprint (JSS)	○	○	○	○	○
Gains in the Education of Mathematics and Science (GEMS)	○	○	○	○	○
UNITE	○	○	○	○	○
Junior Science & Humanities Symposium (JSHS)	○	○	○	○	○
Science & Engineering Apprenticeship Program (SEAP)	○	○	○	○	○
Research & Engineering Apprenticeship Program (REAP)	○	○	○	○	○
High School Apprenticeship Program (HSAP)	○	○	○	○	○
College Qualified Leaders (CQL)	○	○	○	○	○
GEMS Near Peer Mentor Program	○	○	○	○	○
Undergraduate Research Apprenticeship Program (URAP)	○	○	○	○	○
Science Mathematics, and Research for Transformation (SMART) College Scholarship	○	○	○	○	○
National Defense Science & Engineering Graduate (NDSEG) Fellowship	○	○	○	○	○

28. How many jobs/careers in STEM did you learn about during eCybermission?	
Select one.	
○	None
○	1
○	2
○	3
○	4
○	5 or more

29. How many Army or Department of Defense (DoD) STEM jobs/careers did you learn about during eCybermission?	
Select one.	
○	None
○	1
○	2
○	3
○	4
○	5 or more

30. How much do you agree or disagree with the following statements about Department of Defense (DoD) researchers and research:

Select one per row.

	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 solve real-world problems	○	○	○	○	○
DoD research is valuable to society	○	○	○	○	○

31. Which of the following statements describe you AFTER participating in the eCybermission program?

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of GEMS*	*Agree - GEMS contributed*	*Agree - GEMS 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 earning a STEM degree	○	○	○	○
I am more interested in pursuing a career in STEM	○	○	○	○
I am more aware of Army or DoD STEM research and careers	○	○	○	○
I have a greater appreciation of Army or DoD STEM research	○	○	○	○
I am more interested in pursuing a STEM career	○	○	○	○

with the Army or DoD				

32. What are the three most important ways that eCybermission has helped you?	
Benefit #1:	
Benefit #2:	
Benefit #3:	

33. What are the three ways that we could make eCybermission better?	
Improvement #1:	
Improvement #2:	
Improvement #3:	

34. Please tell us about your overall satisfaction with your eCybermission experience.

Appendix E

FY16 eCM Team Advisor/Mentor Questionnaire

Contact Information		
Please verify the following information:		
*First Name:		
*Last Name:		
*Email Address:		
All fields with an asterisk (*) are required.		

*1. Do you agree to participate in this survey? (required)(*Required)		
Select one.		
○	Yes, I agree to participate in this survey	(Go to question number 2.)
○	No, I do not wish to participate in this survey	Go to end of chapter

*2. Please provide your personal information below: (required)(*Required)	
*First Name::	
*Last Name::	

3. Please provide your email address: (optional)

4. What is your gender?	
Select one.	
○	Male
○	Female
○	Choose not to report

5. What is your race or ethnicity?	
Select one.	
○	Hispanic or Latino
○	Asian
○	Black or African American
○	Native American or Alaska Native
○	Native Hawaiian or Other Pacific Islander
○	White
○	Choose not to report
○	Other race or ethnicity, (specify)::

6. Which of the following BEST describes the organization you work for? (select ONE)	
Select one.	
○	No organization
○	School or district (K-12)
○	State educational agency
○	Institution of higher education (vocational school, junior college, college, or university)
○	Private Industry
○	Department of Defense or other government agency
○	Non-profit
○	Other, (specify):

7. Which of the following BEST describes your current occupation (select ONE)		
Select one.		
○	Teacher	(Go to question number 8.)
○	Other school staff	(Go to question number 8.)
○	University educator	(Go to question number 11.)
○	Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	(Go to question number 11.)
○	Scientist, Engineer, or Mathematics professional	(Go to question number 11.)
○	Other, (specify)::	(Go to question number 11.)

8. What grade level(s) do you teach (select all that apply)?	
Select all that apply.	
☐	Upper elementary
☐	Middle school
☐	High school

9. Which best describes the location of your school?	
Select one.	
○	Urban (city)
○	Suburban
○	Rural (country)
○	Frontier or tribal school
○	Home School
○	Online School
○	Department of Defense School (DeDEA or DoDDS) Choose not to report

10. Which of the following subjects do you teach? (select ALL that apply)	
Select all that apply.	
☐	Upper elementary
☐	Physical science (physics, chemistry, astronomy, materials science, etc.)
☐	Biological science
☐	Earth, atmospheric, or oceanic science
☐	Environmental science
☐	Computer science
☐	Technology
☐	Engineering
☐	Mathematics or statistics
☐	Medical, health, or behavioral science
☐	Social Science (psychology, sociology, anthropology)
☐	Other, (specify)::

11. Which of the following best describes your primary area of research?

Select one.

○	Physical science (physics, chemistry, astronomy, materials science, etc.)
○	Biological science
○	Earth, atmospheric, or oceanic science
○	Environmental science
○	Computer science
○	Technology
○	Engineering
○	Mathematics or statistics
○	Medical, health, or behavioral science
○	Social Science (psychology, sociology, anthropology)
○	N/A - I am a teacher not STEM researcher
○	Other, (specify)::

12. In which of the eCybermission regions did you participate? (Select ONE)	
Select one.	
○	West
○	North Central
○	South Central
○	North East
○	South East
○	Not Sure

13. Which of the following describes your role during eCybermisssion?	
Select all that apply.	
☐	Research Mentor
☐	Competition Advisor
☐	Teacher
☐	Other, (specify)::

14. How many eCybermission participants did you work with this year?	
	students.

15. How did you learn about eCybermission? (Check all that apply)

Select all that apply.

☐	Academy of Applied Science (AAS) website
☐	Army Educational Outreach Program (AEOP) website
☐	AEOP on Facebook, Twitter, Pinterest, or other social media
☐	A STEM conference or STEM education conference
☐	An email or newsletter from school, university, or a professional organization
☐	Past eCybermission participant
☐	A student
☐	A colleague
☐	My supervisor or superior
☐	A eCybermission site host or director
☐	Workplace communications
☐	Someone who works with the Department of Defense (Army, Navy, Air Force)
☐	Other, (specify)::

16. 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."

Select one per row.

	Never	*Once*	*Twice*	*Three or more times*	*I've never heard of this program*
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	○	○	○	○	○

17. How SATISFIED were you with the following eCybermission features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Application or registration process	○	○	○	○	○
Communication with National Science Teachers Association (NSTA)	○	○	○	○	○
Submission process	○	○	○	○	○
Value of Cyber Guide live chat	○	○	○	○	○
The variety of STEM mission folder challenges available	○	○	○	○	○
Value of Cyber Guides feedback	○	○	○	○	○
Value of Cyber Guides forum	○	○	○	○	○
eCybermission website	○	○	○	○	○
Educational materials	○	○	○	○	○
Mission control (phone) response time	○	○	○	○	○

Mission control (email) response time	○	○	○	○	○

18. 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 eCybermission.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Become familiar with my student(s) background and interests at the beginning of the JSHS experience	○	○
Giving students real-life problems to investigate or solve	○	○
Selecting readings or activities that relate to students' backgrounds	○	○
Encouraging students to suggest new readings, activities, or projects	○	○
Helping students become aware of the role(s) that STEM plays in their everyday lives	○	○
Helping students understand how STEM can help them improve their own community	○	○
Asking students to relate real-life events or activities to topics covered in eCybermission	○	○

19. 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 eCybermission.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Identify the different learning styles that my student (s) may have at the beginning of the JSHS experience	○	○
Interact with students and other personnel the same way regardless of their background	○	○
Use a variety of teaching and/or mentoring activities to meet the needs of all students	○	○
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	○	○
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	○	○
Directing students to other individuals or programs for additional support as needed	○	○
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	○	○

20. 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 eCybermission.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Having participant(s) tell other people about their backgrounds and interests	○	○
Having participant(s) explain difficult ideas to others	○	○
Having participant(s) listen to the ideas of others with an open mind	○	○
Having participant(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	○	○
Having participant(s) give and receive constructive feedback with others	○	○

21. 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 eCybermission.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Teaching (or assigning readings) about specific STEM subject matter	○	○
Having participant(s) search for and review technical research to support their work	○	○
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	○	○
Supervising participant(s) while they practice STEM research skills	○	○
Providing participant(s) with constructive feedback to improve their STEM competencies	○	○
Allowing participant(s) to work independently to improve their self-management abilities	○	○

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

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Asking participant(s) about their educational and/or career goals	○	○
Recommending extracurricular programs that align with participants' goals	○	○
Recommending Army Educational Outreach Programs that align with participants' goals	○	○
Providing guidance about educational pathways that will prepare participant(s) for a STEM career	○	○
Discussing STEM career opportunities within the DoD or other government agencies	○	○
Discussing STEM career opportunities in private industry or academia	○	○
Discussing the economic, political, ethical, and/or social context of a STEM career	○	○
Recommending student and professional organizations in STEM to my student(s)	○	○
Helping participant(s) build a professional network in a STEM field	○	○

Helping participant(s) with their resume, application, personal statement, and/or interview preparations	○	○

23. How useful were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during eCybermission?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
eCybermission website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
eCybermission Program administrator or site coordinator	○	○	○	○	○
Invited speakers or "career" events	○	○	○	○	○
Participation in eCybermission	○	○	○	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
eCybermission website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
eCybermission Program administrator or site coordinator	○	○	○	○	○
Invited speakers or "career" events	○	○	○	○	○
Participation in eCybermission	○	○	○	○	○

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

Select one per row.

	Yes - I discussed this program with my student(s)	*No - I did not discuss this program with my student(s)*
UNITE	○	○
Junior Science & Humanities Symposium (JSHS)	○	○
Science & Engineering Apprenticeship Program (SEAP)	○	○
Research & Engineering Apprenticeship Program (REAP)	○	○
High School Apprenticeship Program (HSAP)	○	○
College Qualified Leaders (CQL)	○	○
GEMS Near Peer Mentor Program	○	○
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 participant(s) but did not discuss any specific program	○	○
eCybermission	○	○

26. How much do you agree or disagree with the following statements about Department of Defense (DoD) researchers and research:

Select one per row.

	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 solve real-world problems	○	○	○	○	○
DoD research is valuable to society	○	○	○	○	○

27. How often did YOUR STUDENT(S) have opportunities to do each of the following in eCybermission?

Select one per row.

	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 new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○
Use laboratory or field techniques, procedures, and tools	○	○	○	○	○
Participate in hands-on STEM	○	○	○	○	○

activities					
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

28. AS A RESULT OF THEIR eCybermission EXPERIENCE, how much did your student(s) GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
In depth knowledge of a STEM topic(s)	○	○	○	○	○
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	○	○	○	○	○

29. Which category best describes the focus of your student(s) eCybermission activities?	
Select one.	
○	Scientific inquiry
○	Engineering design

30. AS A RESULT OF THEIR eCybermission EXPERIENCE, how much did your student(s) GAIN in their abilities to do each of the following?

Select one per row.

	No gain	*Small gain*	*Medium gain*	*Large gain*
Asking a question that can be answered with one or more scientific experiments	○	○	○	○
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	○	○	○	○
Using knowledge and creativity to suggest a solution to a problem	○	○	○	○
Making a model of an object or system showing its parts and how they work	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○

Carrying out procedures for an experiment and recording data accurately	○	○	○	○
Using computer models of objects or systems to test cause and effect relationships	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○
Considering different interpretations of data when deciding if a solution to a problem works as intended	○	○	○	○
Considering different interpretations of data when deciding how the data answer a question	○	○	○	○
Supporting an explanation for an observation with data from experiments	○	○	○	○
Supporting an explanation with relevant scientific, mathematical,	○	○	○	○

and/or engineering knowledge				
Supporting a solution for a problem with data	○	○	○	○
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	○	○	○	○
Defending an argument that conveys how an explanation best describes an observation	○	○	○	○
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○
Integrating information from technical or scientific texts and other media to support your explanation of an observation	○	○	○	○
Communicating	○	○	○	○

about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)				
Integrating information from technical or scientific texts and other media to support your solution to a problem	○	○	○	○

31. AS A RESULT OF THE eCybermission EXPERIENCE, how much did your student(s) GAIN (on average) in the skills/abilities listed below?

Select one per row.

	No gain	*Small gain*	*Medium gain*	*Large gain*
Learning to work independently	○	○	○	○
Setting goals and reflecting on performance	○	○	○	○
Sticking with a task until it is finished	○	○	○	○
Making changes when things do not go as planned	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○
Communicating effectively with others	○	○	○	○
Confidence with new ideas or procedures in a STEM project	○	○	○	○
Patience for the slow pace of research	○	○	○	○
Desire to build relationships with professionals in a field	○	○	○	○
Connecting a topic	○	○	○	○

or field with their personal values				

32. Which of the following statements describe YOUR STUDENT(S) after participating in the eCybermission program?

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of SEAP*	*Agree - SEAP contributed*	*Agree - SEAP 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 earning a STEM degree	○	○	○	○
More interested in pursuing a career in STEM	○	○	○	○
More aware of DoD STEM research and careers	○	○	○	○
Greater appreciation of DoD STEM	○	○	○	○

research				
More interested in pursuing a STEM career with the DoD	○	○	○	○

33. What are the three most important strengths of eCybermission?	
Strength #1:	
Strength #2:	
Strength #3:	

34. What are the three ways eCybermission should be improved for future participants?	
Improvement #1:	
Improvement #2:	
Improvement #3:	

35. Please tell us about your overall satisfaction with your eCybermission experience.

Appendix F

NSTA Response to FY16 Evaluation Report

This report has a lot of useful data that will guide our efforts to improve our efforts in promoting not only eCM, but also all AEOP initiatives, along with the AEOP goals. NSTA will share and discuss these findings with our eCM staff to accomplish the changes needed to provide a better program in FY17.

NSTA has addressed or will address the following recommendations/issues in the FY17 competition.

1. It is recommended for the program to consider doing more to recruit students from schools serving historically underrepresented and underserved groups and to find ways to support these students so that they can potentially progress to the National competition. Additionally, participation in eCM overall declined largely in FY16. It is recommended that there is a concerted effort in FY17 to increase participation in the program overall.

NSTA has developed a new rubric for the Mini-Grant program to target more Title I schools. We have run into some issues with US citizenship that we are addressing, and most often the US citizenship problems are from underrepresented/underserved groups. It is the hope of NSTA that the new AEOP Strategic Outreach Partnerships will increase the number of students in this population also. Webinars have been scheduled with some of the partners to help them get started. Targeted participation at conferences in low registration states has been planned for FY17.

2. Although recent efforts of NSTA to improve the eCM website to make clear the association of eCM with the AEOP, it may be useful to provide AEOP brochures electronically to teams at all state and regional eCM events, and to consider ways in addition to the "Volunteer Spotlight" to communicate a variety of STEM careers available in the DoD, particularly to the state and regional students.

NSTA will provide the AEOP brochures electronically to all Team Advisors and students through an eblast once registration is completed on December 7, 2017. Additionally, eCM will make the biographies of our CyberGuides more prevalent on the website and will work with our eCM communications person to do more with blogs and highlighting STEM careers on the website this upcoming year.

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

NSTA will continue to work with Widmeyer to help improve the messaging about the AEOP portfolio of initiatives when NSTA exhibits at conferences. This year, NSTA is using the AEOP tabletop display at many of the national conferences. The display is outdated and needs to be updated for all to use. Additionally, at all conferences, the AEOP brochure with rack cards for all programs is being distributed by NSTA staff. NSTA staff has received training with regards to all AEOP initiatives.

4. From page 55: The students who participated in regional eCM also indicated that they would like more guidance or tips on how to answer the question

NSTA has begun a new weekly newsletter called "Mission Possible" to Team Advisors (which are archived on the website for team advisors that register later in the year) that has tips on answering the questions. In the past, this newsletter began going out in January on a bi-weekly basis. This year we began sending out the newsletter to registered Team Advisors in October.

5. From page 55: The eCM-N students responded that there should be more free time during the DC trip, a later curfew, a longer trip, and consideration of the time it takes to get over jet lag and adjusting to the time change.

NSTA has plans in place to extend the NJ&EE timeframe by a day, with activities beginning on Monday morning rather than late Monday afternoon. There will be no "formal" activities planned for the day of travel on Sunday.

6. From page 57: Adults were also asked to respond to an open-ended item asked them to describe three ways eCM could be improved for future participants. Of the 114 out of 181 Team Advisors who responded to this question, there were a variety of responses, with no one category being more than 10% of the responses. The following categories of suggestions represent the Team Advisor responses for this question: overwhelming amount of information on website (a fact sheet would be helpful), teacher training, allow mixed grade teams, less paperwork for TA, more outreach to more students to participate, create a larger variety of categories, provide examples, allow video uploads, make data entry easier, change the timeline so that it is longer, allow spreadsheets for registration, and leave registration entirely in the hands of the students. Focus group participants spoke of improvements regarding communication of overall information.

These topics will be discussed by the NSTA eCM staff. Some of these items (mixed grade teams) will need to be discussed with the Army as this would be a programmatic change.