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Army Educational Outreach Program

eCYBERMISSION

2017 Annual Program Evaluation Report

PART 1: Executive Summary

April 2018

ARMY EDUCATIONAL OUTREACH PROGRAM

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2 | 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 175,000 students from across the U.S., U.S. territories, and Department of Defense Educational Activities (DoDEA)'s schools worldwide have participated in eCM. The program is a web-based science, technology, engineering, and mathematics (STEM) competition designed to engage sixth through ninth grade students in real-world problem solving *Mission Challenges* that address local community needs through scientific practices or the engineering design process. eCM teams work collaboratively to research and implement their projects, from inception to prototyping, which are documented and judged through the submission of *Mission Folders* to the eCM website.

This report documents the evaluation of the FY17 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 one with their Team Advisors; observations of the National Judging & Educational Event (NJ&EE), and an annual program report compiled by eCM.

A total of 21,277 students entered state competitions in FY17 (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 regional judging done via video conference (facilitated by Blackboard Elluminate). The highest score in each region for each grade determined 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. Twenty National Finalist Teams with a total of 73 students and 21 Team Advisors as well as 1 STEM-in-Action Team competed at NJ&EE in FY17.

2017 eCM Fast Facts	
Description	eCYBERMISSION is a web-based science, technology, engineering, and mathematics (STEM) competition for students in grades 6 through 9 that promotes self-discovery and enables all students to recognize the real-life applications of STEM. Teams of 3 or 4 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.
Participant Population	6th-9th grade students
No. of Registered Applicants	27,881 students registered
No. of Participants	21,277
Number of Underserved[1] applicants	12,690
Placement Rate	N/A all that apply are permitted to participate
Registered teams	5,989
Registered teams (complete)	5,989 Complete Teams
Students attending national event	73
Teams attending national event	21
Submission Completion Rate	70.8%
Number of Adults (Team Advisors and Volunteers – including S&Es and Teachers)	3,253
Team Advisors (with complete teams)	795
Number of Volunteers (Ambassadors, CyberGuides, Virtual Judges)	1,145
Number of Army S&Es	1,200
Number of Army/DoD Research Laboratories	46
Number of K-12 Teachers (including preservice)	1,019
Number of K-12 Schools (home, private, public, DoDEA)	776
Number of K-12 Schools Title 1	290
Number of Colleges/Universities	62
Number of DoDEA Students	449
Number of DoDEA Teachers	20
Number of DoDEA Teams	136
Number of DoDEA Schools	16
Number of Other Collaborating Organizations	12

[1] AEOP's definition of underserved includes at least two of the following: low-income students; students belonging to race and ethnic minorities that are historically underrepresented in STEM; students with disabilities; students with English as a second language; first-generation college students; students in rural, frontier, or other federal targeted outreach schools; females in certain STEM fields.

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	$2,980,003
Cost Per Student Participant	$140

Summary of Findings

The FY17 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.

2017 eCM Evaluation Findings	
Participant Profiles	
Participation in eCM increased in FY17	In FY17, 21,277 students participated in eCM, a 3% increase over the 20,607 who participated in FY16.
	As in FY16, student participation by gender was nearly equally distributed between males (49%) and females (51%).
	Students from a variety of backgrounds participated in eCM in FY17. 45% of eCM participants identified as underserved at registration. Nearly half (48%) of participants were White and 10% were Asian, while 10% were Black or African American (an increase from 8% in FY16), and 19% were Hispanic/Latino.
	Students in eCM were enrolled in a variety of school settings, with 41% of students from suburban schools, 28% from urban schools, and 17% from rural schools.
Actionable Program Evaluation	

Students learned about eCM primarily through school contacts or through personal relationships.	About half of responding students learned about eCM from someone who works at the school or university they attend, highlighting the importance of teachers in the student recruitment process. Large proportions of students who competed at the NJ&EE also reported learning about eCM through personal contacts, including friends (39%), family members (24%), and past participants (22%). Fewer regional students reported learning about eCM through these personal contacts (for example 5% learned about eCM through friends and 7% through past participants), however only 262 regional students responded to this question, and of those, nearly a quarter chose not to report how they learned about eCM.
Students are motivated to participate in eCM for a variety of reasons, although students competing at the regional level are more frequently motivated by external factors than students competing at the national level who tend to be motivated by more internal factors.	Regional students reported being primarily motivated by external factors such as teacher or professor encouragement (41%) and an academic requirement or school grade (39%). In contrast, national students reported being motivated by more internal factors such as the desire to learn something new or interesting (41%) and having fun (37%). However, only 251 regional students responded to this question and of those, over a quarter (27%) chose not to report their motivation for participating.
Most student and adult participants were satisfied with the features of eCM they had experienced, although regional students were more likely to express dissatisfaction with some program features than NJ&EE students or adults.	Over half of both regional and NJ&EE students reported being at least somewhat satisfied with most features of eCM including the website (66% and 84% respectively), educational materials (55% and 74%), and the submission process (63% and 88%). Relatively large proportions of students had not experienced resources such as the Cyber Guide live chats (53% regional and 23% NJ&EE) and Cyber Guides feedback (22% regional and 38% NJ&EE). Regional students were more likely to express being "not at all" satisfied with program features such as Mission control phone (13%) and email (12%) response time than were NJ&EE students (1% and 3% reported being not at all satisfied with these features). Students also suggested improvements in program features, commenting, for instance, that the challenge could be more clear and less complex, and that they felt that the website could be improved and the Mission Folder format's usability could be improved.
	The majority of adults were at least somewhat satisfied with all aspects of the program that they had experienced, and very few expressed being "not at all" satisfied with program features. In particular 93% were at least somewhat satisfied with the submission process and 83% were at least somewhat satisfied with the variety of challenges available. Like students, many adults had not experienced resources such as the Cyber Guides forum (54%) and Cyber Guide live chats (56%). Adults suggested a variety of improvements in the program including providing more resources for teachers and examples of completed projects. Adult focus group participants noted that Blackboard can be difficult to use and cannot be accessed at some schools.
Outcomes Evaluation	

eCM student participants reported gains in their STEM knowledge and competencies although students competing at the NJ&EE reported significantly larger gains than students competing at the regional level.	Nearly all eCM students responding to the survey reported some level of STEM Knowledge gains as a result of participating in eCM. Students who had competed at the NJ&EE, however, reported significantly greater gains than those who competed at the regional level. Students at the regional level were more likely to report that they had experienced no gains in areas such as their in-depth knowledge of a STEM topic (12% regional versus 1% NJ&EE) and knowledge of what everyday research work is like in STEM (16% regional versus 0% NJ&EE).
	Over 50% of all students at both the NJ&EE and regional levels reported medium or large gains in nearly all areas of STEM competency. Students who had competed at the NJ&EE reported significantly greater gains than those who competed at the regional level. For example: communicating about experiments in different ways (eCM-NJ&EE 94.2%; eCM overall 62.1%); supporting an explanation for an observation with data from experiments (eCM-NJ&EE 92.8%; eCM overall 63.9%); using knowledge and creativity to suggest a testable explanation for an observation (eCM-NJ&EE 88.4%; eCM overall 65.1%); and carrying out procedures for an experiment and recording data accurately (eCM-NJ&EE 98.5%; eCM overall 68.7%). Students at the regional level were more likely to report that they had experienced no gains in areas such as using computer models of objects or systems to test cause and effect relationships (31% regional versus 17% NJ&EE) and making a model of an object or system showing its parts and how they work (22% regional versus 6% NJ&EE).
	Students reported that increased knowledge in STEM, teamwork or collaboration skills, and the opportunity to develop research skills were benefits of participating in eCM.
	Students at all competition levels reported greater levels of engagement in STEM in their eCM experiences than in their typical school experiences.
	Adults reported that the opportunity for students to focus on real-work problems, work in teams, be involved in their communities, and solve problems are strengths of the eCM program.
eCM had positive impacts on students' perceptions of their 21st Century Skills although students competing at the NJ&EE reported significantly larger gains than students competing at the regional level.	Large majorities of students at all competition levels reported gains in 21st Century skills such as communicating effectively with others and sticking with a task until it is finished. Nearly 90% or more of NJ&EE participants reported "medium" or "large" gains on all 21st Century Skills items. Between 65% and 75% of overall participants reported "medium" or "large" gains on all 21st Century Skills items. Students who had competed at the NJ&EE reported significantly greater gains than those who competed at the regional level, and students at the regional level were more likely to report that they had experienced no gains than students competing at the NJ&EE. For example, 11% of regional students reported that they had not gained in viewing failure as an opportunity to learn and in working well with students from all backgrounds as compared to 0% and 4% of NJ&EE students.

	Adults reported that skills associated with 21st Century skills such as teamwork, communication, problem solving, and perseverance are among the key strengths of eCM.
Students competing at the NJE&E participants were more likely than regional students to report gains in their identity in STEM and interest in engaging in STEM activities in the future.	Like FY16 findings, questionnaire data strongly suggest that the program had a positive impact on students' identity in STEM and likelihood of engaging in STEM activities in the future for students competing at the NJ&EE level. More than three-quarters of students competing at the NJ&EE reported "medium" or "large" gains for every item. Findings for regional level students were mixed. Students at the regional level reported roughly an equal spread across the responses "no gain," "little gain," "medium gain," and "large gain" for all categories (see Table 32R). For example, nearly all NJ&EE students (98.6%) reported "medium" or "large" gains in their sense of accomplishment in a STEM endeavor compared to only 49.3% of Regional students. While nearly all (97%-100%) NJ&EE students reported being more likely to engage in STEM activities in the future after participating in eCM, relatively large percentages (40-51%) of regional students reported that there had been no change in the likelihood that they would engage in future STEM activities outside of regular school classes.
Team advisors used a range of mentoring strategies with students.	A majority of mentors reported using strategies to establish the relevance of learning activities, support the diverse needs of students as learners, support students' development of collaboration and interpersonal skills, support students' engagement in authentic STEM activities, and support students' STEM educational and career pathways.
While most students at all competition levels learned about general careers in STEM, students competing at the NJ&EE level were much more likely to be familiar with DoD STEM jobs or careers.	All NJ&EE students and 66% of regional students had learned about at least 1 STEM job or career during eCM. In contrast, while all NJ&EE students had learned about DoD STEM jobs or careers, less than a third (31%) of regional students had learned about any of these careers. Likewise, while 68% of national students had learned about 5 or more DoD STEM jobs or careers, only 3% of regional students had learned about this number of DoD Stem jobs or careers, suggesting that NJ&EE is a more effective forum for introducing participants to DoD career opportunities than the regional events.
	Adults reported that the most useful resources for exposing students to DoD STEM careers were participation in eCM (76% reported this was at least somewhat useful) and the eCM website (76% reported this was at least somewhat useful). Most adults had not experienced resources such as AEOP on social media (75%), the AEOP brochure (72%), or the AEOP website (58%).
	Over three-quarters (84%) of NJ&EE students indicated that their participation in eCM resulted in an increased interest in pursuing a STEM career with the Army or DoD while only a third of Regional students reported this impact.
	Student focus group participants at the NJE&E reported that the speakers were a key source of information about STEM jobs and careers in the DoD.
eCM participants were likely to express interest in participating in eCM again, however the	Nearly all students (97%) competing at the NJ&EE level, were at least a little interested in competing in eCM again, and 77% of students at the regional level were interested in competing again.

majority of students at the regional level had not heard of other AEOPs.	Findings suggest that students are exposed to other AEOPs at NJ&EE since most NJ&EE students had heard of all other AEOPs and over half expressed being at least somewhat interested in participating in most programs in the future. Students in the NJ&EE focus group credited the alumni panel for some of their familiarity with AEOPs. Surprisingly, NJ&EE students were least likely to have heard of JSS (38% had not heard of it), a program for which middle school students are eligible. Most regional students (60%-71%) had not heard of AEOPs other than eCM and smaller proportions of regional students were interested in future participation.
	Nearly all (96%) NJ&EE students reported being more aware of other AEOPs as a result of eCM, however only 50% of Regional students reported this impact.
	Few adults (1%-9%) reported discussing any other AEOPs with students other than eCM, although over a third (34%) reported that they had discussed AEOP but had not discussed any specific program.
	Adults reported that participating in eCM and the eCM website were the most useful resources for exposing students to AEOPs.
While eCM had positive impact for students competing at all levels, NJ&EE students reported significantly higher levels of impact.	More than half of all students (NJ&EE and Regional) agreed that eCM positively impacted their confidence in STEM knowledge, skills, and abilities (eCM-NJ&EE 91.3%; eCM overall 73.7%); interest in STEM outside of school (eCM-NJ&EE 89.8%; eCM overall 55.3%); interest in taking STEM classes (eCM-NJ&EE 81.2%; eCM overall 51.8%); and appreciation of Army or DoD STEM research (eCM-NJ&EE 95.6%; eCM overall 50.9%).
	Students who competed at the NJ&EE reported statistically significantly higher levels of impact than overall/Regional students. This included items such as confidence in STEM, interest in STEM, awareness of AEOPs, and future interest in STEM education and careers. These findings suggest that attending the NJ&EE event has greater impacts on students than competing at the regional level.

Responsiveness to FY16 Evaluation Recommendations

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

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

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

Industry Base

FY16 Finding: 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.

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.

eCM FY17 Efforts and Outcomes: NSTA developed a new rubric for the Mini-Grant program to target more Title I schools. NSTA addressed some U.S. citizenship issues that tend to arise from the U/U groups. NSTA worked with new AEOP Strategic Outreach Partners to increase the number of students in the U/U population. eCM also attended conferences in states with low registration numbers.

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

FY16 Finding: 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.

eCM FY17 Efforts and Outcomes: NSTA provided AEOP brochures electronically to all Team Advisors and

students through an eblast once they completed registration December 7, 2017. In addition, the AEOP Brochure can be found on the eCM website. CyberGuide biographies were prevalent on the website and CyberGuide S/E experiences were highlights in CyberGuide Chat promotion to students and parents. U.S. Army Scientists and Engineers were profiled in blogs and through advertorials printed in the Pentagram and DC Military Magazine. This was done to recruit more CyberGuides and Virtual Judges to support students.

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

FY16 Finding: 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.

eCM FY17 Efforts and Outcomes: NSTA continued to work with Widmeyer to improve messaging about eCM specifically and AEOP overall. NSTA promoted AEOP STEM efforts at conferences through the distribution of the AEOP Brochure and AEOP rack cards as well as the use of the AEOP Tabletop and new displays, which became available in May. All NSTA staff received training with regards to all AEOP initiatives. NSTA collaborated with RESET to cross-promote AEOP at NSTA's National Conference. NSTA also worked closely with the AEOP Alumni Group to promote AEOP opportunities to eCM Alumni. eCM contributed content to the AEOP blog, was promoted by Widmeyer on AEOP social media, and eCM collaborated with Widmeyer during the AEOP website redesign efforts.

Recommendations for FY18 Program Improvement/Growth

Evaluation findings indicate that FY17 was a success overall for the eCM program. Notable successes for the year include a 3% growth in percentage of participants overall and nearly equivalent participation of male (49%) and female (51%) students. Further, eCM grew the percentage of African American/Black participants by 8% and continued to have good participation from Hispanic/Latinos (19%). Schools and teachers remained the primary mode of recruitment for participation in the program. Participants

reported growth in STEM knowledge overall and over 50% at both NJ&EE and regional levels experienced medium or large gains in nearly all areas of STEM competency. While these successes are commendable, there are some areas that remain with potential for growth and/or improvement.

The evaluation team therefore offers the following recommendations for FY18 and beyond:

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

Despite NSTA's continued efforts in outreach to the Team Advisors and subsequently students through emails and the eCM website, the results of the survey indicate that, as in FY16 (53% regional; 23% NJ&EE) and few participants use the CyberGuide live chat (22% regional; 38% NJ&EE). NSTA should continue to work to market to participants the value of the use of these important resources to increase the usage.

In FY17, more than a third of regional eCM participants (31%) reported on the evaluation survey they had not learned about any DoD/STEM jobs/careers. Conversely, 68% of NJ&EE participants reported learning about five or more DoD/STEM careers. NSTA should continue to work with regional sites to infuse the learning and connections of the program to the DoD and relevant STEM careers within and outside of the DoD.

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. Over a third (38%) of NJ&EE students had never heard of JSS, indicating two things: 1) eCM is likely their first program in the AEOP pipeline, and 2) eCM may not be marketing this program as frequently as other opportunities. Few Team Advisor/Adults (9%) reported discussing any other AEOPs with students besides eCM, a decrease from 25% in FY16. Most regional participants (60-71%) had not heard of other individual AEOPs. As stated in FY16, 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