



Army Educational Outreach Program  
eCYBERMISSION  
FY15 Annual Program Evaluation Report



2015



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## Executive Summary

eCYBERMISSION 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 100,000 students from across the U.S., U.S. territories, and Department of Defense Educational Activities (DoDEA)'s 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 scientific practices or the engineering design process. eCYBERMISSION 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 eCYBERMISSION website.

In support of eCYBERMISSION's implementation efforts, David Heil and Associates, Inc. (DHA) provides independent research and evaluation services to NSTA and the U.S. Army. As an external research and evaluation firm, DHA conducts annual formative and summative evaluations of the web-based competition. This yearlong study focuses on program efficacy and quality of experience; student attitudinal, performance, and behavioral changes; Team Advisor program assessments; and the competition's National Judging & Education Event (NJ&EE). During Fiscal Year 2015 (FY15), DHA collected program data through pre- and post-program surveys, a Team Advisor survey, observations of the NJ&EE event, NJ&EE participant survey, and focus group discussions with NJ&EE competitors and their Team Advisors.

**Table 1. 2015 eCYBERMISSION Fast Facts**

AEOPs	
<b>Major Participant Groups</b>	
Students	27,955
Team Advisors	1,749
Mission Folder Submitted	4,280
Cyberguides	96
Virtual Judges	Virtual Judges: 1,439      Student Virtual Judges: 966
Ambassadors	100
<b>Total Awards</b>	<u>Second-Place State Winners:</u> \$500 U.S Savings Bonds/student <u>First-Place State Winners:</u> \$1,000 U.S. Savings Bonds/student <u>All Regional Finalists:</u> \$1,000 U.S. Savings Bonds/student <u>First-Place Regional Winners:</u> \$2,000 U.S Savings Bonds/student; all expense paid trip to NJ&EE <u>First-Place Nation Winners:</u> \$5,000 U.S. Savings Bonds/students



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## Summary of Findings

The FY15 eCYBERMISSION evaluation collected quantitative and qualitative data to inform continued formative program development efforts in addition to the summative measurement of the competition's participant impacts. The key findings presented below are intended to inform future iterations of program implementation and document current FY15 programmatic success.

- The FY15 evaluation's findings are more representative than FY14 findings due to larger sample sizes. The FY15 collected feedback from 2,492 participants who completed the *eCYBERMISSION Pre-Student Survey*, and 809 participants completed the *eCYBERMISSION Post-Student Survey*. From these samples, 365 students completed both surveys, which enabled pre to post program comparisons.
- Participants reported completing their *Mission Folders* in three to four months, and nearly all of the pre-survey respondents (90.5%) reported that they were competing in eCYBERMISSION for the first time.
- Nearly all (91.0%) of the pre-survey respondents reported learning about eCYBERMISSION from a teacher. Subsequent qualitative descriptions of why students participated in eCYBERMISSION, however, revealed that many students felt "*forced*" to participate because of a mandatory classroom requirement or grade. While this recruitment strategy likely increased the scale of program participation, it could also contribute to more negative feedback from students who did not freely elect to participate.
- Less than 5% of eCYBERMISSION participants had previously participated in other AEOPs. After competing in eCYBERMISSION, however, a quarter of the post-survey respondents reported an interest in other AEOPs. These participants most frequently attributed increased awareness of AEOPs to their eCYBERMISSION participation, Team Advisors, and the eCYBERMISSION website. A large percentages (approximately two-thirds) of respondents also reported that they did not experience the more poorly rated items. This suggests that the students either did not need these resources, or as indicated by qualitative feedback, did not know the resources existed.
- Previous FY14 evaluation data indicated three-fourths of the Team Advisors were unaware of other AEOP offerings. This response fell to a third during FY15, indicating the Team Advisors were more aware of AEOP opportunities available to their students.
- eCYBERMISSION participants reported that the most useful online resources were *Judging Rubrics*, *Examples of Mission Folders*, and the *Mission Folder Worksheets*, while the *Cyberguide Live Chats* prompted the weakest response. Survey feedback additionally indicated participants either did not need or were largely unaware of the lower rated resources.
- eCYBERMISSION participants suggested eCYBERMISSION resources and supports be strengthened through the introduction of website improvements and additional features, increased participant awareness of existing resources, increased clarity of presented information, the provision of more examples, and improved communications.
- A key FY15 program improvement was the participants' and Team Advisors' assessment of the online judging process and Virtual Judges. During FY14, the *Mission Folder* judging process was frequently



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the subject of critique, but FY15 evaluation participants reported greater satisfaction with this important program component in response to various data collection metrics.

- Team Advisors recommended eCYBERMISSION develop a stronger sense of community amongst Team Advisors in order to enhance *Mission Folder* quality and Team Advisor retention.
- A third to half of eCYBERMISSION participants reported engaging in various hands-on applications of STEM either *Every day* or *Most days*, indicates the eCYBERMISSION experience effectively and consistently involved students in STEM.
- In comparison to their pre-program survey feedback, the matched pre- and post-survey respondents were statistically more likely to take advanced STEM high school courses after completing the program.
- Approximately two-thirds of participants reported feeling *Confident* about their ability to conduct a scientific experiment or inquiry after participating in eCYBERMISSION.
- eCYBERMISSION significantly impacted students' development of 21<sup>st</sup> Century literacy skills. Program participants who completed the pre- and post-survey demonstrated significant gains in confidence regarding their ability to look up information about STEM and new technology, analyze large amounts of information in order to make a decision, understand complex scientific information, and use the results of a test/experiment to inform future decisions and/or ideas.
- eCYBERMISSION participants, both before and after program participation, positively rated their ability to work collaboratively in a team. NJ&EE competitors, however, frequently reported that participation in eCYBERMISSION enhanced their ability to value and utilize other team members' perspectives and successfully contribute to a team.
- In comparison to their pre-program survey feedback, the matched pre- and post-survey respondents were statistically more confident in their ability to communicate solutions and STEM concepts and employ a scientific approach to solve problems.
- When DHA asked post-survey respondents to indicate the career fields they were most interested in pursuing as adults, three of the four most frequently selected careers were STEM related (the medical field, engineering or architecture, or scientific research).
- In comparison to their pre-program survey feedback, the matched pre- and post-survey respondents were statistically more likely to apply to a STEM internship or consider working on STEM research with the military/DoD after participating in eCYBERMISSION.
- Approximately half of all eCYBERMISSION *Post-Student Survey* respondents reported that they *Significantly gained* or *gained* knowledge about past or current STEM research, research processes and ethics, approaches scientists and engineers use to solve STEM related problems, and what everyday STEM research work is like.
- Respectively, 25.5% and 19.4% of students reported that *they learned about different careers that use STEM* or *interacted with scientists or engineers* either *Every day* or *Most days* during





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eCYBERMISSION participation. Only 38.9% of students who completed the post-survey also reported that they would like to talk to a STEM professional about their work.

- NJ&EE competitors' assessments of the event were positive, and 79.2% of the competitors considered the competition either *Excellent* (35.1%) or *Good* (44.2%). Their assessment of program logistics (event facilities, arrival and check-in process, hotel accommodations, etc.) additionally improved during FY15. The only exception to this response trend was their assessment of the event's meals, which demonstrated a statistically significant decrease in satisfaction when compared to FY14.
- The NJ&EE schedule was one of the more poorly rated aspects of the FY15 NJ&EE. Both participants and Team Advisors describing the event as "*packed*," "*rigorous*," and "*hectic*," with too little time allocated to activity transitions or competition preparation. However, the FY15 assessment of the event as *Well-organized* was statistically more positive than the FY14 NJ&EE competitors.
- The Washington, DC trip was NJ&EE competitors' most and least favorite NJ&EE activity. The competitors most frequently shared that they valued having an opportunity to meet and share their projects with their state representatives, while other participants found the day's logistics and heat straining.
- Requiring the Team Advisors to always accompany students was a significant point of frustration for both NJ&EE competitors and Team Advisors. Participants of both the student and Team Advisor focus groups recommended FY16 introduce buddy system to the NJ&EE event, which would allow the competitors more freedom of movement and Team Advisors more opportunities to rest.
- When DHA asked the NJ&EE competitors to select adjectives that *Described* [eCYBERMISSION] *very well*, the three most often selected terms were: *Rewarding*, *Education*, and *Exciting*.
- NJ&EE competitors most frequently reported four areas of academic growth due to eCYBERMISSION and NJ&EE participation: increased understanding of STEM and its real-world applications, improved public speaking skills, increased knowledge of content specific to their eCYBERMISSION project, and increased knowledge of the Army and its utilization of STEM.
- When DHA asked the NJ&EE competitors to describe life skills gained from eCYBERMISSION and NJ&EE participation, they reported improved public speaking skills, the development of various 21<sup>st</sup> Century skills, and improved socialization skills.

## Recommendations

1. Increase eCYBERMISSION participants' awareness of program resources by embedding a brief introductory video into the online registration.
2. Improve the eCYBERMISSION experience by addressing current issues with the *Mission Folder* auto save and multi-user functionality.
3. Introduce mechanisms to enhance Team Advisors' interactions and peer-to-peer support.



4. 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.
5. Introduce an appropriate buddy system to the FY16 NJ&EE competition to enable students more freedom of movement and reduce Team Advisor strain.





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## Introduction

Entering its thirteenth year of implementation, the online eCYBERMISSION competition annually invites students to “accept the challenge” and explore ways in which science, technology, engineering, and mathematics (STEM) can be harnessed to solve real-world issues. By completing a *Mission Challenge* in one of seven areas (*Alternative Sources of Energy; Environment; Food, Health, & Fitness; Forces & Motion; National Security & Safety; Robotics; and Technology*), teams of three to four students use scientific practices or the engineering design process to develop solutions for local community problems.

Adult support and online resources encourage the efforts of eCYBERMISSION teams. Each team selects a designated Team Advisor, often a teacher or parent, to help complete the registration process, identify appropriate community issues and related *Mission Challenges*, support project activities and task completion, and review the official write-up of the project (the *Mission Folder*). Adult support is further contributed by volunteer, online Cyberguides who offer students technical knowledge and expertise. The Cyberguides, either Army scientists or engineers, provided students project guidance and feedback through regularly scheduled live eCYBERMISSION chats, instant messaging, and participation in webinars.

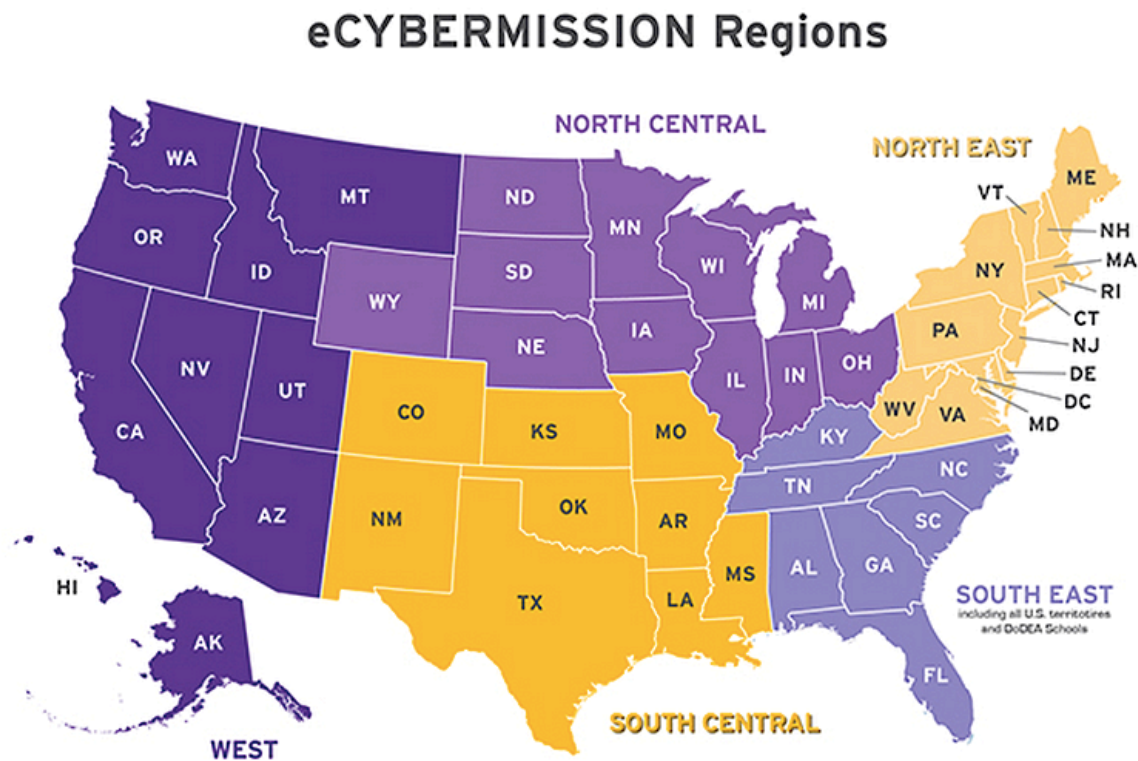
The eCYBERMISSION website additionally provides students and Team Advisors access to a variety of online resources. During the FY15 competition, a student *Team Resource* page, hosted on the eCYBERMISSION website, included eight video lessons, which ranged in topic from teamwork to executing an experiment to drawing conclusions, and accompanying worksheets. These materials were supplemented by documents containing information specific to *Mission Folder* development, scientific practices, and the engineering design process.

Team Advisors received similar online support through an *Advisor Resource* page. This webpage hosted a ten-minute, video tutorial that provided explanations of website features, program role descriptions, resource material locations and descriptions, competition rules and timelines, FAQs, program blogs and updates, and procedures for contacting eCYBERMISSION personnel. At the time of this report’s development, the video had 5,247 views.

The *Advisor Resource* page also included a downloadable, 208 page comprehensive document entitled *Team Advisor Resource Guide*, which described program eligibility, rules, *Mission Folder* structure and criteria, and provided sample lesson plans for each grade. These materials were again individually housed on the resource page in addition to: program updates, answer keys, suggested implementation timelines (project completion schedules for three, four, and six month time periods), grading rubrics, *Mission Folder* submission process instructions, and explanations of how the program aligns to Common Core, the Next Generation Science Standards (NGSS), and each state’s individual standards. These resources were designed to support Team Advisors’ fulfillment of program responsibilities and encourage teachers to integrate eCYBERMISSION participation into their classroom curricula.

Finally, volunteer Virtual Judges comprised of both military and civilian STEM experts reviewed and scored the teams' completed *Mission Folders*. Five randomly selected judges scored each *Mission Folder* based on three criteria: *Application of Scientific Inquiry using Scientific Practices or Engineering Design Process* as identified by scientific practice or engineering score cards (70%), *Benefit to the Community* (18%), and *Team Collaboration* (12%). The virtual judging process identified a) State Winners from each grade band and b) the Regional Finalists (the teams from each grade to receive the top three scores in the five designated national competition regions, see Figure 2). Regional judges reviewed the finalists' *Mission Folders* and participated in a teleconference, during which finalists gave a four minute project presentation followed by a three minute questions and answer session. The resulting regional winners then traveled to the Washington, DC area to compete in the annual National Judging and Educational Event (NJ&EE).

**Figure 1. Five eCYBERMISSION Competition Regions**



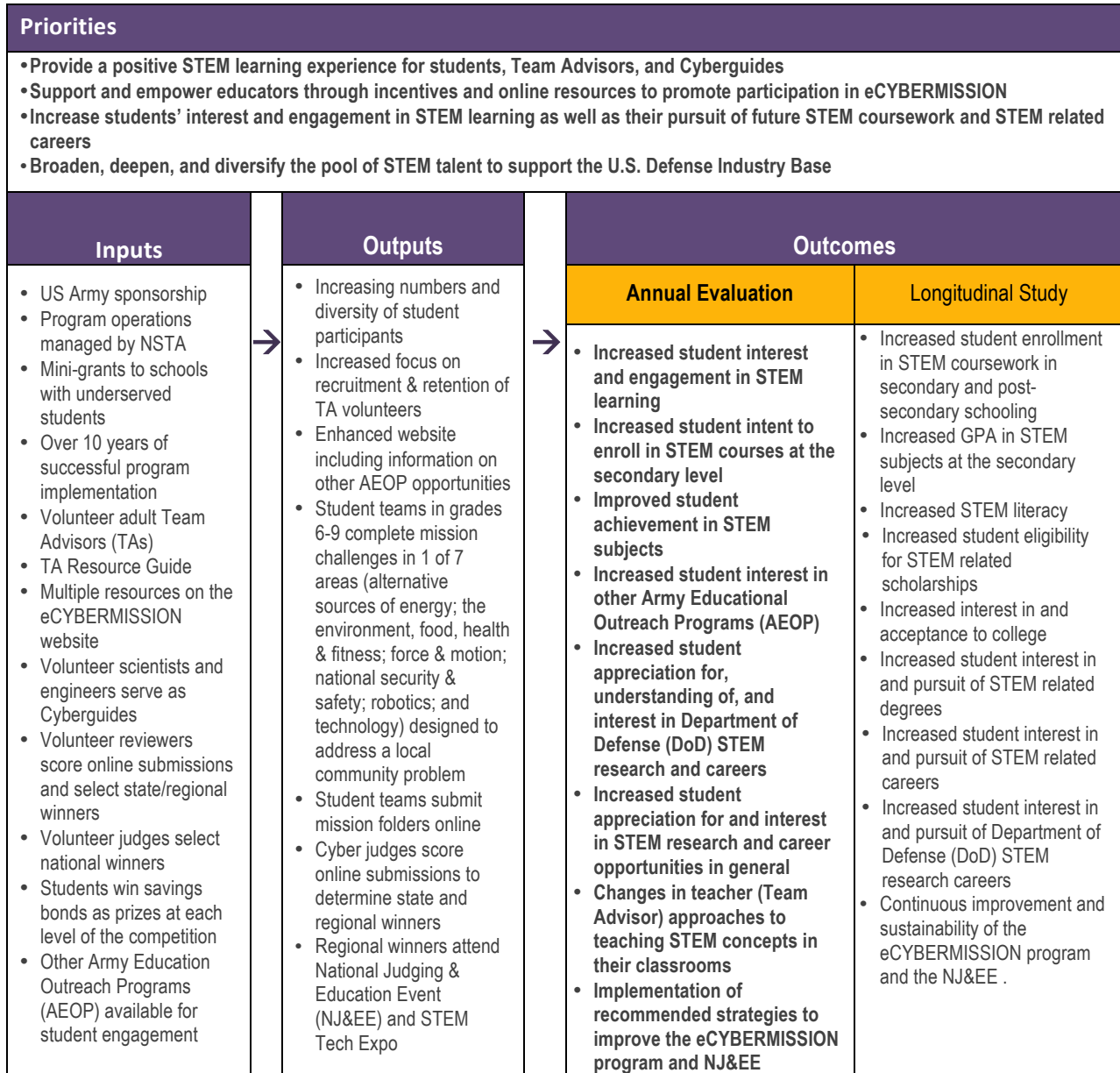
Source: eCYBERMISSION Website

### Logic Model

The eCYBERMISSION logic model presented in Figure 2 visually depicts the program's theory of action and highlights specific ways in which the inputs and activities lead to programmatic outcomes. The logic model highlights the expected causal chain from the inputs (resources) through actions and products (outputs) to anticipated outcomes, and it supported DHA's development and guidance of evaluation activities.



**Figure 2. eCYBERMISSION Logic Model**



### *Methodology: Data Collection, Sample Size, and Demographics*

DHA eCYBERMISSION evaluations were initiated during the 2012-2013 competition, which marked the first comprehensive evaluation of the program. The FY15 evaluation builds on these previous efforts and continues to assess the strengths, shortcomings, improvements, outputs, and short-term outcomes of the program's implementation. In order to accurately understand and represent eCYBERMISSION's



implementation efforts, participants' experiences, and the program's impacts, the evaluation utilized quantitative and qualitative data collection methodologies. DHA collected quantitative data via surveys and qualitative feedback through surveys, facilitated focus group discussions, and NJ&EE observations.

The FY15 evaluation included broad-based data collection, which DHA and NSTA conducted through the administration of online surveys to participating students (*eCYBERMISSION Student Pre- and Post-Surveys*), Team Advisors (*eCYBERMISSION Team Advisor Survey*), and NJ&EE competitors (*NJ&EE Student Survey*). DHA designed data collection instruments to assess participant demographics, *eCYBERMISSION* and Army Education Outreach Program (AEOP) awareness and participation, competition satisfaction, and the program's impact on students' STEM interests, attitudes, and awareness; 21<sup>st</sup> century skills; and perceptions of and interests in STEM career fields.

DHA and NSTA program personnel sent email invitations, which included a link to the *eCYBERMISSION Pre-Student Survey*, to all program participants and their Team Advisors during December 2014. NSTA facilitated the delivery of several email reminders to students and Team Advisors prior to DHA's closure of the online survey at the end of February 2015. During this three-month period, 2,492 students completed the survey, which included two sub-samples of participants: general student participants (1,597 students) and students enrolled in schools that received mini grants to support program participation (895 students).

After closing the survey, DHA immediately identified the *eCYBERMISSION Pre-Student Survey* respondents' Team Advisors. In order to more effectively develop a matched pre- and post-survey data set, DHA targeted the team members of the 192 identified Team Advisors (146 regular survey Team Advisors, and 46 mini grant Team Advisors) when administering the *eCYBERMISSION Post-Student Survey* invitation. During April 2015, 809 students completed the post-survey, which resulted in a matched pre- and post-survey sample of 365 students. When deemed appropriate, the findings presented in this report reflect the total 2,492 pre-survey sample, 809 post-survey sample, and the 365 matched student sample. The following tables present the total pre-survey sample set and the matched pre- and post-student data set demographics.

Table 2. Grade	Total	Matched
6th Grade	14.0%	9.6%
7th Grade	23.1%	23.1%
8th Grade	40.0%	56.7%
9th Grade	8.3%	10.2%

Table 3. Gender	Total	Matched
Male	40%	43%
Female	42%	55%

Table 4. School Type	Total	Matched
Public	69.9%	92.0%
Private	6.2%	4.7%
Home School	0.2%	0.0%
DoDEA School	5.1%	0.3%
DOD School	0.6%	0.0%

Table 5. Free/Reduced Lunch	Total	Matched
Yes	28.9%	29.5%
No	37.2%	45.5%
Don't know/ Chose not to answer	19.1%	24.0%



Table 6. eCYBERMISSION Participant Race/Ethnicity	Total Sample	Matched Sample
Hispanic or Latino	12.2%	8.5%
Asian	8.3%	12.7%
Black/African American	9.7%	16.0%
Native American/Alaska Native	0.6%	0.0%
Native Hawaiian/Other Pacific Islander	1.2%	0.8%
White/Caucasian	43.2%	51.5%
Unknown/Do not wish to report	3.7%	3.3%
Multiracial	6.7%	7.20%

The third survey DHA designed for the FY15 evaluation collected feedback from students who participated in NJ&EE, and it examined their perceptions of and satisfaction with the event. NJ&EE participants completed the survey, which was hosted on the newly adopted eCYBERMISSION registration system, during the final evening of the event. Seventy-seven students representing the regional winners and five STEM-in Action Grant recipient teams completed the survey. Nearly ten percent of the NJ&EE survey respondents also completed the pre-student survey (9.3%), the post-student survey (11.6%), or both (6.9%).

The final survey, which collected similar information as the eCYBERMISSION pre- and post-student surveys, was administered via email to all FY15 Team Advisors. Over a one-month period, 209 Team Advisors completed the survey. Three-fourths of the Team Advisors reported being female and Caucasian (73.6% and 76.3% respectively), and the majority of the Team Advisor (85.6%) also reported being a teacher. The majority (81.4%) of the teachers taught middle school students in a U.S. based public (84.0%) or private (11.7%) school located in a suburban (45.7%), urban (31.5%), or rural (21.0%) setting, although nearly a quarter (22.4%) also reported teaching high school students.

Table 7. eCYBERMISSION Team Advisor Race/Ethnicity	Percentage
Hispanic or Latino	5.7%
Asian	5.7%
Black/African American	5.2%
Native American/Alaska Native	1.5%
Native Hawaiian/Other Pacific Islander	0.0%
White/Caucasian	76.3%
Unknown/Do not wish to report	5.2%
Multiracial	6.7%



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## Observations & Focus Groups

A DHA evaluator attended the final two days of the FY15 NJ&EE competition. During the site visit, the evaluator observed the teams finalizing their presentation set-ups; the National Judging; the eCYBERMISSION National Showcase, a second project presentation to fellow competitors and guests; and the National Awards Luncheon. DHA additionally utilized this time to conduct two focus group discussions. The first focus group was on the evening of June 17, 2015, with NJ&EE Team Advisors who discussed their eCYBERMISSION and NJ&EE experiences and perceived student impacts. A second focus group was conducted the following afternoon immediately after the eCYBERMISSION National Showcase. The DHA evaluator met with representatives of each team (each team selected their own representative) to discuss how they had been impacted by eCYBERMISSION participation, the strengths and weakness of current program and NJ&EE implementation structures, and their awareness and interest in STEM fields and careers.

## Findings

### *eCYBERMISSION & AEOP Participation*

DHA collected quantitative and qualitative data regarding eCYBERMISSION and AEOP program participation via the *eCYBERMISSION Pre-Student Survey* and NJ&EE student focus group discussion. This feedback revealed that the majority of the students (69.3%) who completed the *eCYBERMISSION Pre-Student Survey* completed either the *Environment* or *Food, Health, & Fitness* mission challenges. The students also reported that on average it took between three and four months to complete and

Table 8. Mission Challenge Selection	
Mission Challenge	Percentage
Alternative Sources of Energy	6.90%
Environment	43.4%
Food, Health & Fitness	25.9%
Forces & Motion	2.0%
National Security & Safety	6.6%
Robotics	5.2%
Technology	10.2%

submit their *Mission Folders*. As previously observed in the FY14 evaluation, FY15 students reported minimal prior program experience. Nearly all (90.5%) the students who completed the pre-survey reported no previous eCYBERMISSION competition experience, which equated to 96.7% of both the matched general and mini grant recipient samples. The majority (85.7%) of the total student sample also reported that the highest level of competition they had experienced was general participation, while 8.8% of the students reported being a competitor at State and less than 5% had participated in Regional or National eCYBERMISSION competitions.

The pre-survey also asked students to share how they first learned about eCYBERMISSION by selecting one of nine responses or an “other” field. Nearly all (91.0%) of the FY15 students who answered this question reported learning about the program from a teacher, while 3.0%, 2.3%, and 0.9% of the students respectively selected the eCYBERMISSION website, family/friends, or a school newsletter or email as the source of their





initial program awareness.

The students further described their program participation by explaining why they decided to compete in eCYBERMISSION. A qualitative analysis of the students' written answers resulted in the identification of six emergent themes. As previously indicated by the quantitative data, teachers were critical to student participation, and the students' most commonly cited reason for eCYBERMISSION participation was the program was a required component of their coursework or critical to their grade. While many of these students shared that they thought the program would be an interesting or fun experience, this particular method of program recruitment also prompted numerous students to share that they felt forced into eCYBERMISSION participation, which may have negatively impacted their assessment of the program and its overall impact.

The remaining five response themes included:

- An affective response related to their love of a topic, their interest and excitement in the program, or the desire to help improve or support their school or community;
- The opportunity to explore STEM interests or prepare for a future STEM college and/or career path, learn or experience something new, or develop 21<sup>st</sup> Century Skills;
- A friend's recommendation of the program, or the opportunity to do something with friends;
- The opportunity to be challenged or participate in a science competition; and
- An interest in winning saving bonds or traveling to Washington, DC.

*"Because my teacher required it. Also it seemed fun and like an interesting activity to participate in."*

*"Because I was forced to by my teacher for a grade."*

*"It seemed fun!"*

*"I decided to join eCYBERMISSION because I wanted to help solve a problem in a community that I love so much."*

*"I decided to participate because I thought this was a good way to strengthen my scientific knowledge in what I'm interested in. It also helps me learn the fundamental and the process needed to come up with a scientific solution."*

*"It seems like a good way to build teamwork."*

*"I get to spend more time with my friends working together as a team."*

*"Looked like you could really put your mind to the test."*

NJ&EE students' explanations of their decision to participate in the competition further reflect these survey responses. Again, the majority of the students referenced the role teachers play in program recruitment by sharing that their participation was initiated by a classroom assignment or teacher's recommendation of the program. Other students reported learning about the program from friends or family members, their previous program participation, or the adaption of a project developed during another science competition.

As the primary cause of students' participation, DHA asked Team Advisors to share how they first learned about eCYBERMISSION as well. Team Advisors provided this feedback by selecting the most relevant answer of 16 options or an "other" field. The five most frequently selected response items are as follows:





1. School, university, or professional organization newsletter or email (30.4%)
2. eCYBERMISSION website (20.4%)
3. Another teacher in my school or district (18.8%)
4. Other eCYBERMISSION Team Advisor (14.9%)
5. Previous eCYBERMISSION program participant (10.5%)

The impact of teachers was further demonstrated by students' reported program motivation. The students' provided insight into the factors that motivated their participation by rating twelve items in response to the post-survey. Table 9 presents the percentage (and Mean) of all *eCYBERMISSION Post-Student* respondents' selection of the two most positive Likert scale responses (*Extremely motivating* and *Motivating*) in addition to the matched general and mini grant students' responses. Across all three samples, the percentages demonstrated minimal variations (approximately 5% to 10%), and half or more of the students rated ten of the twelve items as motivating. The mini grant respondents' percentages, however, were generally weaker. Yet when the general and mini grant matched samples were statistically compared, only two of items – *Opportunity to do something with friends* and *Opportunity to solve a problem in my community* – were identified as significantly less motivating.

	<b>Total Post Sample</b>	<b>General Matched</b>	<b>Mini Grant Matched</b>
A school grade	74.3% (1.98)	77.6% (1.88)	66.7% (2.05)
Creating something that could help people	71.5% (2.05)	73.3% (1.98)	67.0% (2.16)
Opportunity to do something with friends*	69.3% (2.07)	74.9% (1.90)	57.5% (2.31)
Having fun	65.1% (2.15)	69.6% (2.05)	60.7% (2.22)
Opportunity to solve a problem in my community*	64.6% (2.19)	71.1% (2.03)	53.8% (2.44)
Extra credit for school	63.7% (2.35)	64.8% (2.35)	59.4% (2.31)
The desire to learn something new or interesting	62.3% (2.25)	64.2% (2.16)	55.8% (2.41)
The competition's prizes	59.7% (2.39)	55.6% (2.46)	54.8% (2.46)
Resume/college application building	57.8% (2.39)	59.8% (2.35)	54.3% (2.43)
Opportunity to compete in Washington, D.C.	55.5% (2.50)	56.5% (2.47)	50.0% (2.51)
Community service	48.7% (2.66)	48.3% (2.64)	46.2% (2.71)
Interest in STEM	43.1% (2.87)	39.8% (2.95)	42.5% (2.80)

\* Statistically significant difference between Regular and Mini Grant student samples at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Extremely motivating, 2=Highly motivating, Moderately motivating, 4=Slightly motivating, 5=Not motivating)

The evaluation examined students' participation in other AEOPs as well. Table 10 indicates that less than 5% of either the total or matched pre-survey respondents had previously participated in an AEOP program, and that Camp Invention, Science & Engineering Apprentice Program and Gains in the Education of Mathematics and Science (GEMS) garnered the largest participation rates. The table also includes the more varied



percentage of students either *Very interested* or *Interested* in participating in the AEOPS, which indicates the samples were most interested in GEMS, Camp Invention, and the SMART College Scholarship. Further statistical comparisons of the matched general and mini grant student responses indicated that the mini grant recipients were significantly more interested in participating in each of the AEOP programs in the future.

Table 10. eCYBERMISSION Participants' Past AEOP Participation & Future Interest				
	Total Sample		Matched Sample	
	Previous Program Participation	Interest* in Future Program Participation	Previous Program Participation	Interest* in Future Program Participation
Camp Invention	3.4%	23.6%	4.0%	21.7%
Junior Solar Sprint	1.4%	11.2%	1.7%	13.5%
Gains in the Education of Mathematics and Science (GEMS)	2.9%	25.3%	3.8%	20.3%
West Point Bridge Design Competition	2.3%	13.5%	1.7%	15.5%
Science & Engineering Apprentice Program	3.5%	15.9%	3.5%	20.9%
Research & Engineering Apprenticeship Program	2.0%	15.3%	1.2%	19.2%
High School Apprenticeship Program	1.2%	16.1%	0.6%	21.4%
Junior Science & Humanities Symposium	1.4%	14.0%	1.7%	19.8%
UNITE	N/A	12.6%	N/A	16.0%
College Qualified Leaders	N/A	12.3%	N/A	21.9%
Undergraduate Research Apprenticeship Program	N/A	14.0	N/A	19.1%
Science, Mathematics, and Research for Transformation (SMART) College Scholarship	N/A	20.0%	N/A	27.2%

N/A due to age requirements of program participation

\*Interest = Respondent selection of *Very Interested* and *Interested*

Team Advisors, who were predominantly classroom teachers, also described their level of awareness and interest in other AEOP offerings. With the exception of eCYBERMISSION, which 53.8% of the Team Advisors had participated in at least twice, approximately a third of the Team Advisors had never heard of the eleven other AEOPs. This is a dramatic improvement in comparison to the three-fourths of FY14 Team Advisors who



never heard of the AEOPs.

In order to assess the Team Advisors' interest in the AEOPs, the survey asked them to assess how likely they were to introduce students to other age appropriate AEOP programs in the future. Nearly all (92.3%) of the Team Advisors were either *Very Likely* or *Likely* to introduce students again to eCYBERMISSION, but less than 20% of the Team Advisors were similarly interested in the remaining AEOPs. The five programs the Team Advisors were most interested in were:

1. **West Point Bridge Design Competition** (19.3%);
2. **Junior Solar Spirit** (16.6%);
3. **Junior Symposium and Humanities Symposium** (16.6%);
4. **Camp Inventions** (12.7%); and
5. **Gains in the Education of Mathematics and Sciences (GEMS)** (12.3%).

The post-survey also included metrics designed to measure the impact eCYBERMISSION participation had on students' AEOP awareness and their potential future participation. The survey asked the students to rate their agreement regarding whether they were more aware of and interested in the other AEOPS. In response to the first metric, half (52.3%) of the students agreed that they were more aware of the AEOPs, and 19.4% of the students considered eCYBERMISSION to be the primary reason for their agreement. Nearly half (44.0%) of the students similarly agreed that they were more interested in participating in other AEOPS, but only 13.6% of the students considered eCYBERMISSION to be the primary reason for their agreement.

The survey finally asked the students to rate how much nine program items helped them to learn about AEOPs by selecting either: *A lot*, *Some*, *A little*, *Not at all*, or *Did not experience*. Table 11 presents the percentage of students who selected either *A lot* or *Did not experience*. Collectively, these two response categories demonstrate the importance of program participation and the team advisor role, while also indicating that more could be done to increase the reach and impact of AEOP communication resources.

Table 11. Participants' AEOP Awareness (Total Post)		
AEOPs	<i>A lot</i>	<i>Did not experience</i>
Participation in eCYBERMISSION	23.3%	N/A
Team Advisor	27.0%	18.5%
eCYBERMISSION Cyberguides	10.5%	39.0%
eCYBERMISSION website	24.4%	18.9%
eCYBERMISSION on Facebook, Twitter, Pinterest or other social media	6.1%	58.4%
AEOP website	12.7%	43.5%
AEOP on Facebook, Twitter, Pinterest or other social media	4.9%	60.2%
AEOP brochures	6.1%	64.3%
It Starts Here! AEOP Magazine	6.1%	64.3%

Since the Team Advisors play an important role in advancing students' awareness of AEOP programs, DHA again asked them to assess whether four items increased their awareness of AEOPs. Over two thirds of the Team Advisors reported that participation in eCYBERMISSION and the eCYBERMISSION website *Significantly*



*increased* or *Increased* their awareness (68.4% and 69.2% respectively). The impact of AEOP brochures, in comparison to students' assessment, rose to 17.5%, while their assessment of the AEOP magazine's impact on their awareness was also 6.0%.

### *eCYBERMISSION Program Resources & Support Structures*

In order to support future program development and implementation efforts, DHA asked the eCYBERMISSION participants and Team Advisors to evaluate the program's resources and support structures. The *eCYBERMISSION Post-Student Survey* collected both quantitative and qualitative data regarding this evaluation objective, which was further explored during focus group discussions held during NJ&EE.

DHA collected student participant survey data regarding eCYBERMISSION resources and online supports via three questions. The first question asked the students to rate the usefulness of ten program resources housed on the eCYBERMISSION website by selecting one of six responses: *Very useful*, *Useful*, *Somewhat useful*, *Slightly useful*, *Not at all useful*, or *Did not use*. The students reported that the three most useful items were the *Judging Rubrics*, *Examples of Mission Folders*, and the *Mission Folder Worksheets*, while the *Cyberguide Live Chats* prompted the weakest assessment. Table 12 presents the percentage of the total post-survey student respondents who selected *Very useful* and *Useful* or *Did not use*. While it indicates that approximately a quarter to half of the students considered eight of the ten resources useful, it also reveals that a similar percentage of students selected *Did not use* in response to the more weakly rated resources. This response trend suggests that either the students did not need the lower rated resources or they were unaware of their existence. NJ&EE student focus group participants likewise shared that they generally did not use many of eCYBERMISSION online resources, yet several students did consider the judging rubrics, advisor resources, and online *Mission Folder* examples useful.

Table 12. eCYBERMISSION Participants' Assessment of Program Resources (Total Post)		
	<i>Very useful/Useful</i>	<i>Did not use</i>
Judging Rubrics	53.0%	13.8%
Examples of Mission Folders	46.2%	20.5%
Mission Folder Worksheets	43.4%	22.1%
Mission Pointers	35.8%	28.8%
Mission Folder Development Guides	35.8%	27.6%
Links to Additional Websites	34.1%	30.5%
Video Lessons	27.6%	40.1%
eCYBERMISSION Webinars	24.7%	48.0%
Mission Control Help Desk	20.4%	48.8%
Cyberguide Live Chats	15.6%	56.5%

DHA further analyzed this survey data by statistically comparing the matched general and mini grant student samples' responses. Table 13 presents the percentage of both student samples that selected the previously

discussed response categories and their mean responses. The analysis indicates that there were significant differences between the two student groups' utilization of program resources, except for the generally underutilized *Cyberguide Live Chats*. While the general student participants considered the *Judging Rubrics* significantly more useful than the mini grant students, the mini grant students rated each of the remaining eight items denoted by an asterisk (\*) as more useful. While the data does not indicate the specific underlying causes for these differences, it is likely that the percentage of students who did not use the resources was a contributing factor.

Table 13 Participants' Assessment of Program Resources (Matched: General & Mini Grant Samples)						
	General Matched Sample			Mini Grant Matched Sample		
	Very useful/ Useful	Did not use	Mean	Very useful/ Useful	Did not use	Mean
Judging Rubrics*	77.9%	7.4%	1.96	48.2%	14.5%	2.97
Examples of Mission Folders*	52.8%	22.5%	2.99	49.0%	17.3%	2.88
Mission Folder Worksheets*	51.9%	26.2%	3.19	60.0%	7.3%	2.50
Mission Pointers*	41.3%	33.9%	3.57	44.0%	18.3%	3.06
Mission Folder Development Guides*	39.2%	34.8%	3.62	47.3%	17.3%	3.04
Links to Additional Websites*	39.1%	35.2%	3.66	42.3%	18.0%	3.12
Video Lessons*	19.9%	56.7%	4.58	60.3%	10.8%	2.61
eCYBERMISSION Webinars*	18.3%	56.3%	4.6	38.7%	27.0%	3.45
Mission Control Help Desk*	18.2%	59.7%	4.74	34.6%	24.3%	3.47
Cyberguide Live Chats	12.2%	64.3%	4.94	28.2%	42.7%	4.06

\* Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Very useful, 2=Useful, 3=Somewhat useful, 4=Slightly useful, 5=Not at all useful, 6=Did not experience)

The student respondents also rated their satisfaction with eight program elements and resources. Unlike the previous assessed program resources, at most only a third (38.5%) of the students reported not experiencing the presented items. Most notable of these responses was over half of the students reported being satisfied with the *Mission Folder* judging process and the resulting feedback, which was an identified area of weakness during the FY14 program evaluation. However, only a third of the students reported satisfaction with their communications with local scientists, eCYBERMISSION Mission Control, and Cyberguides. Given the importance of external support to *Mission Folder* development and students' understanding and awareness of STEM fields and careers, these response rates could be stronger.

**Table 14. eCYBERMISSION Participants' Program Resources Satisfaction (Total Post Sample)**

	<i>Very satisfied/Satisfied</i>	<i>Did not experience</i>
eCYBERMISSION registration process	63.9%	N/A
The Mission Folder judging process	56.4%	9.1%
Feedback provided by eCYBERMISSION judges about your Mission Folder	54.6%	14.4%
The variety of STEM topics included in eCYBERMISSION	53.3%	10.6%
Educational materials (e.g., workbooks, online resources, etc.) included on the website	51.2%	19.2%
Interactions you had with local scientists/professionals during the development of your Mission Folder	35.5%	37.4%
Communication with eCYBERMISSION Mission Control	34.6%	33.9%
Technical advice offered by Cyberguides	32.6%	38.5%

This data was again analyzed via a statistical comparison of matched general and mini grant post-survey responses. The results of the analysis indicates that the general student sample was more satisfied with the first four items, and their assessment of the *Mission Folder* judging process and resulting feedback prompted statistically significant differences. Conversely, the mini grant students were more responsive to the final four items and significantly more satisfied with the educational materials and Mission Control and Cyberguides communications (see Table 15). The average response to each item, however, was below *Satisfied* ( $M=2.00$ ).

**Table 15. eCYBERMISSION Participants' Program Resources Satisfaction (Matched: General & Mini Grant Samples)**

	General Matched Sample			Mini Grant Matched Sample		
	<i>Very satisfied/Satisfied</i>	<i>Did not experience</i>	Mean	<i>Very satisfied/Satisfied</i>	<i>Did not experience</i>	Mean
eCYBERMISSION registration process	69.1%	N/A	2.37	56.5%	N/A	2.52
The Mission Folder judging process*	65.7%	7.7%	2.42	45.3%	8.5%	2.86
Feedback provided by eCYBERMISSION judges about your Mission Folder*	65.4%	12.1%	2.50	42.3%	13.7%	3.09
The variety of STEM topics included in eCYBERMISSION	62.9%	9.1%	2.57	47.1%	7.5%	2.87
Educational materials included on the website*	49.8%	22.7%	3.14	54.7%	6.6%	2.69
Interactions you had with local scientists/professionals during the development of your Mission Folder	37.4%	40.3%	3.75	37.2%	21.7%	3.50
Communication with eCYBERMISSION Mission Control*	32.7%	38.4%	3.90	40.7%	21.3%	3.29
Technical advice offered by CyberGuides*	28.3%	48.7%	4.22	37.4%	20.6%	3.36

\* Statistically significant at a 95% confidence level ( $p<0.05$ ).

Mean (1=Very satisfied, 2=Satisfied, 3=Somewhat satisfied, 4=Slightly satisfied, 5=Dissatisfied, 6=Did not experience)



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The *eCYBERMISSION Post-Student Survey* asked the students to describe what resources could be improved or added to the program to help support students develop their *Mission Folders*. Over 50% (475 students) of the total survey sample, provided an answer. DHA's analysis of the responses identified six emergent themes:

**1. Recommendations for website improvements**

- *Mission Folder* Auto Save
- *Mission Folder* multiuser capabilities  
(responses were frequently deleted when multiple people tried to complete fields)
- ID markers to help track and identify individual's content contributions
- Individual logins
- Improved navigation features
- Multiple fonts and font sizes
- Improved uploads and folder submission processes

**2. Additional features**

- A Team Calendar to support project planning
- Time management tools
- More team communication tools
- An experiment safety guide
- An introductory video for student participants that explains their website resources
- More *Mission Folder* videos designed to demonstrate folder strengths and weaknesses, and various characteristics demonstrated by the folders of Regional and State Winners

**3. Need for increased awareness of existing resources**

**4. Need for the website to include more information, examples, and/or greater clarity**

**5. Improved communications**

- Timeliness and quality of feedback from judges
- Timeliness of Mission Control responses

**6. Specific resources**

- Cyberguide Live chats
- Judging rubrics
- Mission Folder utility
- Mission Pointers
- Website
- Videos

Similarly, the Team Advisors evaluated program resources and supports by providing quantitative and qualitative assessments. The Team Advisors first rated the quality of 13 eCYBERMISSION program supports and resources, which Table 16 presents in ranked order. Half (51%) of the Team Advisors rated only one item, the eCYBERMISSION website, as *Excellent*. However, at least a quarter of the Team Advisors similarly rated all but four items as *Excellent*. Like the students' assessment of the lower rated items, the Team Advisors

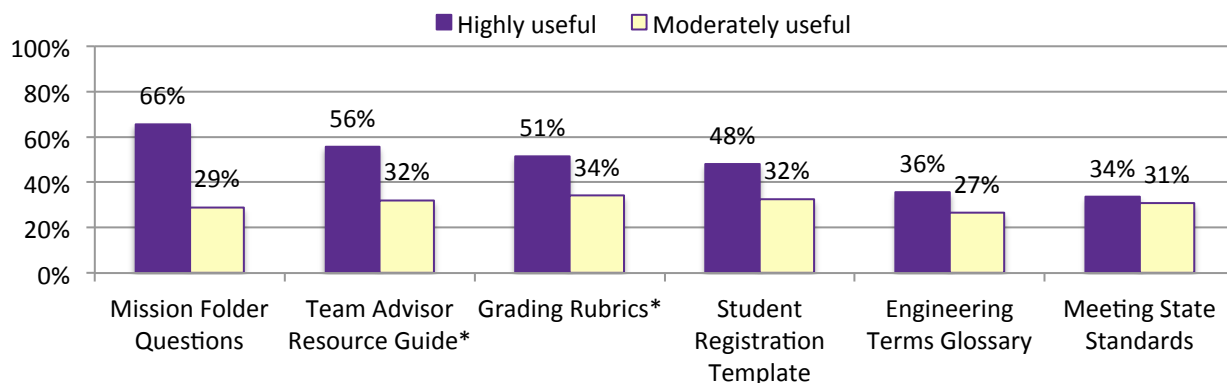


response of *Did not experience* was high, indicating that more effort should be given to increasing Team Advisors' awareness of resources. When statistically compared to the previous FY14 Team Advisors' assessment of resources' quality, DHA identified no statistically significant differences.

Table 16. Team Advisors' Assessment of the quality of eCYBERMISSION Program Supports		
	Excellent	Did not experience
eCYBERMISSION Website	51.4%	1.1%
Mission Folder Tips	44.4%	5.6%
Judging Criteria	44.4%	7.3%
Mission Control Help Desk	43.6%	17.9%
Mission Folder Worksheets	32.2%	10.7%
Helpful References Websites	30.9%	20.2%
Teacher Resources Section	30.1%	18.2%
Cyberguides	28.7%	32.0%
Videos	22.8%	32.8%
Webinars	16.1%	52.8%
Social Media Resources	10.1%	64.0%
eCYBERMISSION Blogs	8.6%	62.3%
Army Corner	5.1%	77.5%

The Team Advisors also rated how useful six aspects of the program were to their support of students or their classroom incorporation of the program. Figure 3 depicts the percentage of advisors who selected either *Highly useful* or *Moderately useful*, which were the two most positive ratings of the five-point Likert-scale used to assess these metrics. The Team Advisors' assessment of these resources was highly positive. The majority (between 80% and 95%) of the Team Advisors rated each of the first four as either *Highly useful* or *Moderately useful*, while approximately two thirds of the respondents similarly rated the remaining two resources.

**Figure 3. Team Advisors' Assessment of eCYBERMISSION Supports' Usefulness**



\* Statistically significant differences between FY14 and FY15 Team Advisor responses data at a 95% confidence level ( $p < 0.05$ ).



The percentage of Team Advisors who selected either *Highly* or *Moderately useful* in response to each resource increased in comparison to the previous year's Team Advisor's data as well. The assessment of the *Team Advisor Resource Guide* and *Grading Rubric* demonstrated the greatest gains (combined gains of 27% and 21% respectively), which represented statistically significant differences. The Team Advisors' assessment of the *Engineering Terms Glossary*, however, demonstrated the smallest gain (a combined gain of 6%).

The Team Advisors' also provided feedback regarding what specific program supports were most helpful to them as advisors. DHA's analysis of their qualitative responses identified five emergent response themes:

1. **Mission Control and eCYBERMISSION email communications**
2. **The eCYBERMISSION website**
  - Specifically the Team Advisor Resource page
3. **Judging rubrics and criteria**
4. **Videos**
5. **Mission Folder tips and development guides**

*"Mission Control was outstanding. I really appreciate the personal attention we received."*

*"As a teacher trying to guide 37 groups through a program I am just becoming familiar with, I don't have hours to spend finding the answers I need on the website."*

*"eCYBERMISSION website was a good central location for information."*

*"Having the rubric made available and judging criteria is the most helpful aspect for me."*

*"The videos were engaging and explained things to the students in an organized way."*

*"Mission Folder Tips were helpful."*

Similarly, the survey asked the Team Advisors to describe how the program supports could be improved. DHA's qualitative analysis of the Team Advisors' responses identified the following six themes and subcategories.

1. **Website features and content**
  - Website organization/navigation
  - Lack of an auto save feature caused lost work
  - More project examples
  - Vagueness and lack of clarity
2. **Communications**
  - Judging
  - Cyberguide
3. **Program Community and Support**
4. **Local Community Resources**
5. **Project/Topic selection**
6. **Aesthetic/Affective Comments**



Moreover, the Team Advisors' responses to this survey question suggest program's implementation efforts improved in comparison to FY14. The frequency with which Team Advisors cited communication issues dramatically decreased from the FY14 Team Advisors' responses. However, Cyberguides were still cited as a program resource in need of improvement. Specifically, the Team Advisors noted that the *"Cyberguides should be more visible"* and that their responses to students *"could be more timely and detailed."* Unlike FY14 responses, the Team Advisors' focus group discussion of improving *Mission Folder* judging was also far less frequent.

The FY15 Team Advisors, however, were more interested in eCYBERMISSION providing greater eCYBERMISSION community resources to support Team Advisors. The Team Advisors, especially new Team Advisors, reported a need for more peer-to-peer mentoring amongst experienced and new Team Advisors in order to increase *Mission Folder* quality and long-term retention of Team Advisors. Another critique noted by several Team Advisors was socio-economic challenges of program participation that continue to place lower income student competitors at a disadvantage.

- *"Having a veteran advisor be a mentor to young and new advisors would be a way to increase the number of mission folders submitted."*
- *"I wish there were more local support groups in my community as I had to read everything and try to figure out what to do by myself."*
- *"There desperately needs to be some sort of resource available for low income students and schools, to put us on the same playing field as more privileged students/schools."*

Finally, the students assessed their interests in various social media platforms. This item was included in the survey in an effort to inform the future utilization of social media within eCYBERMISSION resource development and communication efforts. Table 17 presents the students' reported *Hourly* and *Daily* use of each platform and demonstrates that Instagram and Snapchat are the primary social media tools used by the students.

Table 17. Social Media Usage		
	Hourly	Daily
Instagram	25.8%	25.9%
Snapchat	20.5%	17.4%
Twitter	7.9%	9.3%
Tumblr	6.0%	4.8%
Facebook	5.8%	10.9%

### STEM Engagement & Attitudes

The evaluation examined ways in which eCYBERMISSION participation impacted students' STEM engagement and attitudes, and DHA asked the students to describe the program's impact on their STEM activities and confidence. This section of the report presents findings as either total post-survey responses or through the comparison of total (both general and mini grant) matched pre- and post-responses.

In order to assess eCYBERMISSION's impact on students' engagement in STEM activities, DHA asked the students to report how frequently they engaged in five STEM activities both before (pre-survey) and after

(post-survey) their eCYBERMISSION experience. The students rated their engagement by selecting one of five Likert responses: *Daily*, *At least once a week*, *At least once a month*, *Every few months*, and *Never or almost never*. Table 18 presents the percentage of the matched sample students who selected either *Daily* or *At least once a month* and their mean responses. At most, a third of these students engaged in the activities either before or after their eCYBERMISSION participation, while the means (M) indicates they pursued these activities either *At least once a month* (M=2) or *Every few months* (M=3). Yet, the frequency of the students' engagement demonstrated statistically significant increases in response to each item except for *watching television programs about STEM topics*.

**Table 18. Pre- and Post-Matched Student Samples' STEM Engagement (*Daily/At least once a month*)**

	Matched Pre	Matched Post
Watch television programs about STEM topics	36.2% (3.27)	10.5% (3.26)
Read books or magazines about STEM topics*	14.8% (4.07)	20.1% (3.73)
Participate in a STEM club, camp, or competition*	11.0% (4.45)	18.5% (4.03)
Use a computer to design or program something*	26.0% (3.57)	35.5% (3.25)
Design mechanical gadgets*	8.9% (4.34)	16.4% (3.92)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=*Daily*; 2=*At least once a week*; 3=*At least once a month*; 4=*Every few months*; 5=*Never or almost never*)

A comparative analysis of the general and mini grant students' matched post program responses identified two final statistically significant differences within this response data: *Participation in a STEM club, camp or competition* and *design mechanical gadgets*. In both cases, the mini grant students reported engaging in these activities more frequently than the general student sample (General M=4.13, Mini Grant M=3.69; and General M=4.10, Mini Grant M=3.46 respectively).

Students also shared how often they engaged in four STEM activities during eCYBERMISSION by selecting either: *Every day*, *Most days*, *A few times*, *At least once*, or *Not at all* (see Table 19). These items were less behavioral in design and instead examined STEM learning, application, and hands-on engagement. The students' responses indicate eCYBERMISSION participation prompted a third to half of all post-survey respondents to regularly engage in the STEM activities. A statistical comparison of the general and mini grant students' responses yielded no a statistically significant difference.

**Table 19. Participants' Engagement in STEM Activities During eCYBERMISSION (*Every day/ Most days*)**

	Total Post	General Matched	Mini Grant Matched
Learn about STEM topics that are new to you	53.8% (2.51)	56.7% (2.44)	63.7% (2.29)
Apply STEM knowledge to real-life situations	43.2% (2.79)	45.3% (2.73)	39.3% (2.76)
Use laboratory procedures or tools	42.3% (2.84)	20.6% (2.63)	33.0% (2.75)
Participate in hands-on STEM activities	39.7% (2.97)	19.2% (2.93)	24.3% (2.72)

Mean (1=*Every day*; 2=*Most days*; 3=*A few times*; 4=*At least once*; 5=*Not at all*)

Approximately half of all students who completed the post-survey additionally reported that they were likely to enroll in advanced STEM high school courses or electives and participate in other science competitions in the next ten years. The likelihood of the general matched student sample to pursue these activities, however, was weaker than the mini grant students, but only their interest in advanced STEM course enrollment demonstrated a significantly lower response (see Table 20). These findings indicate that program participation does likely contribute to or help sustain students' interests in curricular and extracurricular STEM experiences.

**Table 20. Participants' Pre- and Post-Survey Interest in STEM Curricular/Extra-Curricular Activities During the Next Ten Years (*Very Likely/Likely*)**

	Total Post	General Matched	Mini Grant Matched
Take advanced STEM high school courses (AP, dual enrollment, etc.).*	56.1% (2.39)	45.5% (2.58)	51.5% (2.42)
Take elective STEM classes	48.3% (2.65)	38.9% (2.82)	44.3% (2.72)
Participate in more science competitions	48.3% (2.65)	39.3% (2.85)	44.4% (2.74)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1= Very likely, 2=Likely, 3=Undecided, 4=Unlikely, 5=Very Unlikely)

The evaluation further explored this program objective by asking the students to rate their agreement with four statements regarding the importance and their personal interest in STEM coursework. Table 21 presents the percentage of the total matched pre- and post-students who agreed (selected *Strongly agree* or *Agree*) with the statements. With the exception of *Science classes are my favorite classes*, the students' responses were highly positive. However, when the pre- and post-survey responses were statistically compared, the two first, and most highly rated, items regarding STEM importance demonstrated statistically significant losses, although both items still garnered a mean responses between *Strongly agree* ( $M=1$ ) and *Agree* ( $M=2$ ).

**Table 21. Pre- and Post-Matched Samples' STEM Interests (*Strongly agree/Agree*)**

	Pre Matched	Post Matched
It is important to me that I do well in my math and science classes.*	91.5% (1.44)	87.7% (1.57)
It is important to my parents that I do well in my math and science classes.*	90.3% (1.45)	87.8% (1.58)
Science classes are my favorite classes.	44.2% (2.71)	48.0% (2.66)
I like learning how to use a new technology.	74.9% (1.92)	73.8% (1.95)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree)

Finally, the survey asked the students' to describe whether their eCYBERMISSION participation contributed to or was the primary cause of their agreement with three statements regarding STEM engagement. Approximately, half to two-thirds of the students agreed with the statements (see Table 22). The students' mean responses further indicate that eCYBERMISSION contributed to their agreement with the first statement, while it played less of a role in their interest to pursue two scholastic activities.



**Table 22. eCYBERMISSION's Impact on STEM Confidence & Interests (Total Post)**

	<i>Agree – eCYBERMISSION was the primary reason</i>	<i>Agree – eCYBERMISSION contributed</i>	<b>Mean</b>
I am more confident in my STEM knowledge, skills, and abilities.	20.7%	48.7%	2.23
I am more interested in taking STEM classes in school.	15.0%	37.2%	2.55
I am more interested in participating in STEM activities outside of school requirements.	14.6%	31.7%	2.65

*Mean (1=Agree – eCYBERMISSION was the primary reason, 2=Agree – eCYBERMISSION contributed, 3=Disagree – This happened but not because of eCYBERMISSION, and 4=Disagree – This did not happen)*

The student respondents also assessed their post-program STEM engagement by rating their confidence conducting scientific practices or using the engineering design process (see Table 23). The students' assessment of these statements were more positive than the previously discussed STEM engagement metrics, and approximately two-thirds of all of the post-survey respondents considered themselves *Very Confident* (M=1) or *Confident* (M=2). The reported confidence of the general matched sample was also slightly stronger than the total sample, while the mini grant matched sample was slightly weaker than the total sample. A statistical comparison of the general and mini grant students' matched responses further demonstrated that the general students were statistically more confident in their ability to conduct a scientific experiment or inquiry than the mini grant students.

**Table 23. Participants' Assessment of STEM Confidence (Very confident/Confident)**

	<b>Total Post</b>	<b>General Post</b>	<b>Mini Grant Post</b>
Conduct a scientific experiment*	71.7% (2.04)	78.7% (1.87)	60.5 (2.27)
Conduct a scientific inquiry*	66.0% (2.21)	79.1% (1.88)	58.8% (2.41)
Use the engineering design process	59.0% (2.34)	65.5% (2.19)	53.2% (2.42)

*Mean (1=Very confident, 2=Confident, 3=Moderately confident, 4=Slightly confident, 5=Not confident)*

In addition to assessing the eCYBERMISSION students' STEM engagement, the evaluation also examined the program's impact on students' STEM attitudes. Table 24 presents the percentage (and Mean) of all post-student survey respondents who agreed eCYBERMISSION positively effected their attitudes toward each STEM field and increased their confidence to do well in STEM courses. Again, the students' responses were positive, and approximately half to two-thirds of the students agreed eCYBERMISSION participation had a positive impact on their attitude.

Table 24. As a result of participating in eCYBERMISSION... (Post all)	
	Strongly agree/Agree
...I have a more positive attitude toward science.	61.2% (2.83)
...I have a more positive attitude toward technology.	62.8% (2.23)
...I have a more positive attitude toward engineering.	52.9% (2.44)
...I have a more positive attitude toward math.	59.7% (2.32)
...I have more confidence in my ability to do well in STEM classes.	51.2% (2.48)

Mean (1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree)

Finally, the evaluation examined eCYBERMISSION's impact on students' STEM attitudes, by asking survey respondents to rate their agreement with a series statements designed to assess the social value of science and technology. The students' responses, both before and after eCYBERMISSION participation, were highly positive. Table 25 demonstrates that the majority (three-fourths or more) of all students who completed the post-survey agreed with six statements. A comparison of the matched sample's pre- and post-survey responses indicated only slight attitudinal changes occurred over the course of the program. However, one statement, *Science is useful for solving problems in everyday life*, did prompt a statistically significant increase in agreement, which is reflective of the community problem solving encouraged by *Mission Folder* completion.

Table 25. Social Value of Science and Technology (Strongly agree/Agree)			
	Total Post	Pre Matched	Post Matched
Science is helpful for understanding the world we live in.	88.2% (1.62)	92.9% (1.59)	88.1% (1.62)
Science is useful for solving problems in everyday life.*	85.0% (1.73)	78.2% (1.84)	85.6% (1.71)
Science is important to a country's success.	79.5% (1.84)	73.2% (1.97)	76.7% (1.88)
Scientists have a chance to make a real difference in the world.	87.4% (1.63)	88.9% (1.58)	89.1% (1.59)
It's important for everyone to learn some science.	80.9% (1.82)	81.8% (1.82)	80.4% (1.82)
It is important for everyone to have a basic understanding of new technologies.	77.7% (1.91)	74.9% (1.98)	79.2% (1.90)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree)

## 21<sup>st</sup> Century Skills

The students' increased appreciation of STEM and its ability to help solve problems was also indicative of the program's support of 21<sup>st</sup> Century Skills development. The nurturing of these skills, which equip students to meet the demands of the future and include life and career skills; learning and innovation skills (critical thinking, communication, collaboration, and creativity—the "4Cs"); and information and media skills, was another critical goal of the eCYBERMISSION competition. In order to measure the program's achievement of this program outcome, the pre- and post-surveys incorporated numerous questions that prompted students



to assess their skill sets, proficiencies, and self-efficacy (Framework for 21<sup>st</sup> Century Learning, 2014).

First, DHA prompted the students to assess their information literacy. The students assessed this 21<sup>st</sup> Century Skill set by reporting how frequently they engaged in three related behaviors. Their responses ranged broadly (see Table 26). The frequency with which students looked up information about STEM topics was the weakest, although they did report looking up information about new technology and as a means to finding answers to their own questions far more frequently. When DHA compared the matched sample's pre- and post-program assessment of these metrics, the first two items demonstrated statistically significant gains.

**Table 26. Pre- and Post-Matched Student Sample's STEM Behaviors (Daily/At least once a month)**

	Matched Pre	Matched Post
Look up information about STEM on the Internet*	16.1% (4.12)	27.5% (3.58)
Look up information about new technologies*	31.6% (3.38)	40.9% (3.04)
Look up information to find the answers to my own questions	60.6% (2.51)	63.2% (2.35)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree)

While the students' ability to look up information demonstrated low-level STEM literacy gains, they also assessed their confidence utilizing information. The students' response to these statements, which represented 21<sup>st</sup> Century Skill implementation, were highly positively (means of approximately 2 or *Confident*), and each demonstrated positive gains after program participation. The gains in the students' assessment of the first two items were also statistically significant, suggesting program participation positively impacted students' confidence.

**Table 27. Pre- and Post-Matched Student Sample's 21<sup>st</sup> Century Skills Implementation (Very Confident/Confident)**

	Matched Pre	Matched Post
Analyze large amounts of information in order to make a decision*	56.4% (2.33)	69.8% (2.06)
Understand complex scientific information*	44.3% (2.69)	54.9% (2.42)
Draw conclusions from the results of an experiment or data	71.8% (2.08)	73.7% (2.03)
Use data to support or counter an argument	68.5% (2.03)	74.3% (1.98)
Use feedback from others to improve ideas	68.5% (2.03)	73.4% (2.01)
Use the results of a test/experiment to inform future decisions and/or ideas*	62.7% (2.22)	69.9% (2.05)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Very confident, 2=Confident, 3=Moderately confident, 4=Slightly confident, 5=Not confident)

Another key component of 21<sup>st</sup> Century Skills assessed by the survey was students' ability to communicate and work as part of a team. Nearly half (43.7%) of the students who completed the post-survey reported that they communicated with other students about STEM either *Every day* or *Most days*, while the majority (84.5%) of the students reported working as part of a team at a similar frequency while participating in



eCYBERMISSION. Two thirds (67.2%) of the students also agreed (selected *Strongly agree* or *Agree*) that after participating in eCYBERMISSION, they could work better with a team. Collectively, these metrics demonstrate that the students engaged in and benefited from required eCYBERMISSION communication and teamwork.

An analysis of the pre- and post-survey survey feedback further demonstrated the students' confidence communicating and working with others either improved or changed little after completing eCYBERMISSION. The percentage of students who selected either *Very confident* (M=1) or *Confident* (M=2) in response to the four statements (see Table 28) ranged from half to nearly three-fourths of the matched sample respondents. The two first statements, which pertained to students' communication skills initially demonstrated the weakest confidence rates, but also exhibited the largest and only statistically significant gains, while the students' confidence regarding working with others as a member of a group changed little.

Table 28. Pre- and Post-Matched Sample's Communication and Collaboration ( <i>Very Confident/Confident</i> )		
	Matched Pre	Matched Post
Explain why a specific solution is the best way to solve a problem*	56.7% (2.37)	70.0% (2.13)
Communicate STEM related concepts to others*	33.8% (3.04)	49.0% (2.61)
Work with a team of people to solve a problem	71.3% (2.00)	72.7% (2.01)
Resolve disagreements when working with other people	70.0% (2.01)	71.5% (2.06)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Very confident, 2=Confident, 3=Moderately confident, 4=Slightly confident, 5=Not confident)

Finally, the evaluation explored eCYBERMISSION'S impact on students' problem solving skills. Problem solving was a key component of eCYBERMISSION, and the students reported frequently engaging in problem solving behaviors as a result of their participation. Approximately two-thirds of all students who completed the post-survey reported that they identified a question or problem(s) to investigate or found creative explanations or solutions either *Every day* or *Most days* during eCYBERMISSION. The students additionally assessed how frequently they took things apart to see how they work or worked on mathematical puzzles both before and after program participation. The students' engagement in these two problem-solving activities demonstrated little change.

As with the previous 21<sup>st</sup> Century Skills, the students' were confident in their ability to solve problems both before and after program participation (see Table 29). While the students were most confident in their ability to creatively solve problems and set goals to finish their projects, their confidence regarding the use of a scientific approach or practice to solve problems demonstrated the largest and only statistically significant gain. Given the program's emphasis of science practices and the engineering design process, this gain suggests exposure to science practices and the engineering design process positively impacted the students during eCYBERMISSION participation.



**Table 29. Pre- and Post-Matched Student Sample's Problem Solving (Very Confident/Confident)**

	Matched Pre	Matched Post
Use a scientific approach or practices to solve a problem*	55.5% (2.38)	64.9% (2.23)
Come up with creative solutions to a problem	72.7% (1.96)	72.4% (2.03)
Set goals to help get work or a project finished	70.2% (1.96)	71.5% (2.02)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean (1=Very confident, 2=Confident, 3=Moderately confident, 4=Slightly confident, 5=Not confident)

The Team Advisors also assessed the program's impact on students' 21<sup>st</sup> Century Skills by indicating whether a series of statements described the eCYBERMISSION experience. The majority of Team Advisors selected the most positive response, *Describes very well*, when responding to the phrases (see Table 30). The percentage of Team Advisors who selected, *Describes very well*, in response to each statement also increased by at least 10% in comparison to the FY14 response data. When DHA statistically compared the FY14 and FY15 Team Advisors data, however, only the first statement regarding teamwork demonstrated a statistically significant gain.

Table 30. Team Advisors' Assessment of eCYBERMISSION Descriptions	<i>Describes very well</i>
Builds teamwork*	91.1%
Fosters innovation	80.0%
Encourages community connections	70.4%
Promotes identifying and solving real-world problems	93.9%
Relevant to youth	82.2%
Strengthens participants' STEM knowledge and skills	87.2%

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

The participants of the NJ&EE competition, who represent the most successful program participants, also rated how well these and two other phrases described their eCYBERMISSION experience. Like the Team Advisors, the students' responses were highly positive (see Table 31). The only exception to this response trend was the students' assessment of whether eCYBERMISSION improves written communication skills, which garnered a notably weaker response in comparison to the other phrases.



Table 31. NJ&EE Participants' Assessment of eCYBERMISSION Descriptions	<i>Describes very well</i>
Builds teamwork	84.4%
Fosters innovation	79.2%
Encourages community connections	77.6%
Promotes identifying and solving real-world problems	89.6%
Relevant to youth	87.0%
Strengthens participants' STEM knowledge and skills	81.8%
Improves communication skills (public speaking)	81.8%
Improves communication skills (written)	45.5%

### *STEM Fields: Awareness & Interests*

Another intended program goal addressed by the evaluation is students' interest in and awareness of various STEM fields and career pathways. In order to assess this outcome, DHA collected feedback regarding two outcomes identified in the program's logic model (see Figure 1):

- Increased student appreciation for, understanding of, and interest in Department of Defense (DoD) STEM research and careers; and
- Increased student appreciation for and interest in STEM research and career opportunities in general.

The evaluation measured these outcomes through a variety of student and Team Advisor survey questions and participant focus group discussions.

Table 32 and 33 provided a baseline understanding of the students' college and career plans. They indicate that nearly all of the post-survey student respondents (86.8%) reported that they planned to attend a four-year college or earn a higher degree, after participating in eCYBERMISSION. Table 33 additionally demonstrates the percentage of students interested in various professions in order of interest. While a large percentage of students were undecided, three of the top four actual career fields selected by students were STEM related.

Table 32. Academic Aspirations (Total Post)	
Graduate from high school	8.0%
Go to a trade or vocational school	1.0%
Go to college for a two-year associate degree	4.1%
Go to college for a four-year (Bachelor's) degree	26.3%
Earn a Master's degree	31.8%
Earn a Doctorate	28.7%

**Table 33. Participants' Career Aspirations (Total Post)**

Work in the medical field (doctor, nurse, lab technician)	15.7%
Undecided	12.7%
Engineer or architect	12.5%
Athlete or other work in sports	9.5%
Scientist or researcher	6.4%
Artist (writer, dancer, painter)	5.8%
Teacher	4.1%
Military, police, or security	3.9%
Work in computers or technology	3.7%
Business person or manager	3.4%
Lawyer	3.4%
Skilled craftsperson (carpenter, electrician, machinist)	1.0%
Other	19.0%

Moreover, the students shared how likely they were to pursue various steps of a STEM career. While the percentage of students who reported that they were likely to graduate from high school mirrored their earlier survey feedback (86.6%), DHA's comparison of the total matched student sample's response to this item yielded a statistically significant decrease from pre to post. However, the statistical comparison of the remaining items indicates eCYBERMISSION had a positive impact on students' more immediate career plans, as their reported likeliness to apply to a STEM internship program and consideration of STEM military research significantly increased.

**Table 34. Pre- and Post-Matched Sample's STEM Academic and Professional Ten-Year Goals (*Very likely/Likely*)**

	Matched Pre	Matched Post
Graduate from high school*	96.4% (1.11)	88.6% (1.34)
Attend college and major in a STEM field	42.4% (2.61)	46.1% (2.58)
Apply to a STEM internship or apprenticeship program*	29.9% (3.00)	36.0% (2.85)
Pursue a STEM related job or career	34.0% (2.86)	38.6% (2.80)
Consider working on STEM research with the military/DoD*	1.8 (3.89)	24.4 (3.23)

\*Statistically significant at a 95% confidence level ( $p < 0.05$ ).

Mean: (1=Very likely, 2=Likely, 3=Undecided, 4=Unlikely, 5=Very unlikely)

The students provided feedback regarding knowledge gained about STEM research, processes, ethics, and daily practices as a result of their eCYBERMISSION experience as well. Approximately half of all students who responded to the post-survey reported that their participation prompted notable knowledge gains. While this is a positive response rate, it could be higher given the potential opportunities to interact with local STEM professionals or Cyberguides. The potential for growth in this program component was further demonstrated by the students' assessment of how frequently *they learned about different careers that use STEM* or



*interacted with scientists or engineers*, which only 25.5% and 19.4% of students respectively reported doing either *Every day* or *Most days*. Increasing students' exposure to and interactions with STEM fields and professionals would likely need to be supported by a new program requirement designed to encourage the students, since only 38.9% of students who completed the post-survey reported that they would like to talk to a STEM professional about their work.

Table 35. Participants' Self-Assessed STEM Knowledge Gains (Total Post)	
	<b>Significant gains/Gains</b>
Knowledge of past or current research conducted in a STEM topic or field	50.8%
Knowledge of research processes, ethics, and rules for conduct in STEM	52.2%
Knowledge of how scientists and engineers work on real problems in STEM	54.4%
Knowledge of what everyday research work is like in STEM	50.8%

The students also described the impact of eCYBERMISSION on their STEM career attitudes and interests. In response to the pre- and post-survey, the students rated their agreement with the statements, *I would make a good scientist or engineer someday* and *I would like to have a career that allows me to make discoveries or create something new*. The percentage of students who agreed (selected *Strongly agree* or *Agree*) increased in response to both statements, albeit minimally (48.1% to 53.0% and 58.3% to 59.3% respectively), which did not equate to statistically significant gains. Nearly half of the students (44%) also agreed that they were more interested in *earning a STEM degree or pursuing a career in STEM*. The percentage of students aware, appreciative, or interested in Army and DoD STEM research and careers were also within a similar response range (see Table 36). Collectively, these responses indicate that program participation has positively impacted students' career aware interests and awareness, especially in light of the large proportion of students who reported required or mandatory participation, yet there is still opportunity for continued improvement.

Table 36. After participating in eCYBERMISSION... (Total Post)	
	<b>Strongly agree/Agree</b>
I am more aware of Army or DOD STEM research and careers.	56.4%
I have a greater appreciation of Army or DOD STEM research.	59.4%
I am more interested in pursuing a STEM career with the Army or DOD.	40.1%

Table 37 further demonstrates that the eCYBERMISSION website, Team Advisors, and participation in eCYBERMISSION also supported the students' increased awareness of Army and DoD STEM careers, while the impact of AEOP social media efforts, brochures, and magazine was limited. However, like the students' awareness of other AEOP opportunities, a quarter to two-thirds of the students did not experience the presented mechanisms. These findings, therefore, indicate that the program communication platforms could be more effective in disseminating information regarding Army and DoD STEM careers.



**Table 37. eCYBERMISSION Participants' Gains in Army or DoD STEM career awareness**

	<i>A lot</i>	<i>Did not experience</i>
eCYBERMISSION website	19.9%	27.1%
Team Advisor	16.5%	27.4%
Participation in eCYBERMISSION	14.4%	N/A
eCYBERMISSION Cyberguides	9.6%	46.2%
AEOP website	8.1%	52.3%
eCYBERMISSION on Facebook, Twitter, Pinterest or other social media	7.2%	63.8%
AEOP on Facebook, Twitter, Pinterest or other social media	5.9%	65.5%
AEOP brochures	5.9%	65.5%
It Starts Here! AEOP Magazine	5.9%	61.9%

DHA also asked the Team Advisors to evaluate the program's impact on their and their students' awareness of DoD research and opportunities. Table 38 demonstrates that the majority of the Team Advisors agreed with the presented statements, and believed that their participation in eCYBERMISSION had a positive impact on their awareness of the social benefits of DoD research and researchers.

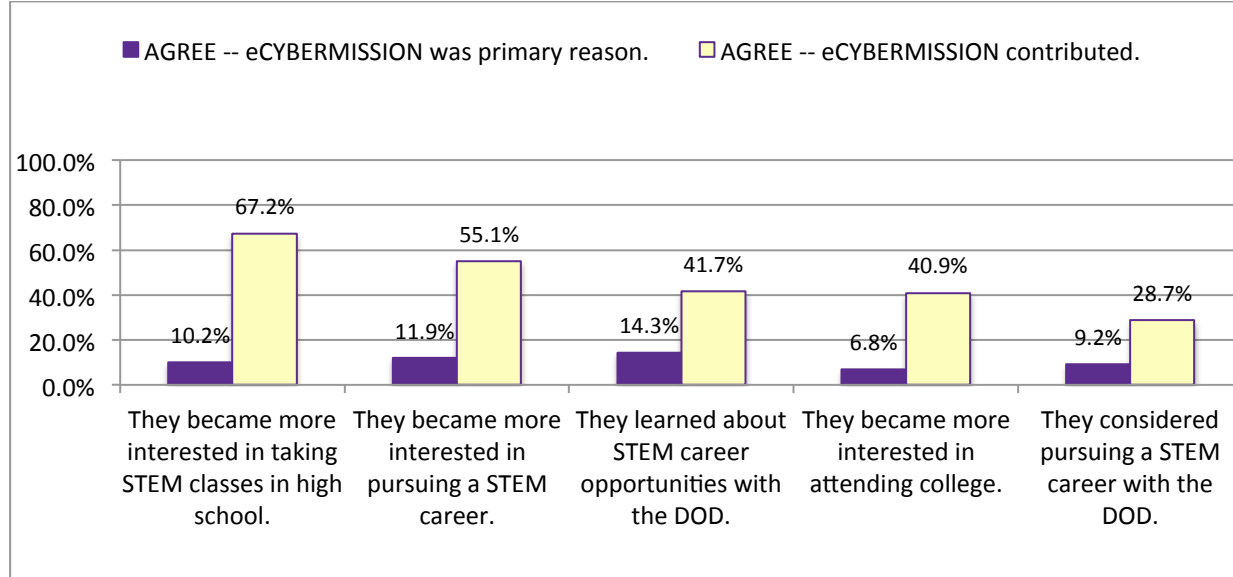
**Table 38. Team Advisors' Assessment of DoD Research and Researchers' Social Value**

	<i>Strongly agree/ Agree</i>
DoD research and researchers advance science and engineering fields.	88.3%
DoD research and researchers develop new, cutting-edge technologies.	86.5%
DoD research and researchers support non-defense related advancements in science and technology.	81.6%
DoD research and researchers solve real-world problems.	86.6%
DoD research and researchers are valuable to society.	87.2%

The Team Advisors also agreed that eCYBERMISSION participation positively impacted students. While only an approximate 10% of the Team Advisors considered eCYBERMISSION the primary cause behind the students' increased participation and interest in STEM career pathways, a quarter to two-thirds of the Team Advisors considered eCYBERMISSION a contributing factor to students' gains. The percentage of FY15 Team Advisors' reported agreement also increased by 10% (at most) in comparison to FY14 Team Advisors' assessment, although this did not equate to statistically significant changes.



**Figure 4. Team Advisors' Assessment of eCYBERMISSION's Impact on Participants' DoD STEM Awareness**



### *National Judging & Education Event*

The final program component examined by the FY15 eCYBERMISSION evaluation was the National Judge & Education Event (NJ&EE) held in Washington, D.C. Nearly three-fourths (70.1%) of the event's competitors reported that they had no prior eCYBERMISSION participation experience, while nearly a fifth (18.2%) had competed in the program only once before. The majority (77.8%) of the NJ&EE competitors similarly reported no prior NJ&EE experience, although 16.9% and 3.9% of the competitors reported participating in NJ&EE once or twice respectively. Regardless of previous NJ&EE experience, the majority (79.2%) of the competitors considered the competition either *Excellent* (35.1%) or *Good* (44.2%).

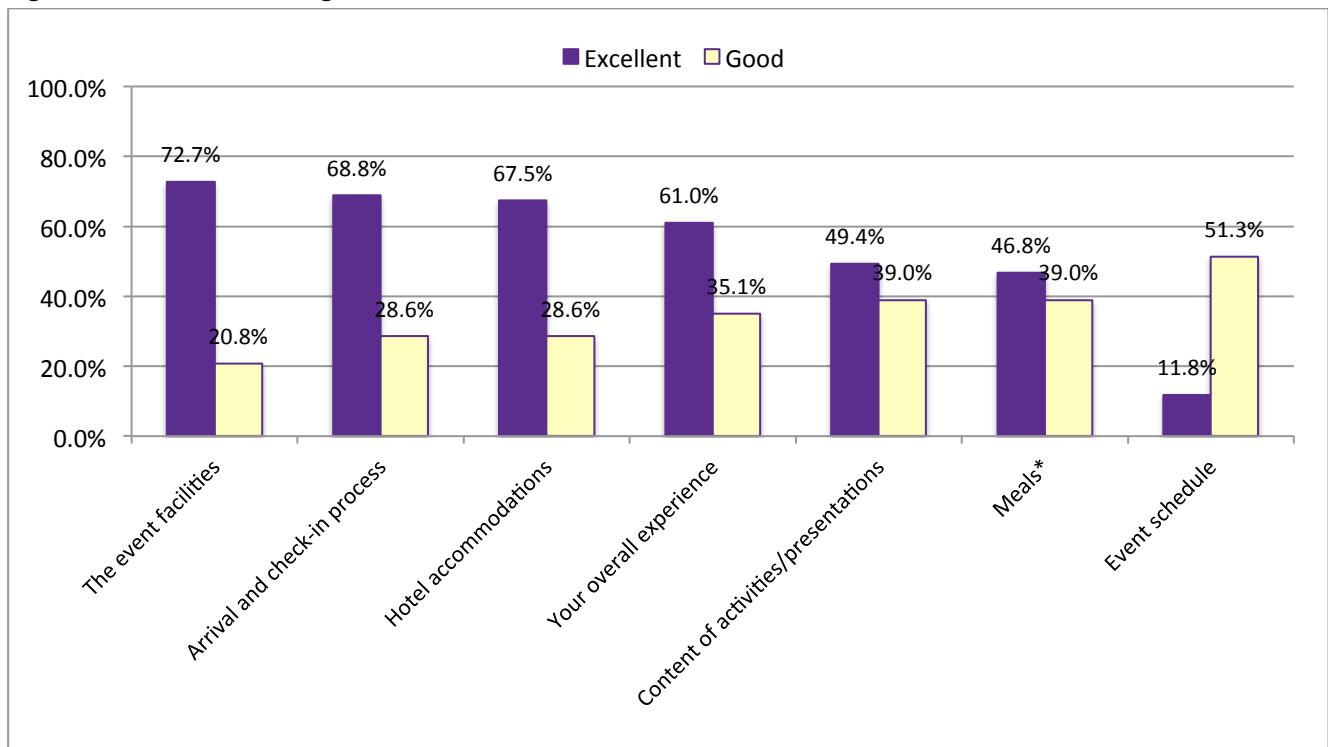
While this indicates general satisfaction with the NJ&EE experience, the evaluation examined various event logistics beginning with an assessment of pre-competition experiences. The students' responses to these items (see Table 39) demonstrated even higher rates of satisfaction as the majority (85% or more) of the students rated the pre-NJ&EE items as either *Excellent* or *Good*. The students were most satisfied with the initial notification of their finalist status, although open-ended survey remarks indicated the item's rating could be improved by earlier notification. The students' responses further indicate pre-NJ&EE communications, whether between program personnel and teams or via written communications, were most in need of improvement. The focus group participants clarified that providing information directly to parents, instead of through the Team Advisors, would have improved program communications. Team Advisors additionally cited that the allocation of more time for the completion of pre-NJ&EE paperwork would have been much appreciated.

**Table 39. Pre-NJ&EE Program Logistics**

	<i>Excellent</i>	<i>Good</i>	<i>Combined</i>
Initial notification of your Finalist Team status	61.0%	32.5%	93.5%
eCYBERMISSION's advance planning and communication with your team	35.1%	55.8%	90.9%
Assistance from event/program staff prior to departure	49.4%	37.7%	87.1%
Print or electronic materials sent in advance of the event	46.1%	39.5%	85.6%

The NJ&EE competitors also rated general logistics of the actual NJ&EE event on a five-point Likert-scale consisting of *Excellent*, *Good*, *Average*, *Below average*, and *Poor*. The percentage of competitors who selected either *Excellent* or *Good* is presented below in Figure 5, which demonstrates the majority (over 80%) of competitors selected either of these two responses when rating each item except the *Event schedule* (a finding which qualitative feedback will explore in more depth later in this section). In comparison to FY14 NJ&EE responses, the percentage of students who positively rated each statement also increased, except in response to *Meals*, which demonstrated a statistically significant decrease (FY14 M=1.39, FY15 M=1.68).

**Figure 5. General NJ&EE Logistics**



\*Significant at a 95% Confidence Level ( $p, 0.05$ )

Mean (1=Excellent, 2=Good, 3=Average, 4=Below Average, 5=Poor)

While the previous findings examined the overall NJ&EE experience, DHA also asked the NJ&EE competitors

to assess specific activities scheduled throughout NJ&EE. The majority of the students (approximately 80% or more) of the students positively rated the activities (see Table 40). This represents 16% to 37% increases in *Combined* responses to each statement when compared to FY14 student ratings. A statistical comparison of the FY14 and FY15 data further revealed that the FY15 competitors' responses to six specific events were significantly more positive than the FY14 responses. Most notable of these were the "Let's Move" Army exercise sessions, "Get Up and Speak" workshop, and Capitol Hill visits, which FY14 NJ&EE competitors or Team Advisors either poorly rated or negatively discussed.

Table 40. NJ&EE Schedule					
	<i>Excellent</i>	<i>Good</i>	<i>Combined</i>	<i>FY14 Mean</i>	<i>FY15 Mean</i>
Orientation meeting	27.3%	58.4%	85.7%	1.95	1.87
Army Values presentation*	50.6%	41.6%	92.2%	1.98	1.57
Welcome Dinner	64.9%	29.9%	94.8%	1.48	1.40
Team Building--Instant Challenge	55.8%	32.5%	88.3%	1.52	1.55
"Let's Move" Army exercise sessions*	48.1%	36.4%	84.4%	2.00	1.68
STEM Challenge Keynote Speech*	39.5%	48.7%	88.2%	2.08	1.72
NSRDEC Combat Feeding	53.9%	30.3%	84.2%	1.67	1.62
AEOP Alumni Panel	59.2%	25.0%	84.2%	2.00	1.56
STEM Challenge	51.9%	36.4%	88.3%	1.79	1.60
"Get Up and Speak" workshop*	64.9%	24.7%	89.6%	1.77	1.45
STEM Challenge presentations	36.4%	42.9%	79.2%	2.13	1.84
Tour of Washington, DC memorials	49.4%	40.3%	89.6%	1.75	1.61
Tour of the U.S. Capitol	66.2%	24.7%	90.9%	N/A	N/A
Capitol Hill visits*	69.7%	22.4%	92.1%	1.93	1.38
Overall National Judging Day experience	59.2%	35.5%	94.7%	1.54	1.46
Staff assistance to your team during National Judging	69.3%	26.7%	96.0%	1.56	1.35
Candid interviews on judging day*	75.3%	18.2%	93.5%	1.63	1.31
National Showcase	54.5%	39.0%	93.5%	1.49	1.52

\*Significant at a 95% Confidence Level ( $p, 0.05$ )

Mean (1=Excellent, 2=Good, 3=Average, 4=Below Average, 5=Poor)

The survey explored the students' assessment of the event's scheduled offerings by also asking the students to qualitatively identify their favorite and least favorite NJ&EE activities. The three most frequently cited favorite activities were the Washington, DC trip, "Get Up and Speak" workshop, and the STEM Challenge. While the students enjoyed having the opportunity to experience the national memorials, the opportunity to meet their congressional representatives was the most noted highlight of the DC visit, since it provided students the opportunity to describe and explain their projects to important public figures. The students' explanations of their selection of the "Get Up and Speak" workshop focused on how fun the activity was, the usefulness of acting and improvisational skills, and its ability to make them feel more confident and comfortable speaking in front of a large group of people. The students' description of the STEM challenge



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similarly focused on how fun and interactive the activity was, the opportunity it provided to make new friends, and the opportunity to learn something new or interesting.

The students' selection of the activities they liked least was more varied. While the Washington, DC visit was most frequently cited as the students' favorite activity, it was also the most frequently cited least favorite activity. The students' negative selection of this NJ&EE activity pertained more to the logistics of the day than the actually activity itself. The students consistently noted how *"unbearable"* the heat was during the tours; the length of the day, which was exacerbated by a long bus ride; or previous Washington, DC visits. Several students also suggested improving the day by visiting one of the Smithsonian museums, which would facilitate opportunities for free exploration and access to air conditioning, instead of touring the memorials. During the focus group discussion, the students also suggested the Washington, DC tours be moved to after the National Showcase, since it would make a nice close to the program and allow students to enjoy the experience without feeling worried or stressed about the pending competition.

Although less frequently cited, the students' answers also focused on frustrations with the STEM challenges due to lack of clear explanations, *"kits [that] kept breaking,"* or previous exposure to a similar activity. Other students shared that overall there were too many activities that became *"boring"* because of long lectures or opening statements, which they did not consider to be *"kid friendly."* Other students also cited frustration caused by the event's schedule, which did not allow for adequate free time and resulted in little sleep, and the inconvenience caused by having to always be with their Team Advisor chaperone. Despite these critiques, several students also took this question as an opportunity to further share their program satisfaction by reporting that they did not have a least favorite activity, but enjoyed all of the event's offerings.

As previously indicated, the need for a *"'buddy system' instead of having the Team Advisor constantly follow [students] around"* was a theme also frequently cited by students and Team Advisors when describing how NJ&EE could be improved. While the students recognized the security issues at hand, they still found the situation problematic, since it made organizing opportunities to finalize presentations more difficult and could delay a whole group, if one team member was straggling. This was reflected in the student focus group discussion when previous NJ&EE competitors noted their preference for the FY14 buddy system. The Team Advisors similarly shared their frustrations with the intensity of the required team oversight.

The intensity of the schedule was another theme that repeatedly appeared in the students' survey and focus group feedback. Students frequently described the schedule as *"packed," "rigorous,"* and *"hectic,"* with too little time allocated to activity transitions. The students shared that at times this caused the event to get off schedule and seem disorganized. The intensity of the schedule was also considered challenging because it did not afford time dedicated specifically to presentations. Consequently, the students reported staying up late with their teams to review research and practice their presentations, which was made even more difficult by the earlier curfew implemented during the FY15 NJ&EE. Consequently, students who attended the focus group reported breaking curfew in order to practice with their team. The survey respondents who discussed this problem also reported that the lack of time specifically allocated to preparations increased their stress



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and caused late, sleepless nights that made the early mornings and full schedule even harder to manage.

Although infrequently cited, the students recommend snacks be made available to help them stay energized during the full schedule. They also recommend that future participants be given more opportunities to select which STEM challenge and workshop activities they experience. This was suggested as a way to increase the number of students who participate in activities that align with their STEM interests. Finally, the students requested more opportunities to get to know other teams attending NJ&EE.

Regardless of these challenges, the NJ&EE competitors reported positive impacts. When the event survey asked the students to rate how well 13 adjectives described the event, the five most positively rated items demonstrates the general value they ascribed to their NJ&EE experiences.

1. **Rewarding** (76.3%)
2. **Educational** (73.7%)
3. **Exciting** (66.2%)
4. **Respectful** (65.8%)
5. **Fun** (63.6%)

The students' assessment of these program descriptors also closely mirrored FY14 answers, although the terms *Exciting* and *Rewarding* switched positions within the ranking. The students' selection of the most positive Likert scale item used to assess these adjectives (*Strongly agree*) also increased by approximately 10% to 15% in responses to each item, in comparison to the FY14 NJ&EE data. When DHA statistically compared the FY14 and FY 15 responses, only one of the 13 items, *Well-organized*, yielded a statistically significant difference with the FY15 participants rating the statement more positively (FY14 M=2.26; FY15 M=1.88, Mean: 1=*Strongly agree*, 2=*Agree*, 3=*Neutral*). Consequently, this response trend indicates that regardless of scheduling critiques shared by the students, the FY15 event was perceived more positively.

The evaluation also explored more meaningful program impacts by asking the students to share how participation in eCYBERMISSION and NJ&EE supported their academic growth and development of life skills. DHA's qualitative analysis identified four response themes regarding the students' academic growth. These included:

1. **Increased understanding of STEM and its real-world applications**
2. **Improved public speaking skills**
3. **Knowledge of content specific to their eCYBERMISSION project**
4. **Knowledge of the Army and their utilization of STEM**



The students' description of how eCYBERMISSION supported their development of life skills was even more targeted, and their answers pertained to three themes. These included:

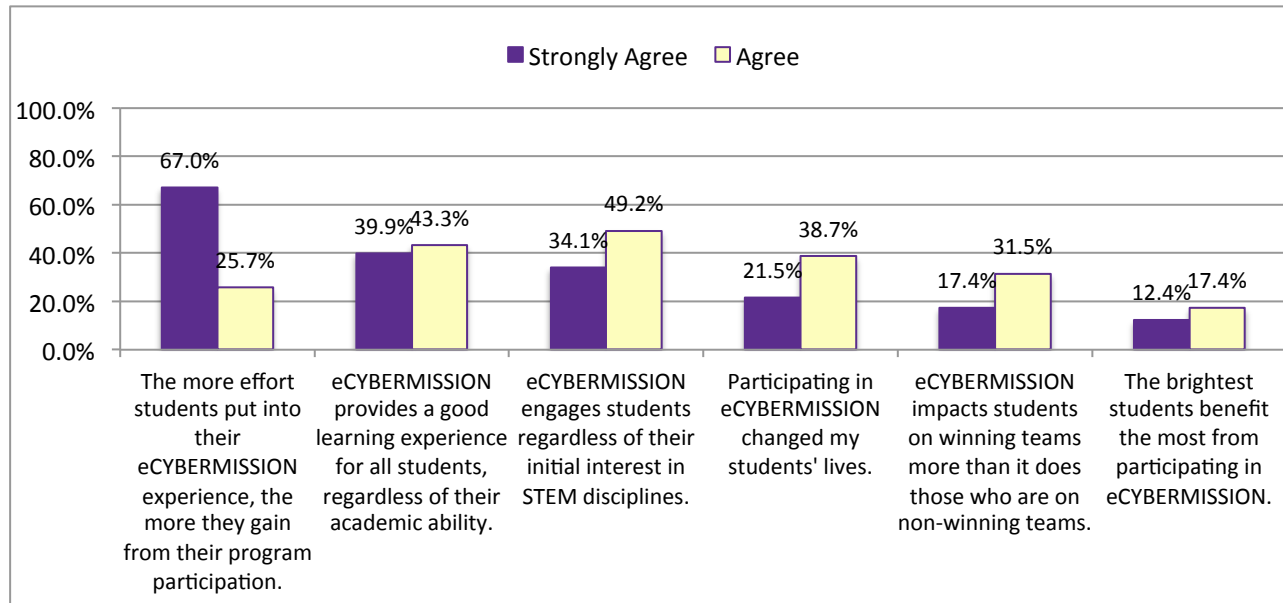
1. **Improved public speaking skills**
2. **The development of 21<sup>st</sup> Century Skills** (Confidence, discipline, work ethic, cooperation, and time management skills)
3. **Improved socialization skills, such as friendliness and overcoming shyness**

The students also explained in what ways, if at all, eCYBERMISSION and NJ&EE participation impacted or changed how they approached or solved problems. The evaluation specifically targeted this 21<sup>st</sup> Century Skill, since a primary goal of the *Mission Folder* was the identification and solution of a community problem. The students' feedback again indicates eCYBERMISSION participation has a positive impact on students' understanding and approach to problem solving. DHA's qualitative analysis identified five response themes, which are outlined in Table 41.

<b>Critical thinking</b>	<b>Creativity</b>	<b>Collaboration</b>	<b>Methodical approach</b>	<b>Attitudinal shift</b>
<ul style="list-style-type: none"> <li>• Reflective and thoughtful consideration of options</li> <li>• Recognition that multiple solutions exist</li> <li>• Approaching a problem from multiple perspectives</li> </ul>	<ul style="list-style-type: none"> <li>• Out of the box thinking</li> <li>• Taking innovative approaches</li> </ul>	<ul style="list-style-type: none"> <li>• Value of multiples perspectives</li> <li>• Benefits of "bouncing off each other"</li> <li>• Being open to different perspectives</li> </ul>	<ul style="list-style-type: none"> <li>• Application of a scientific approach</li> <li>• Application of an engineering design</li> <li>• Value of being procedural and thinking ahead</li> <li>• Efficiencies created by a systematic approach to a problem</li> </ul>	<ul style="list-style-type: none"> <li>• Increased perseverance</li> <li>• Approaching problems calmly, logically, and/or deliberately</li> <li>• Taking problems seriously</li> <li>• Perceiving a problem as an opportunity</li> </ul>

Finally, the Team Advisors provided feedback regarding their perception of the program's impact. Approximately half (48.9%) to nearly all (92.7%) of the Team Advisors agreed (selected *Strongly agree* or *Agree*) with five statements designed to five of the six statements, while only 29.8% of the Team Advisors agreed with the final statement regarding whether the program only benefits the brightest students, which DHA designed to elicit disagreement (see Figure 6).

**Figure 6. Team Advisors' Assessment of eCYBERMISSION Impacts**



These evaluation findings collectively demonstrate the success of FY15 eCYBERMISSION program implementation. While there are still opportunities for continued development, the students' assessment of program implementation efforts generally improved in comparison to FY14. Summative evaluation efforts similarly indicate that eCYBERMISSION, despite significant instances of required program participation, positively impacted students' awareness of AEOP offerings and STEM related military/DoD research and career pathways, STEM engagement and attitudes, development of critical 21<sup>st</sup> Century life and academic skills, and STEM career awareness and aspirations. The NJ&EE competition, in its new Baltimore location, additionally demonstrated significant improvements in its coordination and implementation in comparison to FY15, although the intensity of scheduling could benefit from future adjustments.





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## Recommendations

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

Edit the ten-minute, eCYBERMISSION video tutorial on the *Advisor Resource* page into a brief three to five minute program introduction for student participants. The video should provide a broad overview of eCYBERMISSION followed by a detailed description of resources available on the program's website. By embedding this video into the online registration process, in addition to the *Team Resource* page, NSTA will help ensure all program participants begin the competition with a similar, baseline understanding of resources designed to support their *Mission Folder* completion and their website locations. Although continued exploration of these materials will be the responsibility of the participants, this brief addition to the registration process would likely reduce participants' critiques of website navigability and requests for resources already in existence.

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

In order to reduce participant frustration and encourage efficient development of quality *Mission Folders*, the website's infrastructure needs to be adapted to more effectively meet students' needs. All data entered into response fields should be automatically saved to ensure responses are not lost or time wasted on re-creating responses. NSTA should further support team collaboration by improving the *Mission Folder's* multi-user interface as well, which would allow multiple students to simultaneously access and edit responses. The introduction of these features will significantly support teams' successful workflow, and allow teams to focus their time and attention on thorough project development and completion instead of negative program frustrations created by lost or overwritten data.

3. **Introduce mechanisms to enhance Team Advisors' interactions and peer-to-peer support.**

Numerous Team Advisors were interested in the opportunity to communicate with other eCYBERMISSION advisors. Whether facilitated through the introduction of a Team Advisor forum, discussion feed, or an instant messaging feature, these Team Advisors were interested in discussing eCYBERMISSION, classroom incorporation strategies, and lessons learned with other educators. While these Team Advisors recognized that eCYBERMISSION is a competition, they believed increased peer communications would prove useful to both new and experience Team Advisors. These features would support the development of a sense of community among interested Team Advisors, which would reduce frustrations, enhance the Team Advisor experience, and encourage effective team guidance.

These features would also prove useful to future eCYBERMISSION implementation efforts and Team Advisor recruitment. Publicly posted comments and discussion could create an online record that details aspects of the program considered confusing or challenging in addition to documenting strategies Team Advisors use to



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address these issues. This information would not only help NSTA identify weaknesses in current program descriptions and communications, but also enable the dissemination of creative solutions and identification of useful content appropriate for eCYBERMISSION tips and emails. The creation of an online Team Advisor community would support Team Advisor recruitment and retention as well, since potential Team Advisors would join the program with the knowledge that they would receive access to a robust network of STEM educators and peer support.

- 4. 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.**

Both the competitors and Team Advisors considered the NJ&EE schedule to be too *“packed,” “rigorous,”* or *“hectic.”* Consequently, both participant groups reported feeling exhausted by the end of the week. In order to improve the overall NJ&EE experience and reduce participant strain, NSTA should consider lengthening the event by half a day or reducing the activities incorporated in the current schedule. By altering the event’s schedule, NSTA would provide more time for activity transitions; occasional breaks, which would enhance participants’ attention and interest during activities; and most importantly, create blocks of time specifically devoted to presentation preparation and practice. The latter is critical because NJ&EE competitors reported that, despite having a full event schedule, their teams consistently stayed up late or woke up earlier than required to practice their presentations, which further exacerbated their exhaustion.

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

By allowing students to go from their rooms to certain predetermined locations within the NJ&EE facility, NSTA would increase both competitor and Team Advisor event satisfaction. The lack of this system, in addition to mixed messages and enforcement of rules regarding student movement during FY15, was a source of frustration frequently referenced by students and Team Advisors alike. While the parameters of a buddy system must be carefully considered, the introduction of one would be well received. Introducing this system to the FY16 NJ&EE would additionally support program schedule efficiencies. Students would be able to take the elevator or stairs, if their Team Advisor wanted to use the opposite; quickly return to their rooms for forgotten items without causing the whole team to be late; and allow teachers a small amount of separation from their students during the week.



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## References

Partnership for 21<sup>st</sup> Century Skills. (“n.d.”). *Framework for 21<sup>st</sup> Century Skills*. Retrieved from <http://www.p21.org/our-work/p21-framework>.