



Army Educational Outreach Program
eCYBERMISSION
2014 Annual Program Evaluation Report



September 2014



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eCYBERMISSION

ANNUAL EVALUATION REPORT



Presented to the:

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Prepared by Shannon Weiss
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DAVID HEIL & ASSOCIATES, INC.
Innovations in Science Learning

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 the use of either scientific practices or the engineering design process. eCYBERMISSION teams work collaboratively to research and implement their projects, which are documented and judged via the submission of "*Mission Folders*" hosted on the eCYBERMISSION website.

In support of the eCYBERMISSION program's implementation efforts, David Heil and Associates, Inc. (DHA) provides independent research and evaluation services to the National Science Teachers Association (NSTA) and the U.S. Army. As an external research and evaluation firm, DHA conducts an annual evaluation and efficacy study of the web-based eCYBERMISSION competition. This yearlong study focuses on program efficacy and quality of experience; student attitudinal, performance, and behavioral changes; team advisor behavioral change; implementation of recommended changes to improve future program implementation and impact; and the competition's National Judging & Education Event (NJ&EE).

METHODOLOGY

The study included broad-based data collection through DHA's and NSTA's administration of online surveys to 2013-2014 participating students and Team Advisors. DHA designed data collection instruments to assess participants' community demographics, eCYBERMISSION and Army Education Outreach Program (AEOP) participation, competition satisfaction, and the impact program participation had on students' STEM interests, attitudes, and awareness; 21st century skills; and perceptions of and interests in STEM fields and careers. An invitation and link to the survey were emailed to all participants after program registration, while a link to a second post-survey was emailed to participants after the submission of their *Mission Folder*. A survey containing similar sets of question was administered via email to all Team Advisors.

A separate survey assessed student perceptions of and satisfaction with the NJ&EE. NJ&EE participants completed the survey during a two-week period immediately following the competition. A DHA evaluator attended the 2014 NJ&EE to observe the event and to conduct focus groups with Team Advisors and students regarding their NJ&EE experience and their perceptions of the strengths and weaknesses of the event.

FINDINGS

- Students who competed in eCYBERMISSION reported that their participation was prompted by required classroom assignments, an interest in savings bonds prizes, or the opportunity to explore and/or prepare for a STEM career path, create something new, or have fun.
- 2013-2014 was the first year of program participation for the majority of the eCYBERMISSION survey respondents.

- With the exception of Gains in the Education of Mathematics and Science (GEMS), less than 5% of the eCYBERMISSION students reported participating once in another AEOP. Most frequently the students reported that they had never heard of the programs. The majority (at least 75%) of the Team Advisors, similarly, shared that they had never heard of the AEOPs.
- One third of the eCYBERMISSION students reported that participation in eCYBERMISSION, the program's website, and their Team Advisors increased their awareness of both AEOPs and STEM careers most. One third to half of the Team Advisors similarly reported an increased awareness of AEOPs and STEM careers due to eCYBERMISSION participation and website.
- Student focus group participants reported limited awareness and minimal use of the eCYBERMISSION website's collaborative tools and instead utilized communication and resources sharing tools that they were already familiar with (e.g. Google Drive, Gmail, etc.).
- Students shared that the expertise provided by Cyberguides was highly valued when requested.
- Team Advisors considered Mission Control, Mission Folder questions, the Team Advisor Resource Guide, the Student Registration Template, and scoring rubrics to be the most useful resources provided by the eCYBERMISSION website.
- Team Advisors identified the response time of Mission Control and Cyberguides, the regularity of blog updates, and the overall navigability of the eCYBERMISSION website as the aspects of the website most in need of improvement.
- Team Advisors' were most frustrated with and concerned by the Mission Folder judging process and the judges' overall lack of feedback regarding students' work.
- Statistical analyses of the eCYBERMISSION students' quantitative feedback indicated that comparisons between students' pre- and post-program participation in STEM activities, frequency of teaching others how to use a new technology, confidence regarding eleven 21st Century skills, and interests in and attitudes toward STEM fields and careers demonstrated statistically significant gains.
- Analyses of students' pre- and post-survey feedback indicated that student STEM attitudes and perceptions of military research and researchers were weaker after participation. However, this trend was less prominent within the matched sample data set.
- Approximately 75% of the NJ&EE competitors rated the event's meals, hotel accommodations, facilities, overall experience, and arrival and check-in process as excellent or good, while the event's provision of recreational time and advanced planning and communication with teams were rated most poorly.
- Focus group discussions with NJ&EE competitors and Team Advisors revealed that the scheduling, logistics, and limited exposure to Washington DC's monuments, museums, and government representatives was one of the most disappointing aspects of the NJ&EE event.
- Finally, the majority (over 75%) of the NJ&EE students either strongly agreed or agreed that NJ&EE was exciting, educational, rewarding, respectful, and engaging.

RECOMMENDATIONS

1. Increase awareness and interest in additional AEOPs by targeting Team Advisors.
2. Provide students and Team Advisors a brief introductory video that highlights the location and purpose of online eCYBERMISSION resources.
3. Enhance program communications by posting blog updates more regularly and further prioritizing Mission Control and Cyberguides' timely feedback to teams.
4. Address Team Advisors' frustration with eCYBERMISSION judging by providing more feedback regarding the rationale of Mission Folders' final scores and encouraging their review as a team activity.
5. Introduce more examples of military research and researchers into program examples, communications, or website highlights.
6. Enhance the NJ&EE experience by further supporting students' preparation for NJ&EE through earlier and more frequent communications, in addition to ensuring the events' overall organization by adhering more closely to the NJ&EE schedule.
7. Enhance the NJ&EE experience by increasing the team's understanding of the exact schedule and activities of the Washington DC Excursion Day, in addition to providing interested teams the opportunity to spend more time exploring the capitol at their discretion, liability, and cost.

INTRODUCTION

Entering its twelfth year of implementation, the eCYBERMISSION annual online competition invites students to explore ways in which science, technology, engineering, and mathematics (STEM) can be utilized to solve real-world issues within their local communities. By accepting a *Mission Challenge* in one of seven areas (*Alternative Energy Sources; Environment; Food, Health, & Fitness; Forces & Motion; National Security & Safety; Robotics; and Technology*), teams of three to four students collaborate and use scientific inquiry framed through scientific practices or the engineering design process to develop solutions.

Participants' project development is additionally guided and fostered through adult support and online resources. Each team registers with a local Team Advisor, often a teacher or parent, who assists students with the registration process and their identification of an appropriate community issue and related *Mission Challenge*, monitors team activity, and provides a review of the team's final project submission, a *Mission Folder*, which includes the official write-up of their project via the eCYBERMISSION website. The eCYBERMISSION website's resources further support both students and Team Advisors. A *Team Advisor Resource Guide* provides the volunteer Team Advisors instructions regarding each step of the *Mission Folder* submission process, worksheets, rubrics of judging criteria, timelines, and explanations of how the program aligns to state standards, Common Core Standards, and Next Generation Science Standards (NGSS). This resource not only help Team Advisors fulfill their responsibilities, but also encourages teachers to integrate eCYBERMISSION participation into their classroom curricula.

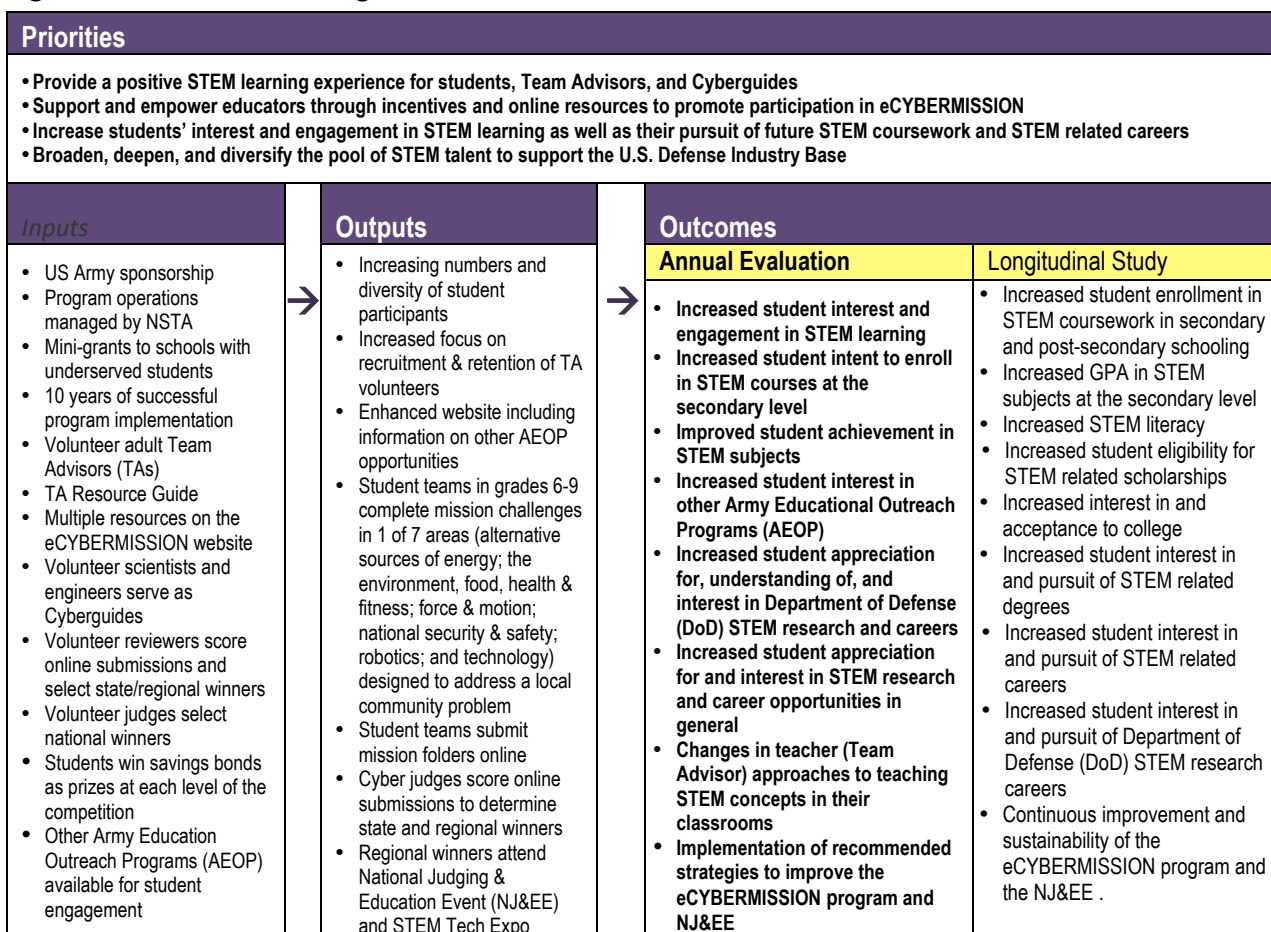
Students receive similar online support through a Team Resource webpage, which includes video lessons and accompanying worksheets designed to help students complete their *Mission Folders*. During the 2013-2014 project year, there were eight video lessons, which ranged in topic from teamwork to executing an experiment to drawing conclusions. Videos and worksheets were supplemented by documents containing information specific to *Mission Folder* development. Moreover, eCYBERMISSION provided the students technical support and expertise via volunteer Cyberguides. The Cyberguides, either civilian STEM professionals or military personnel, provided students feedback and project guidance through the website's discussion forums, instant messaging features, chat rooms, and participation in webinars.

Finally, after each team submits a *Mission Folder*, volunteer Virtual Judges review and score the *Mission Folders* to identify state and regional level winners for each grade level. Regional winners compete at a National Judging and Educational Event (NJ&EE), held annually in the Washington, DC area.

LOGIC MODEL

The eCYBERMISSION logic model presented in Figure 1 visually depicts the theory of action for the eCYBERMISSION program 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 through actions and products (outputs) to anticipated outcomes, which provides a framework to guide evaluation activities and efforts.

Figure 1. eCYBERMISSION Logic Model



METHODOLOGY: DATA COLLECTION, SAMPLE SIZE, AND DEMOGRAPHICS

DHA's current research, which was initiated during the 2012-2013 implementation year, marks the first comprehensive evaluation of the eCYBERMISSION program. The 2013-2014 annual evaluation builds upon these previous evaluation efforts and continues to assess the strengths, shortcomings, improvements, outputs, and short-term outcomes of the overall eCYBERMISSION program and the National Judging and Educational Event (NJ&EE). The evaluation is designed to assess participants' perceptions of the program and the impact eCYBERMISSION had on the 2013-2014 cohort of students and their Team Advisors. Specifically, the evaluation addressed questions related to program strengths and challenges, benefits to the participants, and overall effectiveness in meeting program goals (outcomes).

In order to accurately understand and represent eCYBERMISSION's implementation efforts, participants' experiences, and the program's impacts, the 2013-2014 evaluation utilized both quantitative and qualitative data collection methodologies. Quantitative data was collected via surveys and qualitative feedback was collected through surveys, facilitated focus group discussions, and NJ&EE observations.

SURVEYS

The annual evaluation collected data through the online administration of four surveys:

1. eCYBERMISSION Student Pre-Survey;
2. eCYBERMISSION Student Post-Survey;
3. eCYBERMISSION Team Advisor Survey; and
4. NJ&EE Student Survey.

These surveys collected data regarding participants' demographics, eCYBERMISSION and Army Education Outreach Program (AEOP) participation, competition satisfaction, and the impact eCYBERMISSION had on students' STEM interests, attitudes, and awareness; 21st century skills; and perceptions of and interests in STEM fields and careers.

An invitation and link to the eCYBERMISSION Pre-Survey was emailed to all participants after program registration, and 1,303 students completed the survey. The survey sample was representative of two sub-samples: regular student participants (299 students) and schools who had received mini grants to further support their participation (614 students), and 150 of these students (58 regular eCYBERMISSION students and 92 students with mini-grant funding) also completed the Post-Survey.

Based on the students survey feedback, the pre-survey collected data from a relatively equal sample of male and female students (49% respectively). Nearly two-thirds (59%) of the pre-survey sample reported being Caucasian, while 8% reported their ethnicity as Asian or African American, and 7% reported being Hispanic or Latino(a). Nearly half of the sample (43%) also reported that they were in the 8th grade, while 6th grade students represented a fourth (26%) of the sample, 7th grade students represented 20% of the sample, and 9th grade students represented only 10% of the pre-survey sample. Nearly all of the students also reported that they attended either a public school (84%) or a private school (13%) in either a suburban (62%), urban (22%), or rural (6%) setting. Nearly all of the students (85%) represented households in which English was the primary language spoken and included parents who had either completed a 2- or 4-year college degree (40%) or a more advanced degree (37%). The demographics of matched pre- and post-survey respondents reflected similar trends demonstrated by these unmatched pre-survey student respondents.

The second post-survey was emailed to participants after the submission of their *Mission Folder*, which included the same sub-samples of regular students and mini grant school students. The post-survey was completed by 1,302 students, 987 were regular participants, 165 were students from the mini grant schools, and 150 were students who completed both the pre- and the post-survey as previously described. The students' provision of demographic information in response to the post-survey was consistently weaker and approximately 20% of the students left these fields blank. However, nearly half of the sample (43%) reported being Caucasian, while 11% of the students reported their ethnicity as Hispanic or Latino(a), 6% reported their ethnicity as Black or African American, and 10% reported being multi-racial. The 8th grade was still the largest grade represented in the sample (31%), while 7th grade students represented nearly a fourth of the sample (22%), 7th graders represented 20% of the sample, and the 6th and 9th grade students both represented 12% of the provided demographics. The

majority of the students who provided demographic information attended either a public school (59%) or a private school (10%) in either a suburban (42%), urban (14%), or rural (9%) setting. Two-third of the students (66%) also represented households in which English was the primary language spoken with parents or guardians who had either completed a 2- or 4-year college degree (24%) or a more advanced degree (27%).

Each of the total pre- and post-survey sample sizes collected by the student surveys were more than triple the sample size necessary for statistical analyses appropriate for the eCYBERMISSION competition's populations, which was approximately 29,000 students during the 2013-2014 program year. The response rate, however, did not generate a sufficient sample of matched pre- and post-survey responses to confidently rely upon paired sample t-test analyses of the data set, since the generated sample was less than half of the required 380 matched responses. Consequently, the findings presented within this report were generated through a mix of paired t-test analyses, which provide statistically significant findings but to a lower degree of power, and independent t-test analyses applied to unmatched samples or variables consisting of two factors (e.g., gender). DHA additionally conducted numerous ANOVA analyses to determine whether differences between various variables within data sets impacted responses.

The third survey, which collected similar information as the eCYBERMISSION pre- and post-surveys, was administered via email to all 2013-2014 Team Advisors. Over the course of a month, 329 Team Advisors completed the survey. Two-thirds of these Team Advisors reported being female and primarily Caucasian (71%), while another 22% percent of the Team Advisors were Hispanic/Latino, Asian American (8%), or African American (6%). The majority of the Team Advisor survey sample (79%) also identified themselves as teachers, and nearly three-fourths of the sample taught in a U.S. based public school (69%) or U.S. based private school (9%) located in a suburban (34%), or urban (25%) or rural (16%) setting.

While DHA and NSTA planned to administer the NJ&EE Student Survey during the final evening of the NJ&EE competition, poor Internet connectivity resulted in the surveys being electronically distributed via email and completed during a two-week period directly after the NJ&EE competition. Seventy-four (74) students completed this survey, which was a 93% response rate.

An analysis of the NJ&EE Student Survey indicated that two-thirds of the NJ&EE students were male, and 90% identified themselves as either Caucasian (45%), Asian (26%), or multi-racial (19%). Nearly all of the students (85%) represented households in which English was the primary language spoken and included parents that had either completed a 2- or 4-year college degree (22%) or a more advanced degree (70%). The NJ&EE Student Survey was also quite evenly distributed across the four grade bands (at the most, a difference of 11%), and the majority (81%) of the NJ&EE students attended a U.S. public school, while the remaining students attended a U.S. private school (15%) or were home schooled (3%).

OBSERVATIONS & FOCUS GROUPS

A DHA evaluator attended the final two days of the 2014 NJ&EE. During this site visit, the evaluator observed the students as they finalized their presentation set-ups and presented their *Mission Challenge* projects to the National Judges, and observed a second project presentation to fellow competitors and guests, and the 2014 eCYBERMISSION NJ&EE Awards Banquet. DHA

additionally utilized this time spent on-site to conduct three focus group discussions. The first focus group was held on the evening of June 18, 2014, with the NJ&EE Team Advisors to discuss their eCYBERMISSION and NJ&EE experiences and its student impacts. The second and third focus groups were held immediately after the NJ&EE judging was completed. One focus group was comprised of ten team-selected representatives from each of the sixth and 7th grade teams, while the second included ten students representing the 8th and 9th grade teams. During these two focus groups, the 20 representative NJ&EE students shared feedback regarding how they had been impacted by eCYBERMISSION participation, the strengths and weakness of the current eCYBERMISSION program and NJ&EE characteristics and structures, and their awareness of and interest in STEM fields and careers.

EVALUATION FINDINGS

eCYBERMISSION & AEOP PARTICIPATION

The 2013-2014 eCYBERMISSION pre-survey asked the students to explain why they decided to participate in the eCYBERMISSION competition. DHA's qualitative analysis identified nine emergent themes within the students' responses. One of the most common themes among the students' explanations was that participation in eCYBERMISSION was a required component of either a classroom or homework assignment. Other students cited their interest in winning saving bonds to help meet the cost of college, or the opportunity to explore or better prepare for a future STEM college and/or career path. Another common theme that emerged within the data analysis was that students thought "the competitions looked fun and exciting." Others were interested in trying or creating something new, or had an interest in STEM or a specific STEM field. Finally, students reported participation in eCYBERMISSION because of a desire to support or help their community or the military.

"It sounds fun, and it seems like a very creative way of learning."

"I would love to help in the creation of something that could change the world."

"I have a deep interest in the STEM fields of learning. I would like to participate in an activity that relates to these fields."

"I decided to participate in eCYBERMISSION because it helps the military and the world."

"I had participated two years ago and profited greatly from the experience. I learned that even I, as a minor, could design something that would change the world, and I wanted to do it again."

The 2013-2014 evaluation sample represented students with only minimal previous program participation experience. A third of the regular students (63%), three-fourths (78%) of the mini grant school students, and the majority (87%) of the matched pre- and post-survey respondents reported that their highest level of competition involvement to date had been general participation. Moreover, only two-thirds to three-fourths of the students from each of these three subsamples reported that they had competed in eCYBERMISSION only once.

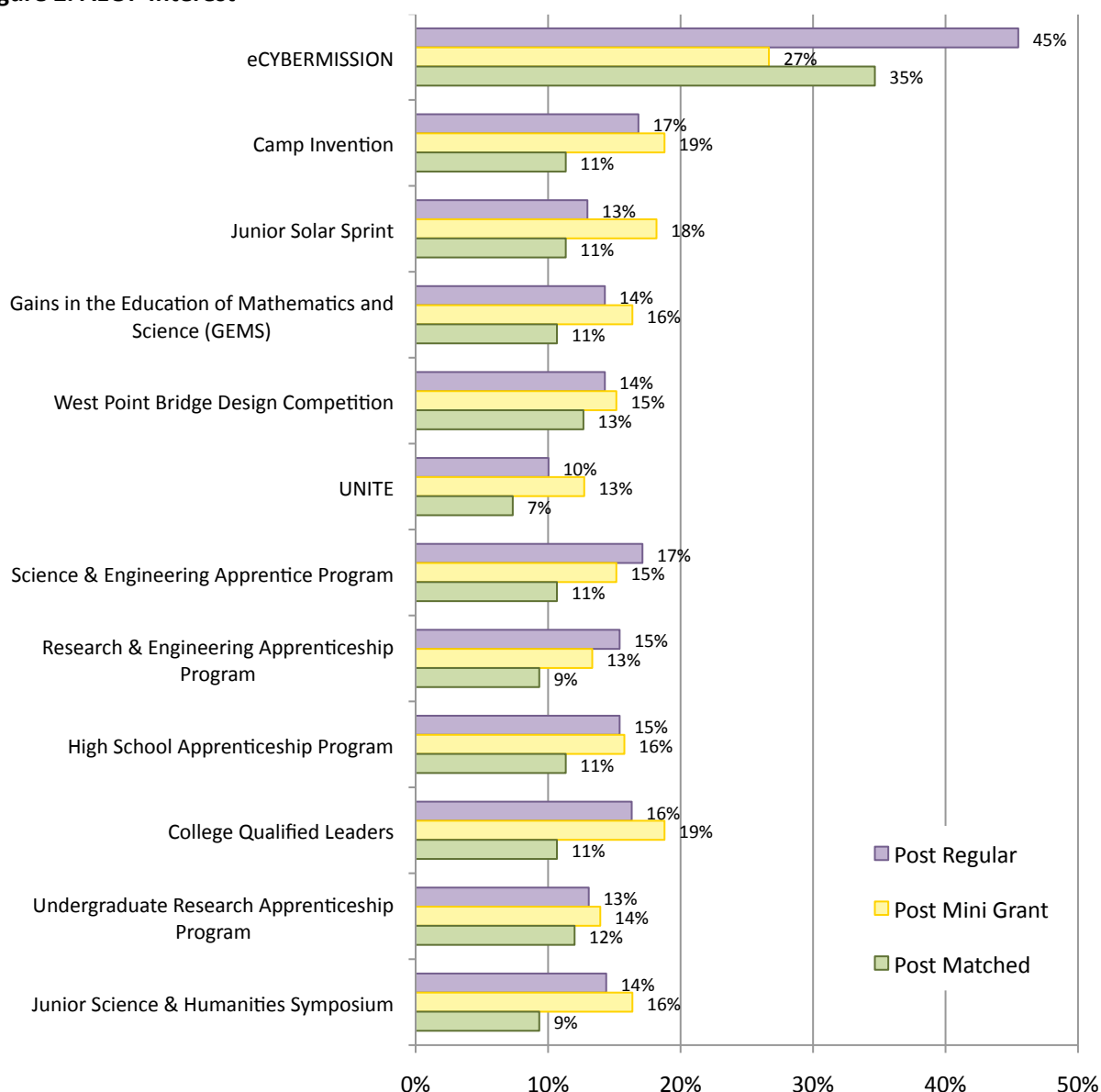
The survey additionally asked the students to share whether they had previously participated in any other Army Education Outreach Programs (AEOP). Table 1 indicates that approximately

a third or more of each sample had never heard of the AEOPs, while Gains in the Education of Mathematics and Science (GEMS) had been experienced by at least 10% of the mini grant and matched students.

Table 1. AEOP Awareness

	<u>Post Regular</u>		<u>Post Mini Grant</u>		<u>Post Matched</u>	
	Once	I've never heard of it	Once	I've never heard of it	Once	I've never heard of it
eCYBERMISSION	76%	1%	66%	1%	64%	1%
Camp Invention	2%	38%	2%	27%	0%	35%
Junior Solar Sprint	1%	40%	5%	24%	0%	38%
Gains in the Education of Mathematics and Science (GEMS)	3%	39%	10%	24%	13%	28%
West Point Bridge Design Competition	3%	38%	2%	27%	3%	31%
UNITE	1%	39%	2%	28%	0%	38%
Science & Engineering Apprentice Program	2%	38%	2%	26%	1%	36%
Research & Engineering Apprenticeship Program	2%	39%	2%	26%	1%	36%
High School Apprenticeship Program	1%	39%	2%	25%	0%	37%
College Qualified Leaders	1%	39%	2%	27%	1%	35%
Undergraduate Research Apprenticeship Program	1%	40%	2%	26%	0%	37%
Junior Science & Humanities Symposium	1%	40%	3%	27%	0%	35%

Although the students reported little prior awareness of these programs, approximately 10% to 20% of the students reported being either “Extremely interested” or “Interested” in participating in the AEOPs in the future. The pre/post matched survey sample, however, demonstrated less interest than the unmatched survey sample students, while the mini grant students frequently reported being the most interested in future AEOP participation.

Figure 2. AEOP Interest


Team Advisors, who were teachers of at least 70% of the regular students and as much as 93% of the matched student sample, also shared their level of awareness and interest in these AEOPs. With the exception of eCYBERMISSION, which 85% of the Team Advisors had participated in at least twice, three-fourths of the educators had never heard of the eleven other AEOPs. The Team Advisors additionally reported the likelihood of whether or not they would introduce their students to the presented AEOPs in the future. Over three-fourths of the Team Advisors (78%) were likely to introduce future students to eCYBERMISSION, but at the most, 10% to 15% of the Team Advisors reported that they were likely to introduce students to four of the eleven AEOPs, which, by order of interest, were: West Point Bridge Design Competition, Junior Solar Spirit, the Science & Engineering Apprenticeship Program, and Gains in the Education of Mathematics and Sciences (GEMS).

In response to the post-survey, the students also assessed to what degree five items increased their awareness of both AEOPs and STEM careers. These items included:

1. Participation in eCYBERMISSION;
2. The eCYBERMISSION website;
3. Team Advisors;
4. AEOP brochures; and
5. Army STEM career magazines.

One third of the students reported that each of the first three items increased their awareness of both AEOPs and STEM careers, while approximately 15% of the students similarly rated the AEOP brochures and Army STEM career magazines.

The Team Advisors similarly rated how well four of the same items increased their awareness of AEOPS and STEM careers on a five-point Likert-scale. Table 2 and 3 demonstrate the percentage of Team Advisors who reported that the items increased their awareness, and clearly indicates that participation and access to the website had a much larger impact on the Team Advisors awareness of both other AEOPs and STEM careers.

Table 2. Impact on AEOP Awareness

<u>AEOPs</u>	<u>Significantly increased my awareness</u>	<u>Increased my awareness</u>
Participation in eCYBERMISSION	31%	27%
The eCYBERMISSION website	22%	33%
AEOP brochures	5%	12%
Army STEM Career Magazine	3%	3%

Table 3. Impact on STEM Awareness

<u>STEM Careers</u>	<u>Significantly increased my awareness</u>	<u>Increased my awareness</u>
Participation in eCYBERMISSION	22%	26%
The eCYBERMISSION website	12%	27%
AEOP brochures	5%	7%
Army STEM Career Magazine	3%	3%

eCYBERMISSION Program Support Structures

Feedback regarding eCYBERMISSION's program support structures was predominantly gathered from the Team Advisors and three focus group discussions conducted during NJ&EE. The NJ&EE students who participated in eCYBERMISSION shared that they generally did not use provided eCYBERMISSION collaborative tools, but instead relied upon Google Docs/Google Drive, Gmail, G-chat, and other platforms commonly utilized within their schools to complete

their *Mission Folders*. Several students, however, reported that the expertise provided by the Cyberguides was very useful. One student shared that their group was “having so much trouble. We couldn’t find any YouTube tutorials. We couldn’t do anything, so we decided to go on eCYBERMISSION, and they [Cyberguides] helped us greatly.”

Similarly, the students reported that much of their content knowledge was derived from either online research or more often from individuals within their personal networks. The students reported that their groups learned to organize meetings with their teachers, other individuals within their communities, or experts within fields related to their project.

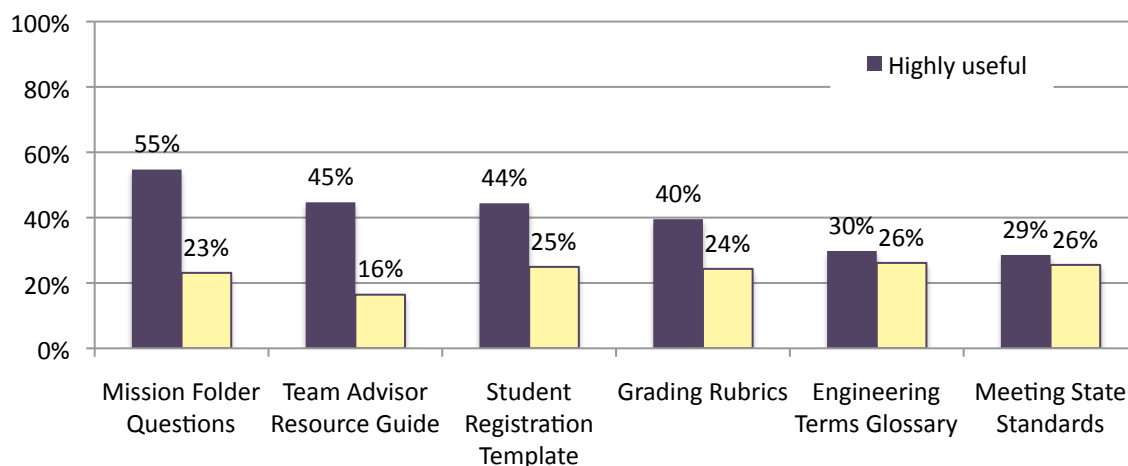
“We spent a ton of time going to people that knew this stuff by heart.”

“Our team used a lot of different experts for our research: doctors, teachers, computer experts, our own pharmacist.”

The post-survey also presented the students with a list of 15 potential motivational factors that could support them during their eCYBERMISSION project work. Regardless of survey group, the students consistently selected six factors most frequently. The students’ feedback demonstrated the importance of the Team Advisors, or teachers, to the students’ motivation, encouragement received from teachers or Team Advisors, an associated academic requirement or classroom grade, having fun, doing something with friends, and serving their community or country.

The Team Advisors provided insights regarding the program’s supports through quantitative and qualitative assessments. The Team Advisors first rated how useful six aspects of the program were to their support of the students or their classroom incorporation of the program. Figure 3 depicts the percentage of advisors who selected either *highly* or *moderately useful*, which were the two most positive ratings of the five-point Likert-scale when assessing the items. Overall, the items were positively rated and approximately three-fourths of the team advisors reported that the Mission Folder Questions, Team Advisor Resource Guide, and Student Registration Template were useful.

Figure 3. Team Advisors’ Assessment of eCYBERMISSION Supports’ Usefulness



While the previous figure provided insight into the Team Advisors' general perception of the eCYBERMISSION resources and supports, the survey also provided an opportunity for them to provide open-ended feedback regarding what specific program supports were most helpful. The most frequently cited program support was Mission Control and email communications, which enabled the Team Advisors to directly ask specific questions and receive immediate answers. Equally cited was the website in general, as its information was easy to access, was "always available," and "gave clear expectations for each step of the process." Another prominent emergent theme within this qualitative data set was the eCYBERMISSION worksheets, which helped "students understand the competition's process before they started their own projects" and "focus the students in what they needed to do." The final emergent themes cited by the Team Advisors pertained to the usefulness of scoring rubrics, which "fostered...understanding of how participants would be assessed" and their ability to identify when students were off task, and *Mission Folder* tips. Although less frequently discussed, several Team Advisors also cited past winner *Mission Folder* samples, videos, Cyberguides, and the STEM Kits.

Similarly, the survey asked the Team Advisors how the program supports could be improved, which prompted a more diverse set of responses. The most frequently cited program supports, however, were various types of program communication strategies. Numerous Team Advisors reported that the response time after contacting Mission Control or Cyberguides could be improved, that the students "were left [with] vague messages or little information to go on" after chatting with Cyberguides, and that the blogs could be updated on a more regular basis. Several Team Advisors shared general feedback regarding communications, such as, "sometimes it seems there might be a breakdown in timely communications."

The navigability of the website was another aspect of the program frequently cited. While several Team Advisors noted that it had improved from the previous program year, numerous respondents shared that the website "needs to be better designed and simplified," that the "links could be made more obvious (buttons, uploading files for instance)," or that it took "quite a while to figure out where everything was, and even then I wasn't sure if I had found what I needed."

Finally, the Team Advisors frequently discussed *Mission Folder* judging, which prompted the most frustration and/or concern. While several Team Advisors requested simple clarifications or additional breakdowns of how scores were determined, others reported concerns regarding the rate of *Mission Folder* scoring noting that after "six months and hundreds of hours on their project, the thought that a judge may only spend a few minutes reviewing [the students] work was not comforting." Other Team Advisors were discouraged by the lack of comments given to students by Cyber Judges explaining why or how scores were determined, or how the projects could be improved. One Team Advisor noted that "without proper feedback, [eCYBERMISSION participation] left students with a negative experience. Without this feedback to learn from, this competition is not worth the time and effort from my class/students."

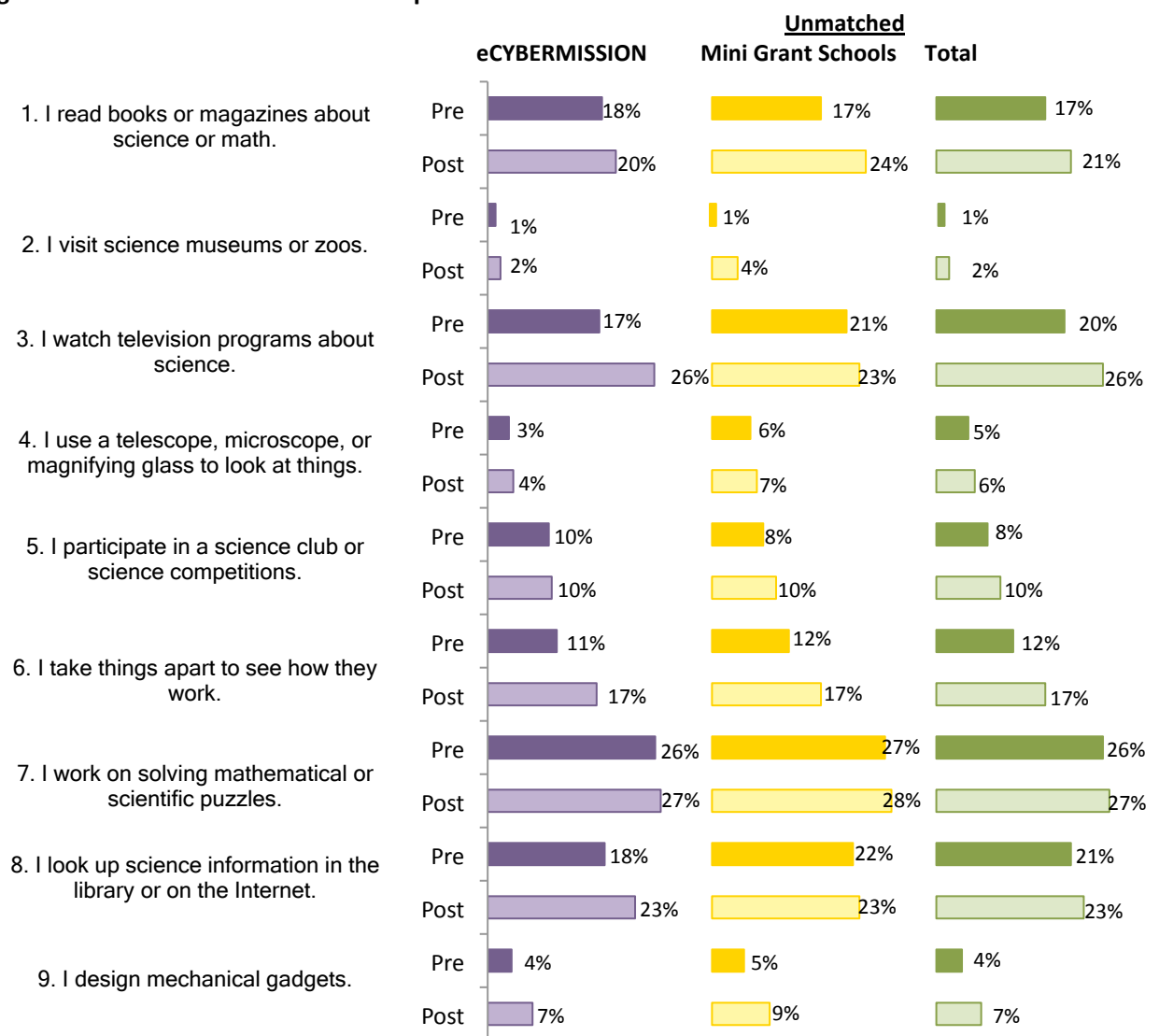
STEM AWARENESS, INTERESTS, & ATTITUDES

The 2013-2014 eCYBERMISSION evaluation examined in what ways program participation impacted students' STEM awareness, interests, and attitudes. Both the pre- and the post-surveys asked students to rate how frequently they participated in nine STEM related activities on a five-point Likert-scale consisting of *at least once a week, at least once a month, every few months, once or twice a year, or never or almost never* (See Figure 4). The figure depicts the

percentage of unmatched students (regular or “eCYBERMISSION” students, mini grant school students, and the total unmatched sample) who selected either *at least once a week* or *at least once a month*. Response trends between the groups were very similar, and the only statistically significant difference between the unmatched “eCYBERMISSION” regular students and the mini grant schools were in response to statements 4, 5, and 9.

While the percentage of students from the mini grant schools who participated in the activities were the same or slightly larger for these three activities, a comparison of their group means indicated that the regular student group reported participating in the activities more frequently. DHA also compared the unmatched students’ pre- and post-survey responses via an independent t-test analysis, which indicated that statements all of the statements, except statements 7 and 8, demonstrated statistically significant gains from pre to post.

Figure 4. The Unmatched Student Samples’ STEM Interests



DHA also explored whether or not differences in demographic variables, such as the primary language spoken at home, students' grade level, or school setting impacted responses to the statements. Analysis of the responses indicated that the students who did not primarily speak English at home provided rates of participation that were significantly greater (95% level of confidence, $p < .05$) in response to activities 5, 7, and 8 of the pre-survey. An analysis of variance (ANOVA) by grade level additionally indicated that the 9th grade students' pre-survey participation in activities 6 and 8 was significantly greater than the younger students, while the 6th grade students' post-survey responses demonstrated a significantly stronger participation rate with statement 2 in comparison to the 8th grade students.

Table 4. The Matched Student Sample's STEM Interests

	Pre	Post
1. I read books or magazines about science or math.	21%	23%
2. I visit science museums or zoos.	1%	5%
3. I watch television programs about science.	22%	25%
4. I use a telescope, microscope, or magnifying glass to look at things.	3%	7%
5. I participate in a science club or science competitions.	5%	5%
6. I take things apart to see how they work.	13%	19%
7. I work on solving mathematical or scientific puzzles.	31%	29%
8. I look up science information in the library or on the Internet.	28%	29%
9. I design mechanical gadgets.	7%	6%

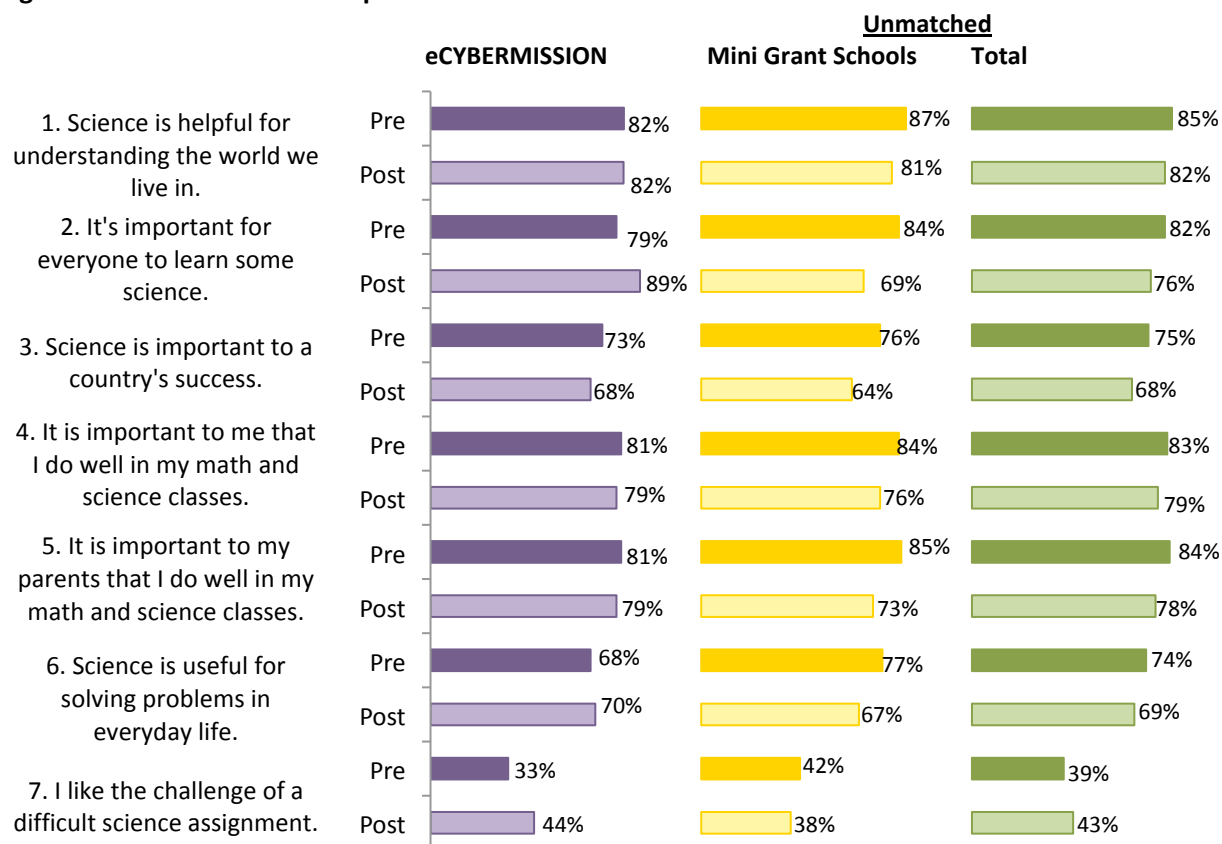
The linked students' pre- and post-survey responses produced similar response trends (see Table 4) as the unmatched student sample's responses. A paired t-test analysis of the matched students' responses indicated that there were also statistically significant improvements within the students' participation in activities 1, 2, and 4 from the beginning of the program to its end. However, the matched responses limited sample size ($n=150$ students) is less than half of the required sample size necessary to generalize this improvement to the large eCYBERMISSION population.

The pre- and post-surveys further examined the participants' STEM attitudes by asking them to rate their agreement with seven statements (see Figure 5). The percentage of students who agreed with each statement generally decreased from pre to post, with the mini grant schools agreeing less frequently with the statements than the regular eCYBERMISSION students. When the total unmatched student samples pre- and post-survey responses' means were statistically compared, the independent t-test analysis revealed that only three statistically significant changes occurred, which were decreased agreement with statements 4, 5, and 6.

When analyzed by grade level, the students' unmatched pre-survey responses indicated that the 9th grade students reported statistically significant higher rates of agreement than both the 7th and 8th grade students in response to statements 3 and 7, while the post-survey responses included no statistically significant differences between the grades' responses. A comparison of the students' pre-survey assessment of the statements by school setting indicated that frontier schools demonstrated weaker rates of agreement than each of the other school settings, while

students from suburban schools reported higher rates of agreement with statement 7 than students from urban schools. A similar analysis of the students' post-survey assessment of the statements by school setting also indicated that students from the frontier schools' agreement with statements 4 and 7 were also weaker than each of the three other school settings.

Figure 5. The Unmatched Samples' STEM Attitudes



The matched students sample, however, reported significantly higher rates of agreement in response to all seven statements when completing both the pre- and the post-survey (see Table 5). A comparison of this sample's pre-survey responses to their post-survey responses additionally indicated statistically significant increased rate of agreement with statement 3. The statistical comparison of the pre-survey responses further indicated that the students who did not report English as the primary language spoken within their home provided higher rates of agreement to both statements 4 and 7, while their post-survey agreement with statement 4 was also more significant than students who spoke English as their primary language at home.

Table 5. The Matched Sample's STEM Attitudes

	Pre	Post
1. Science is helpful for understanding the world we live in.	95%	92%
2. It's important for everyone to learn some science.	91%	89%
3. Science is important to a country's success.	86%	79%
4. It is important to me that I do well in my math and science classes.	94%	89%
5. It is important to my parents that I do well in my math and science classes.	96%	89%
6. Science is useful for solving problems in everyday life.	84%	82%
7. I like the challenge of a difficult science assignment.	47%	48%

21ST CENTURY SKILLS

Another key goal of the eCYBERMISSION competition is preparing students to succeed and meet the demands of the future by equipping them with vital 21st Century Skills, which include life and career skills; learning and innovation skills (critical thinking, communication, collaboration, and creativity—the “4Cs”); and information, media, and technology skills.¹ In order to measure the program’s achievement of this specific program outcome, the pre- and post-surveys incorporated numerous questions regarding the students’ skills, proficiencies, and self-efficacy (Framework for 21st Century Learning, 2014).

First, the students were asked to report how frequently they participated in technology related activities or demonstrations of their information literacy (see Figure 6). The students reported only minimal participation with the first activity, which given the relatively young age of the students was not entirely surprising. An ANOVA analysis of the unmatched student sample’s pre-survey responses further demonstrated the potential impact the students’ age had on their assessment of this activity, since the 6th grade students were significantly less likely to have designed a computer program or website than the 8th and 9th grade students. A quarter to over a third of the students, however, reported participating in the final two statements on a weekly or monthly basis.

The statistical comparison of the regular eCYBERMISSION students and mini grant school students’ assessment of these activities indicated that only the regular students’ reported participation in the third statement was statistically greater than the mini grant school students. A similar comparison of the unmatched sample’s pre- to post-survey responses revealed that only one activity, teaching others how to use a new technology, showed an increase after program participation.

Figure 6. Frequency of The Unmatched Samples’ Participation

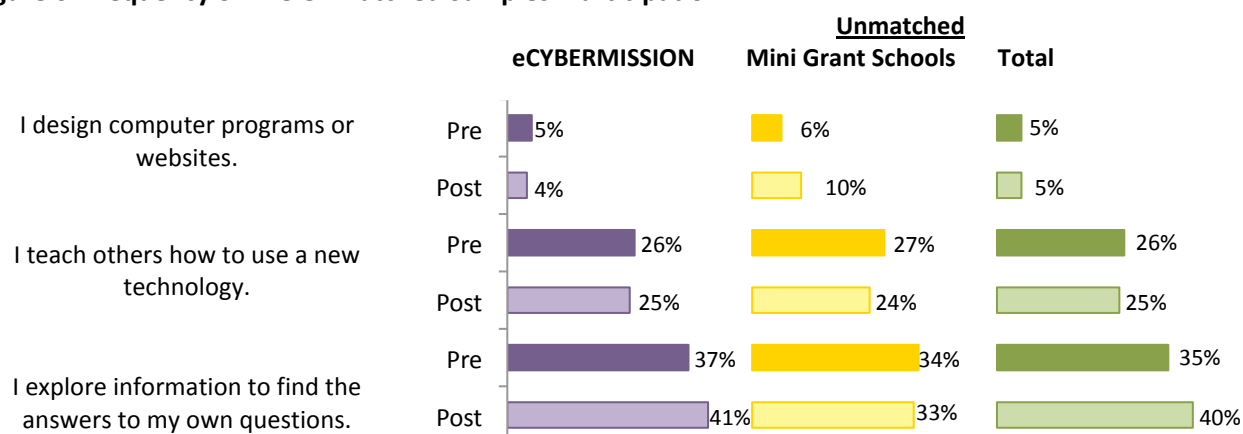


Table 6. Frequency of The Unmatched Samples' Participation

	Pre	Post
I design computer programs or websites.	12%	13%
I teach others how to use a new technology.	25%	31%
I explore information to find the answers to my own questions.	39%	42%

The response of the matched student sample, students who completed both the pre- and the post-survey, followed similar response trends as the larger unmatched sample set (see Table 6). Likewise, the frequency of matched sample students who taught others how to use a new technology also demonstrated a statistically significant increase.

The survey further measured the potential impact of eCYBERMISSION on students' 21st Century Skills by asking the eCYBERMISSION students to rate their agreement with two statements regarding technology (see Table 7 and 8). Approximately 70% or more of the unmatched student groups either *strongly agreed* or *agreed* with the two statements, while nearly 80% or more of the matched student sample similarly agreed with the statements. The mini grant students' pre-survey assessment of the first statement was significantly greater than the regular eCYBERMISSION students, while a pre- to post-survey comparative analysis indicated the students' agreement with the first statement decreased.

Table 7. The Unmatched Samples' Interest in 21st Century Skills

	eCYBERMISSION		Mini Grant Schools		Total	
I like learning how to use a new technology.	68%	71%	76%	70%	74%	71%
It is important for everyone to have a basic understanding of new technologies.	75%	75%	77%	71%	76%	75%

Table 8. The Matched Samples' Interest in 21st Century Skills

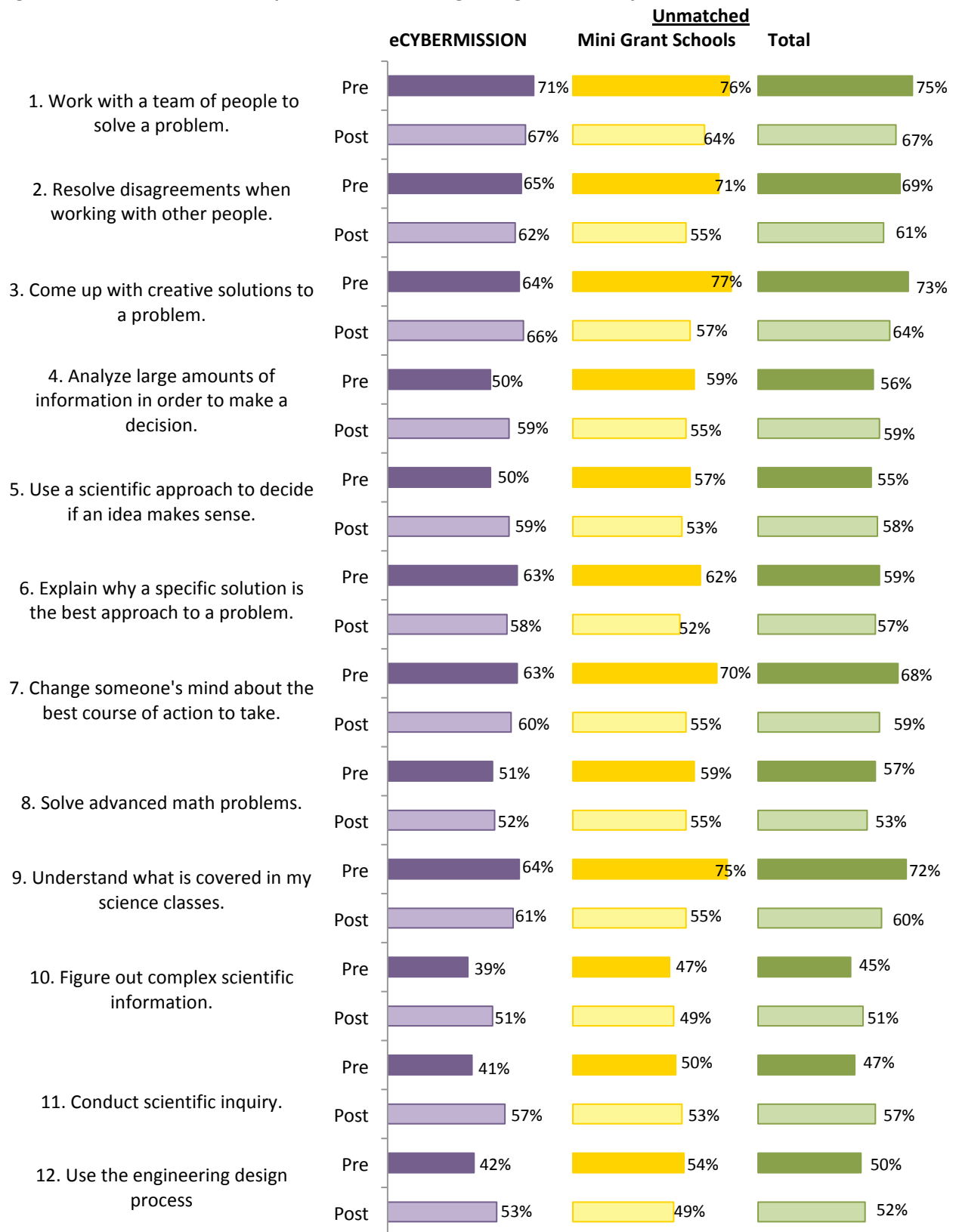
	Pre	Post
I like learning how to use a new technology.	78%	81%
It is important for everyone to have a basic understanding of new technologies.	88%	84%

ANOVA analyses based on the samples' reported demographics resulted in several statistically significant differences. When analyzed by grade, the pre-survey's 9th grade students' reported agreement with the first statement was significantly greater than grades 7 and 8. A similar analysis of the post-survey data based on comparisons of the various schools' setting, indicated that frontier schools were also statistically less likely to agree with the first statement than each of the other school settings, and they also disagreed more with the second statement in comparison to students from schools located in rural or settings.

Comparisons of the matched survey responses additionally yielded statistically significant differences. While overall, the students' pre- to post-survey agreement with the first statement fell, students who reported that English was not the primary language spoken in their homes demonstrated significantly higher rates of agreement than students who primarily spoke English at home.

Finally, the students rated their confidence regarding their ability to do twelve items related to 21st Century Skill-sets, which included items related to teamwork and project collaboration; the

collection, development, and utilization of data; and scientific practices and the engineering design process (see Figure 7). The ***students' overall pre to post responses demonstrated statistically significant gains in confidence in response to every statement except statement 7.*** A comparison of the regular eCYBERMISSION and mini grant school students' responses indicated that all but four statements (1, 10, 11, and 12) prompted statistically significant differences between the two samples. The regular eCYBERMISSION students' generally reported greater confidence in response to statements 2, 4 through 6, 8, and 9, while the mini grant students reported greater confidence in response to statements 3 and 7.

Figure 7. The Unmatched Samples' Confidence Regarding 21st Century Skills


DHA conducted additional analyses of the unmatched student samples' assessed confidence by demographic variables, which indicated that only the analyses based on primary language spoken at home and grade yielded any statistically significant differences. In response to the pre-survey, students who reported that English was not the primary language spoken in their homes had significantly higher rates of confidence in their ability to do items 4 and 8, however, students who similarly reported that language was not the primary language spoken in their homes to the post-survey were significantly less confident in their ability to do item 7. An analysis by grade additionally indicated that the 7th and 8th grade post-survey students had statistically significant differences in confidence when assessing item 2 and that the 7th grade students reported higher levels of confidence.

The students who completed both the pre- and the post-survey reported higher levels of confidence than the unmatched sample sets as demonstrated by Table 9. Moreover, these students' responses demonstrated statistically significant gains from pre- to post-survey completion. Specifically, these students reported higher rates of confidence when assessing items 1 through 6 and 10 through 12 after program completion.

Table 9. Matched Survey Students' Confidence Regarding 21st Century Skill (Very Confident & Confident)

	Pre	Post
Work with a team of people to solve a problem.	77%	86%
Resolve disagreements when working with other people.	77%	84%
Come up with creative solutions to a problem.	79%	85%
Analyze large amounts of information in order to make a decision.	65%	76%
Use a scientific approach to decide if an idea makes sense.	62%	75%
Explain why a specific solution is the best approach to a problem.	65%	77%
Change someone's mind about the best course of action to take.	79%	82%
Solve advanced math problems.	64%	71%
Understand what is covered in my science classes.	79%	76%
Figure out complex scientific information.	53%	69%
Conduct scientific inquiry.	58%	75%
Use the engineering design process.	52%	65%

While the students' survey responses indicated significant gains regarding their 21st Century Skills, DHA additionally asked the Team Advisors to share how well they believed the eCYBERMISSION experiences prompted six desired student impacts (see Table 10) related to 21st Century Skills. ***Approximately three-fourths of the Team Advisors reported that five of presented phrases described eCYBERMISSION very well, but only half of the advisors indicated that eCYBERMISSION encourages community connections.***

Table 10. How well provided phrases describe the eCYBERMISSION experience

	<u>Describes very well</u>
Builds teamwork	72%
Fosters innovation	67%
Encourages community connections	55%
Promotes identifying and solving real-world problems	77%
Relevant to youth	71%
Strengthens participants' science, technology, engineering, and mathematics (STEM) knowledge and skills	72%

STEM FIELDS: AWARENESS & INTEREST

Another desired outcome of eCYBERMISSION is increased student interest and awareness of various facets of STEM fields and STEM careers. DHA's data collection activities targeted feedback on two outcomes previously identified by 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 this occurrence of these outcomes through various student and Team Advisor survey questions and participant focus group discussions. Students assessed this impact by rating their agreement with four statements (See Figure 8). While the matched students reported higher rates of agreement than the unmatched samples, both sample sets demonstrated statistically significant increases pre- to post- gains in reported agreement with the exception of the unmatched sample's assessment of statement 3, which demonstrated no statistically significant change.

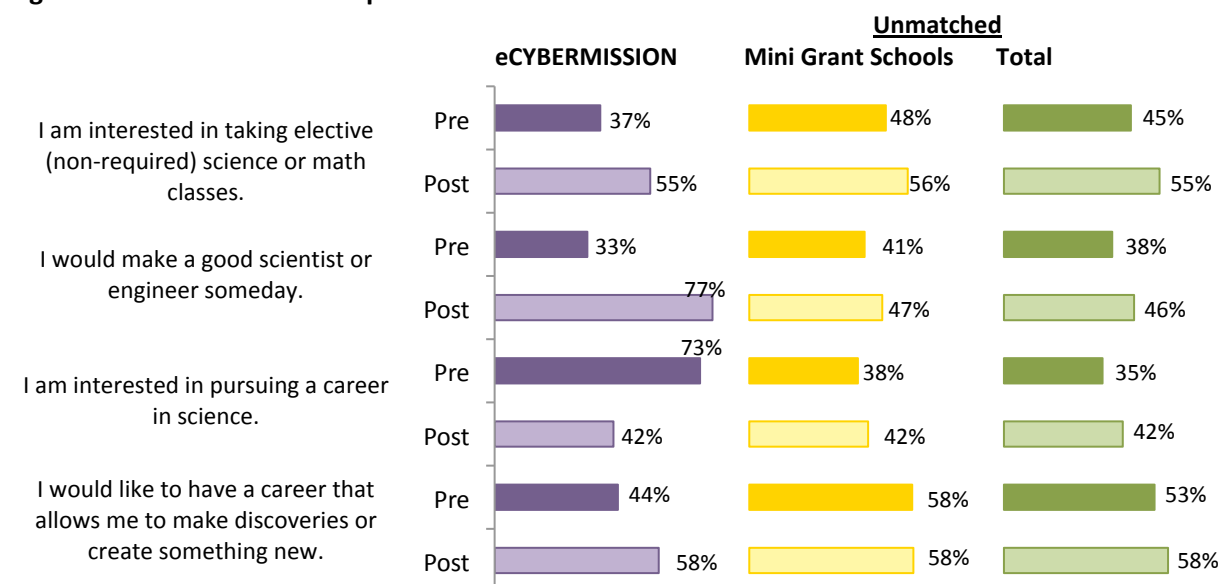
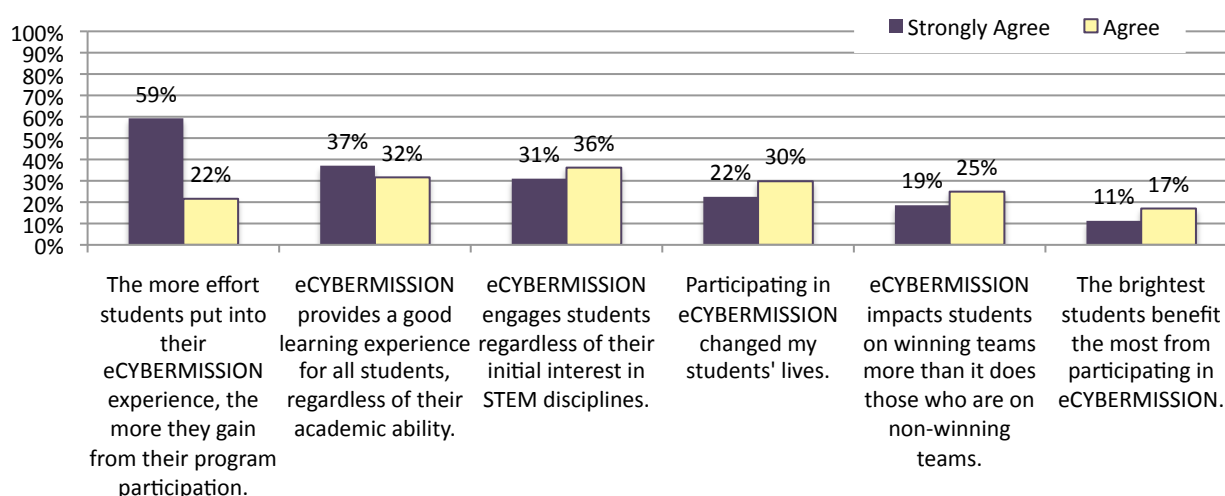
Figure 8. The Unmatched Samples' STEM Field & Career Interests and Attitudes

Table 11. The Matched Samples' STEM Field & Career Interests and Attitudes

	Pre	Post
I am interested in taking elective (non-required) science or math classes.	55%	61%
I would make a good scientist or engineer someday.	54%	59%
I am interested in pursuing a career in science.	52%	58%
I would like to have a career that allows me to make discoveries or create something new.	67%	67%

When the samples' responses were further analyzed by demographic variables, only the unmatched sample set demonstrated statistically significant differences, primarily within the pre-survey. An independent t-test analysis based on the primary language spoken within the students' homes indicated that unmatched pre-survey students who spoke a language other than English at home demonstrated statistically higher rates of agreement with the first and last statements than students who primarily spoke English at home. An analysis by school setting indicated that students from frontier-based schools reported significant weaker agreement than the urban, suburban, and rural schools, while suburban school students reported higher rates of agreement than the urban schools to the first statement. The ninth grade students additionally reported higher rates of agreement than the 7th and 8th grade students when responding to the final statement. The unmatched post-survey students', however, demonstrated only one statistically significant difference when analyzed by demographic variables, which indicated that the frontier schools again reported weaker agreement than the rural and suburban schools.

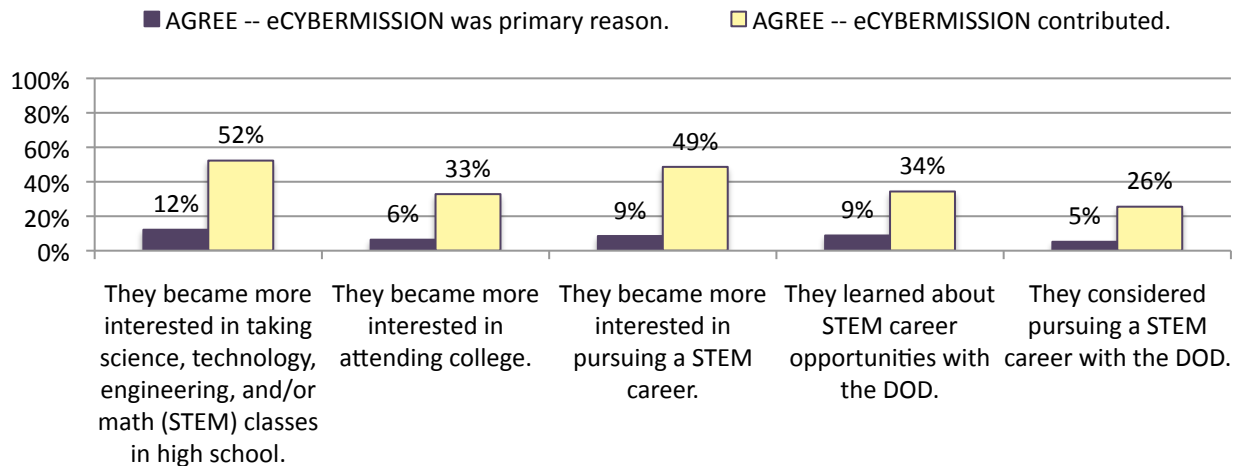
The Team Advisors assessed aspects and potential impacts eCYBERMISSION participation had on their students. The first four statements were designed to illicit high rates of agreement, while the final two statements were intended to prompt disagreement. As demonstrated by Figure 8, between half and three-fourths of the Team Advisors agreed as desired with the first four statements, while between a quarter and a third agreed with the final two statements.

Figure 9. Team Advisors' Assessment of Student Impact

One- to two-thirds of the Team Advisors additionally agreed with a statement regarding the growth of students during their year of participation. While a quarter to a half of the Team Advisors reported that eCYBERMISSION contributed to the students' growth, between five and fifteen percent agreed that it was the primary reason. When DHA compared the Team Advisors'

response through ANOVA analyses, only two statements prompted statistically significant differences. The first was based on their previous level of competition experience, and more Team Advisors who had either only participated or been state winner reported agreed that eCYBERMISSION participation increased their students' interest in attending college.

Figure 10. Team Advisors' Assessment of Impact



Finally, the students were asked to assess their perceptions of military research by rating their agreement with five statements regarding the impact of STEM related military research on a five-point Likert-scale consisting of *strongly agree*, *agree*, *neutral*, *disagree*, and *strongly disagree*. Figure 4 demonstrates the percentage of the unmatched student samples that selected either *strongly agree* or *agree* in response (see Figure 11). The analysis of the unmatched student samples' pre- to post-survey responses indicate that all but the first statement, which demonstrated a statistically significant increase in agreement, resulted in a statistically significant decrease.

Figure 11. The Unmatched Student Samples' Perceptions of Military Research and Researchers

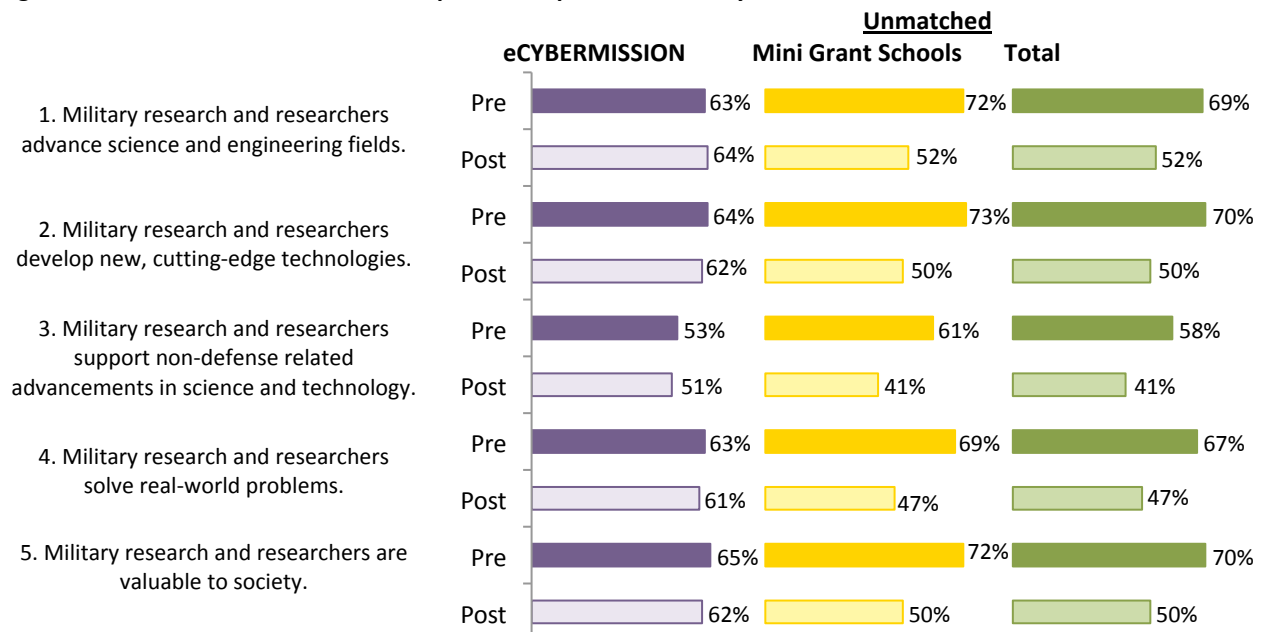


Table 12 presents the matched survey students' reported pre- and post-survey agreement with the five statements. Overall, these students reported significantly higher rates of agreement than the matched sample students, yet their feedback still demonstrated post-survey decreases. However, only two of these declines, their agreement with the fourth and fifth statements, represented a statistically significant decrease.

Table 12. The Matched Student Samples' Perceptions of Military Research and Researchers

	Pre	Post
Military research and researchers advance science and engineering fields.	79%	77%
Military research and researchers develop new, cutting-edge technologies.	84%	71%
Military research and researchers support non-defense related advancements in science and technology.	69%	67%
Military research and researchers solve real-world problems.	81%	74%
Military research and researchers are valuable to society.	81%	75%

The Team Advisor survey likewise asked the advisors to rate their agreement with the same set of five statements. Interestingly, the Team Advisors assessment of the statements was within two percentage points of the matched survey students' post-survey responses, which suggests that although a substantial portion of the students and Team Advisors are participating in the program, more could be done to increase the students' awareness and appreciation of military research and researchers.

Table 13. Team Advisors' Perceptions of Military Research and Researchers

	Strongly Agree/Agree
Military research and researchers advance science and engineering fields.	76%
Military research and researchers develop new, cutting-edge technologies.	73%
Military research and researchers support non-defense related advancements in science and technology.	67%
Military research and researchers solve real-world problems.	74%
Military research and researchers are valuable to society.	76%

National Judging & Education Event

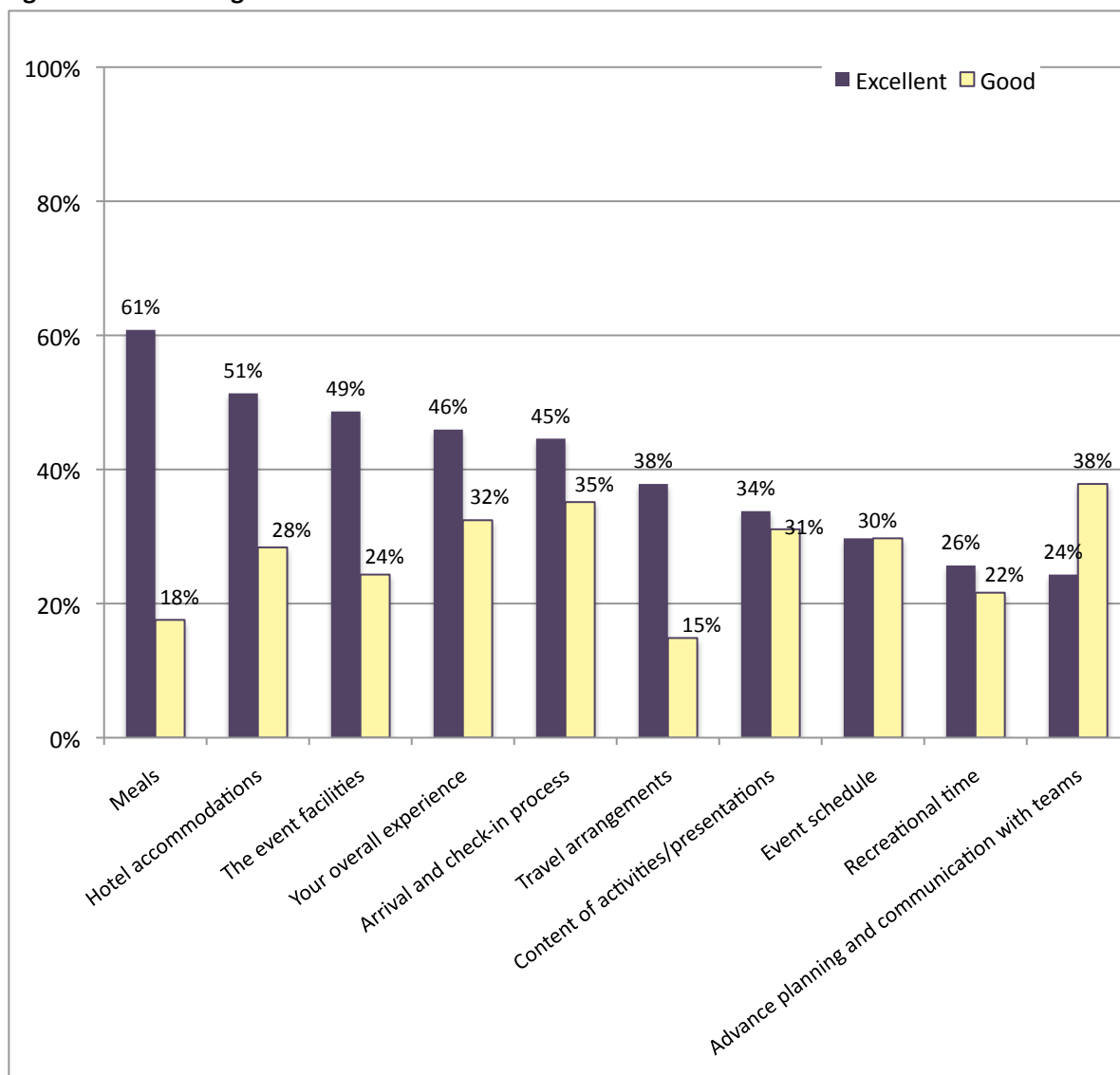
The final focus of the 2013-2014 evaluation efforts was the National Judge & Education Event (NJ&EE) held in Washington, DC, in mid-June 2014. Two-thirds (62%) of the competitors reported that they had no prior eCYBERMISSION participation experience, while a quarter had competed in the program only once before. The majority of the NJ&EE competitors also reported no prior NJ&EE experience, while nearly a fourth of the competitors had previously participated in NJ&EE once (15%) or twice (5%).

The NJ&EE survey also asked the students to describe their earlier eCYBERMISSION project experience. Over three-fourths (79%) of the students reported that they began working on their *Mission Challenges* during the six-month period between July and the end of December 2013.

Nearly half of the competitors also reported beginning their *Mission Challenges* in either October or November of 2013. Nearly three-fourths of the competitors (70%) further reported that it took three to six months to complete their *Mission Folders*. A tenth or less of the students also reported completing their projects in two-weeks (7%) or less than a month (10%), while several groups reported that project work was still on-going.

The NJ&EE competitors also rated the general logistics of the 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 12. Approximately three-fourths of the competitors rated half of the logistic aspects positively, while the remaining items were similarly rated by half of the competitors.

Figure 12. NJ&EE Logistics

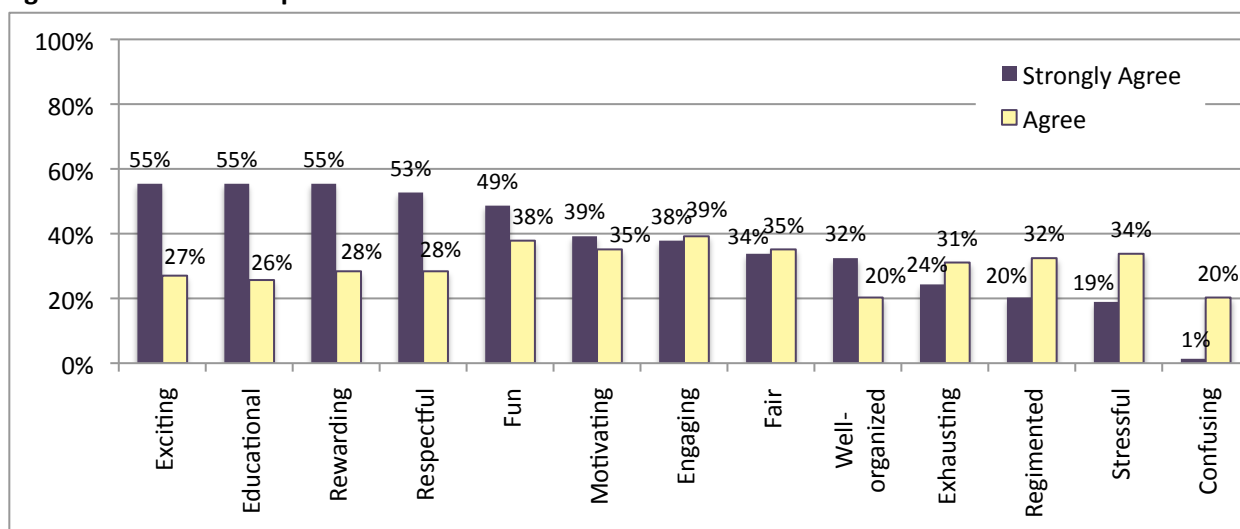


Next, the competitors assessed specific events scheduled throughout NJ&EE, which is presented in Table 14. Between half and three-fourths of the competitors rated the scheduled events positively, except for one event: the *Tour of the American History Museum*. During focus group discussions, both the students and the Team Advisors provided insight into why this and the other tours of Smithsonian museums and the Capitol Hill visits were rated less positively than the other scheduled events. They shared their disappointment with the minimal amount of time set aside for these cultural experiences. The students and Team Advisors additionally commented that the day's schedule could have been more organized.

Table 14. NJ&EE Schedule

	Excellent	Good	Total
Orientation meeting	24%	41%	65%
Army Values presentation	32%	28%	61%
Welcome Dinner	51%	24%	76%
Team Building--Instant Challenge (Helmet Design)	50%	23%	73%
"Let's Move" Army exercise sessions	28%	32%	61%
STEM Challenge Keynote Speech	23%	35%	58%
NSRDEC Combat Feeding	42%	24%	66%
AEOP Alumni Panel	32%	28%	61%
STEM Challenge	47%	15%	62%
"Get Up and Speak" workshop	36%	30%	66%
STEM Challenge presentations	24%	30%	54%
Tour of Washington, D.C. memorials	43%	19%	62%
Tour of Natural History Museum	39%	16%	55%
Tour of Air and Space Museum	39%	20%	59%
Tour of American History Museum	24%	12%	36%
Capitol Hill visits	47%	8%	55%
Overall National Judging Day experience	42%	36%	78%
Staff assistance to your team during National Judging	46%	32%	78%
Candid interviews on judging day	45%	23%	68%
National Showcase	50%	24%	74%
Suzanne Milchling Speech	27%	35%	62%
VIP Meet and Greet	45%	31%	76%
National Awards Luncheon	57%	18%	74%

Despite these few scheduling challenges the NJ&EE competitors further indicated the success of the event by their assessment of which adjectives described the event, and Figure 13 demonstrates the percentage of students who selected either *strongly agree* or *agree*.

Figure 13. Event Description

RECOMMENDATIONS

1. Increase awareness and interest in AEOPs by targeting Team Advisors.

Students identified Team Advisors, who had only a nominal awareness, as an important source of information regarding STEM and other AEOP opportunities. eCYBERMISSION personnel should, therefore, focus their efforts to disseminate and advertise other AEOPs to the Team Advisors. Program correspondence should announce or invite Team Advisors to promote AEOPs or share information regarding how lessons learned through eCYBERMISSION could be expounded upon or scaffold with other AEOP opportunities.

The eCYBERMISSION website should additionally have a page dedicated to “Additional STEM Opportunities” that is prominently displayed in the website’s tab menu. The page would help students and adults, who are either interested or actively participating in eCYBERMISSION, to discover the variety of AEOPs for which they are currently eligible or pursue as junior or senior high school students.

2. Provide students and Team Advisors a brief introductory video that highlights the location and purpose of online eCYBERMISSION resources.

Both student and focus group participants reported only limited awareness of the variety of resources provided by the eCYBERMISSION website, which the eCYBERMISSION project team should address by developing a brief (3 to 5 minute) eCYBERMISSION introductory video. This video, which could be sent to students and Team Advisors immediately after the teams’ completion of the registration process, would welcome students to the program and then demonstrate the variety of tools and resources housed on the eCYBERMISSION website. By showcasing where tools are located, identifying their function, and explaining how they can support participants’ work, the eCYBERMISSION team would provide all students and Team Advisors more awareness and a uniform understanding of the various eCYBERMISSION resources at their disposal.

3. Enhance program communications by posting blog updates more regularly and further prioritizing Mission Control and Cyberguides' timely feedback to teams.

A common theme identified within the Team Advisors' feedback was program communication. As a means of further supporting the Team Advisors and students throughout the competition, the eCYBERMISSION team should commit more time to regularly updating the blogs with relevant information, tips, additional tutorials regarding the website, information about other AEOPs, and other eCYBERMISSION related content. By posting blogs more frequently, eCYBERMISSION will engage the Team Advisors and students, provide useful direction and information, and increase project success and program satisfaction.

eCYBERMISSION should also improve communications between program personnel and students by further emphasizing Mission Control and Cyberguides timely response to teams' inquiries. Discrepancies in the Team Advisors' assessment of program communications regarding response times indicates that the eCYBERMISSION team should better manage expectations by specifying an appropriate window of response times on the website. Mission Control and Cyberguide training materials should then clearly stipulate the acceptable response timeframe to ensure the teams' expectations are met.

4. Address Team Advisors' frustration with eCYBERMISSION judging by providing more feedback regarding the rationale of Mission Folders' final scores and encouraging their review as a team activity.

While Team Advisors valued the judging rubrics, numerous Team Advisors commented on the processes' lack of clarity and limited feedback, which often caused frustration. eCYBERMISSION should improve the judging process and further encourage students' academic development, confidence, and understanding of the iterative nature of scientific practices and the engineering design process by providing clearer explanations of final Mission Folder scores and the strengths and weakness of each project. Once each Mission Folder is judged, teams should be provided and encouraged to access, review, and discuss electronic copies of the judging rubrics completed by Cyberguides assigned to their Mission Folders. The eCYBERMISSION team should present this activity to Team Advisors as a final classroom assignment or group activity that exemplifies the iterative process of science and engineering by prompting students to reflect and brainstorm potential solutions to identified weaknesses and new project ideas based on what they learned.

eCYBERMISSION and Cyberguides should further support the participants' knowledge and sense of self-efficacy by summarizing in three to five sentences the strengths and weaknesses of the participants' Mission Folders. This would not only help direct students' final reflection, but ease students' and Team Advisors' disappointment regarding low scores, since the experience would be turned into a learning moment as they discuss in what ways their work was weak, where they made mistakes, and how they could have addressed these points. Moreover, the insights provided by completed rubrics with written feedback would provide the Team Advisors who consistently participate in eCYBERMISSION insight into what areas they should work on more thoroughly with their students in the future.

5. Introduce more examples of military research and researchers into program examples, communications, and website highlights.

eCYBERMISSION should utilize the breadth of military STEM research and researchers to generate cadres of regional STEM role models that demonstrate the diversity and social impact of military research. By showcasing the ethnic and regional diversity of military research personnel in project examples, inspirational videos housed on the eCYBERMISSION website, or program communications, the eCYBERMISSION team would increase students' awareness of individuals with similar ethnic, socio-economic, and regional backgrounds who have succeeded and contributed to society via participation in military research. The accessibility and familiarity of role models would in turn increase students' awareness and connection to STEM fields and their various opportunities.

6. Enhance the NJ&EE experience by further supporting students' preparation for NJ&EE through earlier and more frequent communications, in addition to ensuring the events' overall organization by adhering more closely to the NJ&EE schedule.

Communication and organization were both themes that frequently appeared within the focus group and NJ&EE survey data. This finding indicates that the eCYBERMISSION team needs to invest more time in finalizing the event's schedule and preparing students and Team Advisors for NJ&EE. Several participants noted that communication was primarily orchestrated through the Team Advisors, which was at times problematic, especially when the Team Advisor was unable to attend NJ&EE. Consequently, the eCYBERMISSION team should request participants' legal guardians submit their email contact information to Mission Control immediately after teams win their regional competitions. The eCYBERMISSION team should use this information to ensure legal guardians are copied on all communications regarding logistics and event expectations. The eCYBERMISSION team should also provide information to the Team Advisors and legal guardians earlier, which would not only ease parents', students', Team Advisors', and chaperones' concerns, but also help define the teams' expectations for the event and help guide their competition preparations.

One to two weeks before NJ&EE, or as soon the Participant Guide is completed, the participants and Team Advisors should receive electronic copies of the guide and its event schedule and facility maps. Earlier access to the guide would allow the Team Advisors to review and further prepare their teams for the competition and establish clear expectations for the activities and schedule of the event. Moreover, earlier dissemination of this information would decrease teams' and program personnel stress by increasing accountability among students, Team Advisors, and program personnel, since everyone would have a clear understanding of where they should be at all times.

7. Enhance the NJ&EE experience by increasing the team's understanding of the exact schedule and activities of the Washington DC excursion Day, in addition to providing interested teams the opportunity to spend more time exploring the capitol at their discretion, liability, and cost.

The schedule of the day spent in Washington DC should be presented in more detail to students and Team Advisors, and preferably before their attendance at the NJ&EE. With this information in hand, the Team Advisors would be able to prepare their teams for the day, determine if they would like to schedule additional time in the capitol, and manage their

group through the educational activities and monuments. By having access to information regarding the day's logistics, the Team Advisors could ensure their students prepare appropriately for the day.

Also provide students, with the permission of their legal guardians and Team Advisors, the opportunity to spend more time in Washington, DC after the scheduled program events. Like evening or day trips offered at professional conferences, the eCYBERMISSION team should present this as an opportunity that is merely facilitated by the program. The additional free time in the city would be first come first served and dependent upon the sufficient early registration of enough teams to warrant the scheduling of a later bus. All activities pursued during free time would be at the discretion, liability, and cost of the teams. However, this would enable the teams to maximize their trip to the nation's capitol and engage in self-directed cultural or educational enrichment activities.

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