Army Educational Outreach Program

Junior Science & Humanities Symposia Program

2015 Annual Program Evaluation Report

ARMY EDUCATIONAL OUTREACH PROGRAM

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Executive Summary

The Junior Science & Humanities Symposia Program (JSHS), administered by the Academy of Applied Science (AAS) on behalf of the Services, is an AEOP pre-collegiate science, technology, engineering, and mathematics (STEM) research competition for high school students. JSHS is co-sponsored by the Army, Navy and Air Force. JSHS encourages high school students to engage in original research in preparation for future STEM career pathways. In regional (R-JSHS) and national (N-JSHS) symposia, students present their research in a forum of peer researchers and practicing researchers from government (in particular the DoD), industry, and academia.

This report documents the evaluation of the FY15 JSHS program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The assessment strategy for JSHS included questionnaires for students and mentors; four focus groups with R-JSHS students and two with mentors, rapid interviews with 9 R-JSHS students, 14 mentors, and 4 JSHS alumnae; and an annual program report compiled by AAS.

Regional symposia were held in 46 university campus sites nationwide. The top five students in each region received an invitation to participate and compete at NJSHS, an all-expense-paid trip hosted by the Services. Of these five, the top two students were invited to present their research as part of the national competition; the third place student was invited to display a poster of his/her research in a competitive poster session; and the fourth and fifth place students were invited to attend as student delegates with the option to showcase their research in a non-competitive poster session.

2015 JSHS Fast Facts	
Description	STEM Competition - Nationwide (incl. DoDEA schools), research symposium that includes 46 regional events and one national event
Participant Population	9th-12th grade students
No. of Applicants	9,347 students and 1,003 teachers self-reported by each of the the 46 sites
No. of Students	5,829 Regional Participants (of whom 218 were selected to attend the National JSHS Symposium)
Placement Rate	62%
No. of Adults (Mentors, Regional Directors, Volunteers – incl. Teachers and S&Es)	3,203
No. of Army and DoD S&Es	300

No. of Army/DoD Research Laboratories	65
No. of K-12 Teachers	1,003
No. of K-12 Schools	1,020
No. of K-12 Schools – Title I	148
No. of College/University Personnel	1,240
No. of College/Universities	120
No. of Other Collaborating Organizations	134
Total Cost	$1,884,434
National Symposium Cost	$339,410
Regional Symposia Support Cost	$705,904
Scholarship/Award Cost	$387,270
Cost Per Student Participant	$323.28

Summary of Findings

The FY15 evaluation of JSHS collected data about participants, their perceptions of program processes, resources, and activities, and indicators of achievement related to AEOP's and JSHS's objectives and intended outcomes. A summary of findings is provided in the following table.

2015 JSHS Evaluation Findings	
Participant Profiles	
JSHS continued to serve students from historically underrepresented and underserved populations. However, there is room for growth in diversity of participants, as well as in program participation overall.	JSHS experienced a 30% decrease in applications to the program and a 21% decrease in participants overall in FY15. JSHS was successful in attracting participation of female students—a population that is historically underrepresented in engineering fields. Regional symposia registration data indicate that over half (56%) of JSHS participants in reporting symposia were female. JSHS had limited success in attracting students from historically underserved minority race/ethnicity and low-income groups. Regional symposia registration data indicate that 9% of students in reporting regions identified themselves as Black/African American and as Hispanic/Latino. Somewhat smaller proportions of student questionnaire respondents identified themselves as Black/African American or Hispanic or Latino (R-JSHS 5%; N-JSHS 3%). While 10% of R-JSHS questionnaire respondents identified themselves as Hispanic/Latino, only 3%

	of N-JSHS respondents identified with this group. The vast majority of N-JSHS student questionnaire respondents (92%) reported that they did not qualify for free or reduced-priced lunches – a commonly used indicator of low-income status. In contrast, 16% of R-JSHS respondents reported qualifying for free or reduced-price lunch. Students from 148 Title I schools participated in JSHS at the regional and national levels, although the program failed to meet its FY15 goal of 20% participation by Title I schools.
	Most regional student questionnaire respondents attended public schools (R-JSHS 77%; data unavailable for N-JSHS students). Although well over a third of respondents attended schools in urban or rural settings (R-JSHS 41%; N-JSHS 43%), which tend to have higher numbers or proportions of underrepresented and underserved groups, over half attended suburban schools (R-JSHS 59%; N-JSHS 58%).
	There was a 30% decrease in the number of applicants in FY15 as compared to FY14, and overall participation was 21% lower in FY15. The program failed to meet its FY15 goal of a 10% increase in the number of participating high schools and, in fact, there was an 8% decline in the number of schools participating in FY15.
	Students participated in regional symposia at 12 HBCU/MSIs nationwide.
JSHS engaged an extensive group of adult participants as mentors, STEM ambassadors, and volunteers, although there is little indication of racial/ethnic diversity among adult participants.	Approximately 1,000 in-service teachers, 35 pre-service teachers, 1,200 college/university personnel (a 33% decrease from the 1,800 college/university personnel who participated in FY14), 300 Army/DoD scientists/engineers, and 460 other adult volunteers served as research mentors or STEM ambassadors in JSHS. Of those who responded to the questionnaire, a large majority (73%) identified themselves as White, with the 3% identifying as Black/African American and 7% as Hispanic/Latino.
Actionable Program Evaluation	
JSHS marketing seems to target K-12 teachers/schools primarily and teacher recommendations appear to be particularly important for student recruitment.	JSHS employed multi-faceted marketing and recruitment strategies to participate in regional symposia. Efforts originating with AAS and regional JSHS directors included personal contact with teachers and high school administrators, printed and electronic promotional materials distributed by direct mail and email, university websites, and targeted marketing at other STEM-related regional initiatives (for example university chapters of the National Society of Black Engineers and the Society of Women Engineers).

	Teacher information appears to be crucial for recruiting students into JSHS. Nearly a third of students reported learning about the JSHS program from someone who works at the school they attend (R-JSHS 30%; N-JSHS 30%). Other significant sources were school or university newsletters (R-JSHS 26%; N-JSHS 20%). Personal connections such as past program participants were another fairly frequently cited source of information (R-JSHS 14%; N-JSHS 15%).
Many students are motivated to participate in JSHS by an interest in STEM and the desire to learn something new.	Both R-JSHS and N-JSHS students were most frequently motivated to participate in JSHS an interest in STEM (R-JSHS 26%; N-JSHS 41%). The next most frequently mentioned highly motivating factor was a desire to learn something new (R-JSHS 16%; N-JSHS 18%). Although students tended to learn about JSHS from their teachers or school staff, this was not reported as a highly motivating factor for participation (R-JSHS 10%; N-JSHS 9%).
JSHS students reported engaging in meaningful STEM learning through hands-on and collaborative activities, although N-JSHS and female students reported learning significantly more than other R-JSHS and male students.	The majority of R-JSHS and N-JSHS students reported in engaging in a variety of activities on most days or every day of their JSHS experience. For instance, 76% of R-JSHS students and 91% of N-JSHS students reported learning about new STEM topics, 75% of R-JSHS and 88% of N-JSHS reported communicating with other students about STEM topics, and 70% of R-JSHS and 85% of N-JSHS students reported interacting with scientists or engineers on most days or every day of their JSHS experience. The differences between N-JSHS and R-JSHS students in overall learning about STEM were statistically significant and female participants reported learning significantly more in JSHS than did males.
	Students reported engaging in a variety of STEM practices during their JSHS experience. For example, students reported participating in hands-on activities (R-JSHS 47%; N-JSHS 60%), identifying problems to investigate (R-JSHS 49%; N-JSHS 56%), and drawing conclusions from an investigation (R-JSHS 52%; 50% N-JSHS) on most days or every day of their JSHS experience.
	R-JSHS and N-JSHS students reported having greater opportunities to learn about STEM in JSHS than they typically have in school. However, responding students from both groups also reported slightly lower levels of engagement in STEM practices in their JSHS experience than they typically have in school.
	Mentors reported using a diversity of strategies to help make learning activities relevant to students, support the needs of diverse learners, develop collaboration and interpersonal skills, and engage students in “authentic” STEM activities.

JSHS informed students about STEM careers in general and, to a lesser extent, about DoD STEM careers specifically. The number of adults working in JSHS decreased in FY15.	Students reported learning about STEM careers in their JSHS experience, although R-JSHS students reported learning about fewer DoD STEM careers than about general STEM careers. While 58% of R-JSHS and 92% of N-JSHS students reported learning about 3 or more STEM jobs or careers, only 25% of R-JSHS had learned about 3 or more DoD STEM careers while 88% of N-JSHS students had learned about 3 or more DoD STEM careers. Only 2% of N-JSHS students reported learning about DoD STEM careers while 47% of R-JSHS students had not learned about any of these careers.
	The overall number of adults supporting the JSHS program delivery decreased by 17% in FY15. Although 84% of mentors reported providing guidance about educational pathways that will prepare students for STEM careers, less than half of mentors (46%) reported discussing STEM career opportunities with the DoD or other government agencies with their students. It should be noted, however that these responses represent an increase in these type of mentor activities from FY14 when only 30% reported discussing STEM careers within the DoD or other government agencies and 18% reported recommending other AEOPs to students.
Students and mentors valued the JSHS experience, although students were less satisfied with judging practices than with other JSHS features.	Large majorities of both R-JSHS students and N-JSHS students reported being very much satisfied with features of their research experience including their working relationship with mentors (80% R-JSHS; 89% N-JSHS) and the research experience overall (78% R-JSHS; 89% N-JSHS).
	Students responding to open-ended questionnaire items particularly valued opportunities to connect with like-minded peers afforded by JSHS and identified providing more of these opportunities as an area for improvement.
	The majority of responding mentors indicated being either somewhat or very much satisfied with those program features they experienced. Student oral presentations were a particular area of satisfaction for mentors, with 90% of responding mentors reporting being at least somewhat satisfied with this feature. Many mentors also commented on the benefits the program in open-ended questionnaire responses, emphasizing the opportunity for students to engage in real-world STEM learning and research and networking with STEM professionals and other students.

	In FY15, JSHS participants' dissatisfaction with the judging process and feedback from judges increased from FY14. Student participants were less satisfied with judging than with other features of JSHS. Over a quarter (30%) of both N-JSHS students expressed that they were not at all satisfied with judging processes at R-JSHS (increased from 3% respectively in FY14 for R-JSHS participants and 0% N-JSHS participants regarding their experience at R-JSHS). Additionally, 30% of R-JSHS and 25% of N-JSHS participants were not satisfied with feedback received from judges (compared to 11% and 21% respectively in FY14. Judge selection and judging practices were also a theme in students' open-ended responses on the questionnaire, where students identified this as an area in need of improvement. In contrast, only 5% of responding mentors indicated that they were not satisfied with the judging process as a feature of JSHS.
Outcomes Evaluation	
JSHS students reported positive program impacts on their STEM knowledge and competencies.	A majority of R-JSHS and N-JSHS students reported large or extreme gains on their in-depth knowledge of a STEM topic or field; knowledge of research, processes, ethics, and rules for conduct in STEM; knowledge of what everyday research work is like in STEM; knowledge of how scientists and engineers work on real problems in STEM; and knowledge of research conducted in a STEM topic or field. N-JSHS students tended to report greater impacts than did R-JSHS students in these areas.
	Many students also reported extreme impacts on their STEM competencies, or abilities to "do STEM." Over half of both R-JSHS and N-JSHS students reported extreme gains in their abilities to do things such as communicate about their experiments and explanations in different ways (63% R-JSHS; 80% N-JSHS), organize data in charts and graphs to find patterns and relationships (64% R-JSHS; 72% N-JSHS); use knowledge and creativity to suggest a testable explanation for an observation (66% R-JSHS; 65% N-JSHS), and ask a question that can be answered with one or more scientific experiments (59% R-JSHS; 63% N-JSHS).
JSHS participants reported gains in students' 21st Century Skills.	Most responding students reported large or extreme gains in nearly all 21st Century Skills. These skills included communicating effectively with others (73% R-JSHS; 79% N-JSHS), viewing failure as an opportunity to learn (73% R-JSHS; 69% N-JSHS), and setting goals and reflecting on performance (69% R-JSHS; 78% N-JSHS). Overall, N-JSHS students and females reported significantly greater impacts on their 21st Century Skills than did R-JSHS students and males.

JSHS participants reported gains in their confidence and identity in STEM, and in their interest in engaging in STEM in the future.	A majority of both R-JSHS and N-JSHS students reported large or extreme gains in factors associated with confidence and STEM identity. Students reported these gains in areas such as feeling more prepared for more challenging STEM activities (68% R-JSHS; 80% N-JSHS), desire to build relationships with STEM mentors (71% R-JSHS; 72% N-JSHS), and confidence to try out new ideas or procedures on their own (70% R-JSHS; 73% N-JSHS), Overall, N-JSHS and female students reported significantly larger gains than R-JSHS and male students in STEM identity and confidence.
	Students also reported being more likely to engage in additional STEM activities both in and outside of school. A majority of students indicated that as a result of JSHS, they were more likely to engage in activities such as working on a STEM project or experiment in a university of professional setting (80% R-JSHS; 75% N-JSHS); taking an elective STEM class (66% R-JSHS; 61% N-JSHS), and mentor or teach other students about STEM (70% R-JSHS; 71% N-JSHS). Overall, N-JSHS and female students reported significantly larger gains than R-JSHS and male students in these areas. Another impressive finding was that 26% of N-JSHS students indicated plans to write or co-write a paper that will be published in a research journal. This indicates the impact of their JSHS experience goes well beyond the actual engagement with the program itself.
JSHS students reported higher education aspirations after participating in JSHS, although their career aspirations showed little change.	After participating in JSHS, students indicated being more likely to go further in their schooling than they would have before JSHS. For R-JSHS students, the proportion of students wanting to complete college increased from 92% to 99% from before JSHS to after JSHS participation. The proportion of N-JSHS students aspiring to a combined M.D./Ph.D. increased from 18% before JSHS to 33% after.
	Students were asked to indicate what kind of work they expected to be doing at age 30, both before and after JSHS participation. A vast majority of students aspired to STEM careers both before and after JSHS participation, although there was a decrease in the number of students who were undecided about their career aspirations (13% to 7% R-JSHS; 8% to 5% N-JSHS).
Although JSHS students were largely unaware of other AEOP initiatives, students showed some interest in future AEOP opportunities.	Most students and mentors were unaware of other AEOP initiatives, however 52% of R-JSHS students and 79% of N-JSHS students indicated that participating in JSHS contributed to their awareness of other AEOPs, and most (50% R-JSHS; 67% N-JSHS credited JSHS with increasing their interest in participating in other AEOPs in the future.

	Most mentors had not participated in and were not aware of AEOP initiatives other than JSHS. Only 36% of mentors reported recommending other AEOPs to students that align with student goals.
	Besides participation in JSHS, students credit invited speaker and career events (41% R-JSHS; 76% N-JSHS) and their JSHS mentors (26% R-JSHS; 13% N-JSHS) with impacting their awareness of other AEOPs at least somewhat. Over a third (36%) of N-JSHS students also credited the AEOP brochure with impacting their awareness of other programs at least somewhat, however only 14% of R-JSHS students reported that the brochure impacted their awareness and 74% of R-JSHS students reported never hearing about the AEOP brochure.
JSHS participants reported positive opinions of DoD research and DoD researchers and reported increased interest in pursuing a STEM career with the DoD.	The participation of Army/DoD laboratories grew to 65 in FY15, a 7% increase from FY14. Nearly all N-JSHS students and about three-quarters of R-JSHS students expressed agreement that DoD research is valuable to society, that DoD researchers solve real-world problems, that DoD researchers develop new, cutting edge technologies, and the DoD researchers advance science and engineering fields. In addition, nearly half of R-JSHS students (49%) and 70% of N-JSHS students indicated that participating in JSHS increased their interest in pursuing a STEM career with the DoD.

Recommendations

Evaluation findings indicate that FY15 was a successful year overall for the JSHS program. Notable successes for the year include the continued high participation rate for females, continued participation by other groups traditionally under-represented in STEM fields, and high levels of mentor and student satisfaction with the programs. Both students and mentors reported participant gains in STEM knowledge and competencies and gains in students' 21st Century Skills as a result of the JSHS experience, and students emerged from the program with more interest in pursuing Army and DoD STEM careers.

While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY16 and beyond:

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

1. Although the applicant placement rate increased from 55% to 62% from FY14 to FY15, it is concerning that there was a 30% decrease in the number of applicants in FY15 as compared to FY14, and overall participation was 21% lower. It is recommended that JSHS track the number of applicants and placement rates at each regional site to insure more consistent placement rates across the portfolio (i.e. Illinois – Chicago had only 20% placement rate

compared to 100% at other sites such as South Carolina). One strategy would be for AAS to work with regional sites to support increasing their capacity to accept more participants in the low placement rate regions.

2. The program failed to meet its goal of a 10% increase in the number of participating high schools and, in fact, there was an 8% decline in the number of schools participating in FY15. Of the 46 regional events held, 18 regions showed a 27% increase over the previous year in the total number of participating high schools. Another 14 regions showed a 37% decrease since FY14. While there are a variety of intervening factors associated with these phenomena, including weather impacts, competing activities, and impacts of school budget cuts on students' ability to travel, program administrators should be mindful of these decreases in participation and particularly the effect they may have on engaging students from underserved and underrepresented populations.

3. AAS may want to support states to reach out and cast broader nets for recruiting participants – beyond the local area of the competition or host. The program may wish to investigate student recruitment practices from the regions that demonstrated growth in FY15 and identify scalable recruitment and marketing strategies that could be applied across regions. Likewise, the program may wish to investigate strategies from regions with decreasing participation with the aim of identifying longitudinal changes in regional practices that may have affected student participation rates. Some recommended strategies to grow the diversity of student participants to increase the number of underrepresented students include conducting outreach to schools with high populations of underrepresented students to make them aware of JSHS and reaching out to academically prepared and competitively eligible underrepresented students to encourage actual participation in JSHS.

4. AEOP objectives include expanding participation of populations historically underrepresented in STEM careers. Since no program-wide demographic data was available from FY14, however, it is not possible to determine whether there was any change in participation of these groups from FY14 to FY15. Collecting demographic information on students participating in the R-JSHS through Cvent will enable a more accurate representation of the JSHS participation pool and concerted efforts should be made by program administrators to ensure that demographic data for all JSHS participants is compiled annually. JSHS failed to meet its FY15 goal for attracting Title I schools (associated with low-income status students) to the program. Of the 1,020 schools participating 15% were Title I schools, falling short of its FY15 goal of 20%. The program should continue to collect information and strategies from specific regional symposia as well as other AEOPs that successfully attract underrepresented and underserved students. This information should be disseminated to the larger JSHS community of regional directors. Additionally, the program may with to consider ways to build on previous efforts to strengthen its outreach to schools that serve large proportions of underrepresented groups of students (e.g., urban schools, Title I schools). JSHS might also consider the possibility of engaging with target districts through the AEOP's strategic outreach initiative opportunities, which provide limited financial support to assist in the ability of a target community to engage with the AEOPs.

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

1. The frequency with which students expressed dissatisfaction with judging practices and judging feedback during their JSHS experience (including the increased dissatisfaction from FY14 to FY15) suggests that there may be a need to direct additional resources to judge recruitment and training. While participation of DoD STEM personnel was constant from FY14 to FY15, there was a 33% decrease in the participation of college/university personnel from FY14 to FY15. The program may wish to further investigate practices of regions that were successful in attracting larger numbers of and greater diversity of judges with the aim of identifying practices that may be scaled across regions. Additionally, the program may wish to consider whether current judging practices established by the program are adequate to ensure standardization of judging practices nationwide and consider additional methods to standardize judging and reduce students' perception of judging bias. The program may wish to consider, for instance, creating judging rubrics, providing enhanced judging training or orientation, and providing methods for judges to easily provide both oral and written feedback to students. Currently, the feedback at regional level JSHS competitions is varied and is mostly verbal in format.

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

1. In order to create a robust pipeline of AEOP programs in which students' progress from other AEOPs into JSHS and beyond, the program may want to consider innovative ways to work with other AEOPs to create a more seamless continuum of programs. One finding that is cause for concern is that although many participants expressed interest in other AEOP programs, most students had never heard of AEOP programs outside of JSHS. Large numbers of students at R-JSHS events reported not having seen the AEOP brochure. This is especially concerning since the FY15 APR indicates that AEOP resources were distributed to all regional symposia. Coupled with this is student reliance on teachers or mentors for information about AEOPs and mentor reports of having little familiarity with AEOPs other than JSHS. The program may wish to consider devising methods to disseminate AEOP information directly to teachers and mentors before the regional events as well as communicating expectations to regional symposia concerning the distribution of AEOP materials at events to ensure that all mentors, teachers, and students have access to structured opportunities that both describe the other AEOPs and provide information to students on how they can apply to them.

2. Evaluation data indicate that nearly half (47%) of R-JSHS students did not hear about any Army or DoD STEM career opportunities during their JSHS experience. Since R-JSHS mentors were reported to be a useful source of information about DoD STEM careers it would be useful for the program to devise ways to familiarize mentors with resources available to expose students to DoD STEM careers. A large majority of N-JSHS (80%) students indicated that invited speakers or career events were a key resource for learning about DoD STEM careers, however over a third (35%) of R-JSHS students reported not having experienced these resources. Because of the potential marked impact of this resource on student awareness of DoD STEM careers, the program may wish to consider innovative ways to connect

regional students with DoD STEM professionals, including creating web-based video profiles of DoD STEM professionals, creating virtual lab tours hosted by DoD STEM professionals, and devising strategies to facilitate regional symposia's efforts to engage DoD STEM professionals as speakers at events.

3. The R-JSHS experience comprises the entirety of the JSHS experience for most students, however consistent differences between R-JSHS and N-JSHS student responses suggest that N-JSHS may have a greater impact on students than R-JSHS. While some of these differences are likely due to initial differences in interest and/or ability between students who are selected to go on to N-JSHS and those who are not, other differences may be related to differences in the availability/quality of mentor support or the availability/quality of activities at each symposium. The program should consider what guidance and support can be provided to regional directors, mentors, and other supporters of R-JSHS to facilitate the identification of mentors (particularly in rural areas and other areas with logistical barriers to accessing university and other professional STEM resources), active engagement in STEM activities, useful feedback from judges, and feelings of success that support a positive STEM identity among students who are not selected for N-JSHS.

4. Participation in the AEOP evaluation continues to be an area of concern. While student and mentor participation rates rose slightly from FY14 to FY15, the continued relatively low rates of participation threaten the generalizability of results. Improved communication with individual program sites about expectations for the evaluation may help. A recommendation was made in the FY14 evaluation report as follows: "Given the large number of participants in the Regional competitions, it may be worth randomly sampling students to respond to the questionnaire, and rechanneling efforts into getting a high response rate from the sample." Although there is no indication that this recommendation was acted upon in FY15, it may be a strategy to consider going forward. It is recommended that JSHS consider requiring regional sites to provide time for participants to complete the AEOP evaluation questionnaire during regional symposia.

Introduction

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

AEOP Goals

Goal 1: STEM Literate Citizenry.

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

Goal 2: STEM Savvy Educators.

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

Goal 3: Sustainable Infrastructure.

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

This report documents the evaluation of one of the AEOP elements, the Junior Science & Humanities Symposia Program (JSHS). JSHS is administered on behalf of the Army by the Academy of Applied Science (AAS) and is co-sponsored by the Navy and Air Force. The evaluation study was performed by Purdue University in cooperation with Battelle, the Lead Organization (LO) in the AEOP CA consortium. Data analyses and reports were prepared using data collected by the former LO, Virginia Tech (VT).

Program Overview

JSHS is an AEOP pre-collegiate STEM competition. JSHS encourages high school students to engage in original research in preparation for future STEM career pathways. The categories of competition are:

1. Chemistry (including geochemistry, energy-alternative fuels, materials science);
2. Engineering;
3. Environmental sciences;
4. Life sciences (including natural sciences, microbiology, molecular/cellular, biochemistry);
5. Mathematics and computer sciences;
6. Medicine & health (including behavioral sciences, neurobiology, biomedical, physiology); and
7. Physics and astronomy.

In regional (R-JSHS) and national (N-JSHS) symposia, students present their research in a forum of peer researchers and practicing researchers from government (in particular the DoD), industry, and academia. In addition, they receive public recognition and awards for their research achievements while competing for scholarship funds.

Regional symposia were held at 46 university campus sites nationwide in 2015. The top five students in each region received an expense-paid trip to the N-JSHS. Of these five, the top two students were invited to present their research as part of the national competition; the third place student was invited to display a poster of his/her research in a competitive poster session; and the fourth and fifth place students were invited to attend as student delegates with the option to showcase their research in a non-competitive poster session. The AAS has established guidelines and "ground rules" for the student research paper competition and provides these guidelines to JSHS regional symposia and other cooperating organizations. These resources allows for a general consistency in student experience and outcome, while still allowing sites the flexibility to design the details of their program to meet the unique needs of their students. All JSHS programs are designed to meet the following objectives:

1. Promote research and experimentation in STEM at the high school level;
2. Recognize the significance of research in human affairs and the importance of humane and ethical principles in the application of research results;
3. Search out talented youth and their teachers, recognize their accomplishments at symposia, and encourage their continued interest and participation in the sciences, mathematics, and engineering;
4. Recognize innovative and independent research projects of youth in regional and national symposia;
5. Expose students to academic and career opportunities in STEM and to the skills required for successful pursuit of STEM;
6. Expose students to STEM careers in the Army and/or DoD laboratories; and
7. Increase the future pool of talent capable of contributing to the national's scientific and technological workforce.

The 46 R-JSHS sites received applications from 9,347 students (self-reported by each of the 46 sites), most sites did not use the CVENT system to process applications/registrations) and were able to accommodate 62% of these (5,829). This represents a 30% decrease in student applicants and a 21% decrease in participants from FY14 when 13,373 students applied and 7,409 were selected. Table 1 summarizes interest and final selection by site.

Table 1. 2015 JSHS Site Applicant and Selection Numbers			
2015 JSHS Site	**No. of Student Applicants**	**No. of Selected Students**	**No. of Selected Teachers**
Alabama	220	124	24
Alaska	80	50	6
Arizona	200	160	20
Arkansas	120	100	30
California Southern	300	110	32
Connecticut	420	320	40
Europe	132	52	17
Florida	440	180	61
Georgia	150	128	15
Hawaii	240	90	14
Illinois	80	60	10
Illinois-Chicago	300	60	5
Indiana	60	50	4
Intermountain	100	80	17
Iowa	130	130	26
Kansas-Nebraska-Oklahoma	100	60	12
Kentucky	60	40	5
Louisiana	150	80	12
Maryland	120	114	30
Michigan Southeastern	90	60	12
Missouri	230	150	27
New England Northern	200	80	12
New England Southern	100	80	10
New Jersey Monmouth	540	424	47
New Jersey Northern	300	160	30
New York Long Island	460	200	62
New York Metro	300	300	30
New York Upstate	530	509	42
North Carolina	170	60	21
North Central	290	234	30
Ohio	280	100	24
Pacific	170	50	14
Pennsylvania	70	50	7

Puerto Rico	152	60	14
Philadelphia	240	80	14
South Carolina	300	300	32
Southwest	80	50	13
Tennessee	110	85	11
Texas	230	86	26
Virginia	520	100	23
Washington	190	135	20
Washington D.C.	230	135	18
West Virginia	40	15	4
Wisconsin	60	60	6
Wyoming-Eastern Colorado	63	60	14
Total	**9,347**	**5,829**	**1,003**
National Symposium		218	60

JSHS engaged approximately 3,206 teachers, faculty, graduate students, and support personnel in conducting the symposia including approximately 300 Army/DoD STEM scientists and engineers (S&Es). It is recommended that JSHS track the number of applicants and placement rates at each regional site to insure more consistent placement rates across the portfolio (i.e. Illinois – Chicago had only 20% placement rate compared to 100% at other sites such as South Carolina). One strategy would be for AAS to work with regional sites to support increasing their capacity to accept more participants in the low placement rate regions.

Table 2. 2015 JSHS Participation

Participant Group	No. of Participants
High school students (grades 9-12)	5,829
Graduate students (including post-baccalaureates)	168
In-service K-12 teachers	1,003
Pre-service K-12 teachers	35
College/university faculty or other personnel	1,240
Army/DoD Scientists & Engineers	300
Other Volunteers	460
Total	**9,035**

Demographic data was reported from approximately one third of the regional symposia. In the 19 regions that reported gender data, 56% of participants were female and 44% were male. Data on race/ethnicity was reported by 18 regions. Nearly half (48%) of students identified themselves as White with another 21% identifying themselves as Asian. While

13% of students chose not to report their race/ethnicity, 9% identified themselves as Black or African American and 9% as Hispanic or Latino. Native American students comprised 1% of the students reporting their race/ethnicity, while .4% were Native Hawaiian or Pacific Islanders.

The total cost of the 2015 JSHS program was $1,884,434, including $387,270 provided in scholarships and awards. Undergraduate tuition scholarships to winners at the R-JSHS and N-JSHS events are payable to the students' college of enrollment upon matriculation. The average cost per student participant for 2015 JSHS was $323.28.

Table 3. 2015 JSHS Program Costs	
2015 JSHS – Summative Cost Breakdown	
Total Cost	$1,884,434
Scholarship/Awards Cost	$387,270
Regional Symposia (46) Support Cost*	$705,904
National Symposium Cost	$339,410
Administrative Cost	$269,339
Cost Per Student Participant	$323.28

** Note that regional symposia often contribute significant additional funds to support their events. Funding may come from a combination of donors including: colleges/universities, STEM organizations, industry, etc. The average cost per student at R-JSHS varies significantly by site. Costs range from a low of $12.76/per person per day to a high of $313/per person per day (Europe and Puerto Rico) or stateside $195/per person per day stateside. The median cost at R-JSHS (excluding awards) is $50.32/pp per day.*

Evidence-Based Program Change

Based on recommendations from the FY14 summative evaluation report, the AEOP identified three key priorities for programs in FY15: (1) increase outreach to populations that are historically underserved and underrepresented in STEM; (2) increase participants' awareness of Army/DoD STEM careers; and (3) increase participants' awareness of other AEOP opportunities. AAS took the following actions in the FY15 administration of the JSHS program in light of programmatic recommendations from the Army and LO, the key AEOP priorities, site visits conducted by AAS and the LO, and the FY14 JSHS evaluation study:

I. **Increase outreach to populations that are historically underserved and underrepresented in STEM:**
   a. Collaborate with HBCU's/MSIs to identify students and to prepare for research competition.
   b. Expanded mentoriship opportunities for students developed through regional symposia efforts to identify external funding.
   c. Expanded partnerships with strategic statewide initiatives designed to increase the pool of STEM talent.
   d. Target outreach to urban or rural schools to identify students and prepare for research competition.
   e. Share best practices to reach and engage underrepresented students among Consortium and JSHS Regions.

f. Engage participation by REAP students and mentors in National JSHS (4 REAP students participated in JSHS).

II. Increase participants' awareness of other Army/DoD STEM careers:

a. Coordinated with tri-service leadership to identify the participation of DoD STEM personnel in regional and national symposia.
b. AAS conducted meetings between Regional Symposium and DoD laboratory personnel (i.e., Mississipi and Maryland).
c. Conducted "Reverse Science Fair" to expose National JSHS participatnes to DoD research and terminology.
d. Expanded use of social media, website, and branded materials to publixize AEOP opportunities/Army STEM careers.

III. Increase participants' awareness of other AEOP opportunities:

a. AEOP materials were distributed to all JSHS Regional Symposia for distribution to Regional participants.
b. Expanded use of social media, website, and branded materials to publicize AEOP opportunities/Army STEM careers.
c. AAS and LO presentations to JSHS Regional Directors at Annual Meeting of Regional Directors; AAS presentations to R-JSHS Advisory Committees; AAS presentations of branded materials to RD's in print and electronic form.
d. REAP students and mentors participated in 2015 N-JSHS.

IV. Other evidence based changes or activities:

a. Expanded outreach to military labs at Regional and National symposia to engage volunteer service.
b. Increased awareness of the volunteers' role in contriuting to the AEOP mission to expand the pipeline of future STEM talent. Provided feedback on success throug presentations and distribution of published reports.
c. Ongoing support of "Teacher Award," and AEOP branded participation certificates to recognize volunteer contributions.
d. Regional sympsia administer training to prepare volunteers, and provide recognition for service. As a result, longstanding service of faculty members was reported across regions.
e. Several regional symposia engage younger faculty and pre-service teachers in STEM outreach and JSHS**.**

FY15 Evaluation At-A-Glance

Virginia Tech, in collaboration with AAS, collected the FY15 evaluation data for the JSHS program. Purdue University, the new evaluation lead, prepared the 2015 evaluation reports. The JSHS logic model below presents a summary of the

expected outputs and outcomes for the JSHS program in relation to the AEOP and JSHS-specific priorities. This logic model provided guidance for the overall JSHS evaluation strategy.

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• Tri-service sponsorship • AAS providing oversight of regional and national programs • Operations conducted by university and DoD partners • Students participating in regional and national programs • STEM professionals and educators serving as research mentors, judges, personnel and volunteers of regional and national programs • Awards for student competitors, and recognition for STEM professionals and educators in support roles • Centralized branding and comprehensive marketing • Centralized evaluation	• Students conduct "authentic" STEM and humanities research, often mentored by STEM professionals and educators • Students present their research in poster or oral presentations at 46 regional symposium • STEM professionals judge presentations and select regional winners • Regional winners advance to N-JSHS (Dayton, OH). • Program activities that expose students to AEOP programs and/or STEM careers in the Army or DoD (including the U.S. Science & Engineering Festival)	• Number and diversity of student participants engaged in programs • Number and diversity of STEM professionals and educators serving as research mentors, judges, personnel and volunteers of regional and national programs • Number and diversity of DoD scientists and engineers and other military personnel engaged in programs • Number and Title 1 status of high schools served through participant engagement • Students, regional directors, national judges, and AAS contributing to evaluation	• Increased participant knowledge, skills and abilities, and confidence in STEM • Increased student interest in future STEM engagement • Increased participant awareness of and interest in other AEOP opportunities • Increased participant awareness of and interest in DoD STEM research and careers • Implementation of evidence-based recommendations to improve JSHS regional and national programs	• Increased student participation in other AEOP and DoD-sponsored programs • Increased student pursuit of STEM coursework in secondary and post-secondary schooling • Increased student pursuit of STEM degrees • Increased student pursuit of STEM careers • Increased student pursuit of DoD STEM careers • Continuous improvement and sustainability of JSHS

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

Key Evaluation Questions

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

The assessment strategy for JSHS included student and mentor questionnaires, four focus groups with R-JSHS students in Ohio and New Jersey and two with adults (mentors) in these regional symposia; rapid interviews with nine students and 14 adults (mentors) at the Ohio and New Jersey R-JSHS and with 4 alumni at N-JSHS; and the Annual Program Report (APR) prepared by AAS. Tables 4-9 outline the information collected in student and instructor questionnaires, focus groups, and interviews, as well as information from the APR that is relevant to this evaluation report.

Table 4. 2015 Student Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, age, grade level, race/ethnicity, and socioeconomic status indicators
	Education Intentions: Degree level, confidence to achieve educational goals, field sought
AEOP Goal 1	**Capturing the Student Experience:** In-school vs. In-program experience; mentored research experience and products (students)
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	STEM Identity: Gains in STEM identity, intentions to participate in STEM, and STEM-oriented education and career aspirations; contribution of AEOP
	Future STEM Engagement: Gains in interest/intent for future STEM engagement (informal activities, education, career)
	AEOP Opportunities: Past participation, awareness of, and interest in participating in other AEOP programs; contribution of AEOP, impact of AEOP resources
	Army/DoD STEM: Exposure to Army/DoD STEM jobs, attitudes toward Army/DoD STEM research and careers, change in interest for STEM and Army/DoD STEM jobs; contribution of AEOP, impact of AEOP resources
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies (students respond to a subset)
	Comprehensive Marketing Strategy: How students learn about AEOP, motivating factors for participation, impact of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers
	Program Specific Online Resources: Usefulness of online resources for participating in AEOP
Satisfaction & Suggestions	Benefits to participants, suggestions for improving programs, overall satisfaction

Table 5. 2015 Mentor Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, race/ethnicity, occupation, past participation
Satisfaction & Suggestions	Awareness of JSHS, motivating factors for participation, satisfaction with and suggestions for improving JSHS programs, benefits to participants
AEOP Goal 1	**Capturing the Student Experience:** In-program experience
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	AEOP Opportunities: Past participation, awareness of other AEOP programs; efforts to expose students to AEOPs, impact of AEOP resources on efforts; contribution of AEOP in changing student AEOP metrics
	Army/DoD STEM: attitudes toward Army/DoD STEM research and careers, efforts to expose students to Army/DoD STEM research/careers, impact of AEOP resources on efforts; contribution of AEOP in changing student Army/DoD career metrics
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies
	Comprehensive Marketing Strategy: How mentors learn about AEOP, usefulness of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers
	Program Specific Online Resources: Usefulness of online resources for supporting students in participating in AEOP

Table 6. 2015 Student Focus Group	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in JSHS, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of JSHS, motivating factors for participation, involvement in other science competitions in addition to JSHS, satisfaction with and suggestions for improving JSHS programs, benefits to participants
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Extent to which students were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Extent to which students were exposed to STEM and Army/DoD STEM jobs

Table 7. 2015 Mentor Focus Group	
Category	**Description**
Profile	Gender, race/ethnicity, occupation, organization, role in JSHS, past participation in JSHS, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of JSHS, benefits to participants suggestions for improving JSHS programs
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Efforts to expose students to AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Efforts to expose students to STEM and Army/DoD STEM jobs
	Mentor Capacity: Local Educators – Strategies used to increase diversity/support diversity in JSHS

Table 8. 2015 Student and Mentor Rapid Interviews	
Category	**Description**
Profile	Gender, race/ethnicity, role in JSHS
Satisfaction & Suggestions	Perceived value of JSHS, benefits to participants suggestions for improving JSHS programs

Table 9. 2015 Annual Program Report	
Category	**Description**
Program	Description of symposia categories and activities
AEOP Goal 1 and 2 Program Efforts	**Underserved Populations:** mechanisms for marketing to and recruitment of students from underserved populations
	Army STEM: Army/DoD STEM Careers – Exposure to Army STEM research and careers (varies by regional, national event); Participation of Army engineers and/or Army research facilities in event activities (varies by regional, national event)
	Mentor Capacity: Local Educators - University faculty and student involvement, teacher involvement

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

Study Sample

Questionnaire responses were received from students participating in the national competition, students from 33 of the 46 regional competitions, and mentors from 41 of the 46 regional sites. Mentors completed the mentor questionnaire once for all students they mentored, whether the students advanced to N-JSHS or not, and therefore their responses do not distinguish between R-JSHS and N-JSHS. Table 10 shows the number of student and mentor respondents by site.

Table 10. 2015 JSHS Site Survey Respondent Numbers

2015 JSHS Site	R-JSHS Students		N-JSHS Students		Mentors	
	No. of Participants	No. of Survey Respondents	No. of Participants	No. of Survey Respondents	No. of Participants	No. of Survey Respondents
Alabama	124	13	5	2	24	6
Alaska	50	17	5	2	6	16
Arizona	160	8	5	3	20	1
Arkansas	100	0	5	2	30	2
California—Southern	110	5	5	0	32	2
Connecticut	320	29	5	1	40	20
DoD Schools-Europe	52	8	5	4	17	10
DoD Schools-Pacific	50	3	5	3	14	2
District of Columbia	135	11	5	1	18	4
Florida	180	0	5	2	61	0
Georgia	128	24	5	1	15	2
Hawaii	90	0	5	3	14	2
Illinois	60	13	5	2	10	8
Illinois-Chicago	60	0	5	1	5	4
Indiana	50	19	5	1	4	5
Intermountain—C), MT, ID, NV, UT	80	7	5	0	17	5
Iowa	130	1	5	0	26	1
Kansas—Nebraska—Oklahoma	60	9	5	0	12	8
Kentucky	40	1	5	2	5	2
Louisiana	80	0	5	0	12	0
Maryland	114	6	5	2	30	2
Michigan	60	9	5	1	12	1
Missouri	150	0	5	1	27	1
New Jersey--Monmouth	424	7	5	3	47	9
New Jersey—Rutgers	160	16	5	1	30	5
New York—Long Island	200	11	5	1	62	5
New York—Metro	300	9	5	1	30	8

New York—Upstate	509	20	5	2	42	9
North Carolina	60	6	5	0	21	0
North Central	234	0	5	1	30	3
New England—Northern	80	1	5	2	12	1
New England—Southern	80	0	5	1	10	0
Ohio	100	27	5	1	24	25
Pennsylvania	50	7	5	1	7	4
Philadelphia	80	9		0	14	4
Puerto Rico	60	20	5	1	14	10
South Carolina	300	0	5	2	32	1
Southwest	50	0	5	0	13	0
Tennessee	85	1	5	0	11	1
Texas	86	5	5	2	26	10
Virginia	100	12	5	2	23	6
Washington	135	8	5	2	20	3
West Virginia	15	2	5	1	4	1
Wisconsin	60	0	5	2	6	1
Wyoming—Eastern Colorado	60	4	5	0	14	4
Total	**5,829**	**348**	**218**	**61**	**1,003**	**219**

‡ No R-JSHS site was indicated by 8 R-JSHS students, and 20 mentors.

Table 11 provides an analysis of student and mentor participation in the JSHS questionnaires, the response rate, and the margin of error at the 95% confidence level (a measure of how representative the sample is of the population). The margin of error for both the student and mentor surveys is larger than generally acceptable, indicating that the samples may not be representative of their respective populations. As previously stated, AAS should work with regional JSHS sites to provide time within the regional symposium activities (following presentations) for participants to complete the AEOP evaluation survey.

Table 11. 2015 JSHS Questionnaire Participation				
Participant Group	**Respondents (Sample)**	**Total Participants (Population)**	**Participation Rate**	**Margin of Error @ 95% Confidence[1]**
R-JSHS Students	356	5,829	6%	±5.03%
N-JSHS Students	61	218	28%	±10.80%
Mentors	239	1,003	24%	±5.54%

Focus groups were conducted at Ohio and New Jersey R-JSHS. The four student focus groups included 24 students (17 females, 7 males) in grades 10 to 12. Two mentor focus groups were also conducted at R-JSHS (Ohio and New Jersey), which included 11 mentors (6 females, 5 males). This group was comprised of all educators (11). Focus groups were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of questionnaire data. They add to the overall narrative of JSHS's efforts and impact, and highlight areas for future exploration in programming and evaluation.

Rapid interviews were conducted at R-JSHS with 9 students (5 females, 4 males), 10 mentors (8 females, 6 males), and 4 JSHS alumnae (1 female, 3 males). The students included 1 oral presenter, 5 poster presenters, and 1 non-presenter. The mentors included 2 judges, 4 chaperones, 3 regional directors, and 5 competition advisor/mentors. As with the focus groups, rapid interviews were intended to provide additional evidence of, explanation for, or illustrations of student questionnaire data; they were not intended to yield generalizable findings.

Respondent Profiles

Student Demographics

Table 12 illustrates demographic information collected from FY15 JSHS questionnaire respondents. In regard to gender, total survey respondents: R-JSHS n=356 (61% female, 38% male, 1% no report); N-JSHS n = 61 (70% female and 30% male). More females (R-JSHS 61%; N-JSHS 70%) than males (R-JSHS 38%; N-JSHS 30%) completed the questionnaire continuing the trend from FY14. Also, similar to FY14, among R-JSHS respondents, more students identified with the race/ethnicity category of White (54%) than any other single race/ethnicity category. However, there is substantial representation of Asian (23%) and Hispanic or Latino (10%) populations. N-JSHS respondents were comparable to the regional population in FY15, with White (44%), Asian (34%), but much fewer numbers of Hispanic and Latino participants

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

(2%). 37% were rising 12th graders in FY15 (down from 51% in 2014). The percentage of rising college freshman was the second largest R-JSHS group at 27%. Among N-JSHS responders, the greatest single grade level was rising college freshmen (46%) and rising 12th graders was second at 39%. Most of N-JSHS respondents (92%) and R-JSHS respondents (80%) reported that they did not qualify for free or reduced-price lunch (FRL)—a common indicator of low-income status. Table 13 shows that a majority of respondents at regionals attended public schools (77%) and respondents at nationals were comprised of 100% DOD school students. Finally, more than half of the participants in the survey attended schools in suburban areas (R-JSHS 59%; N-JSHS 58%).

Survey respondent demographics were similar to the demographic data provided by reporting regional symposia (19 reported gender data and 18 reported the race/ethnicity of participants). Females were slightly less represented among survey respondents than in the reporting regional symposia (61% of R-JSHS questionnaire respondents and 71% if N-JSHS respondents were female versus 56% of R-JSHS participants from reporting regional symposia). The proportion of Black/African American questionnaire responding to the questionnaire was also slightly lower than the corresponding R-JSHS participation rate of this group among the 18 reporting symposia (9% of participants from R-JSHS reporting symposia versus 5% of R-JSHS questionnaire respondents and 3% of N-JSHS questionnaire respondents).

Based upon demographic information provided by regional symposia and questionnaire respondents, it appears that JSHS was successful in attracting participation from female students—a population that is historically underrepresented in some STEM fields. These data suggest that JSHS had limited success in providing outreach to students from historically underserved and underrepresented race/ethnicity and low-income groups. In addition to students from suburban schools, JSHS served students who regularly attended school in urban and rural schools, which historically have lower or limited resources compared to suburban schools. Consistent use of Cvent as a centralized registration tool may more accurately capture JSHS's success at serving students from historically underserved and underrepresented populations. Questionnaire respondent data suggest that regional symposia engage larger proportions of underserved and underrepresented groups than the N-JSHS. In particular, 5% of R-JSHS respondents identified themselves as Black or African American as compared to only 3% of N-JSHS students. Likewise, 10% of R-JSHS respondents identified themselves as Hispanic or Latino as compared to only 2% of N-JSHS students.

Table 12. 2015 JSHS Student Respondent Profile				
Demographic Category	**R-JSHS Questionnaire Respondents**		**N-JSHS Questionnaire Respondents**	
Respondent Gender (R-JSHS n = 356, N-JSHS n = 61)				
Female	218	61%	43	70%
Male	135	38%	18	30%
Choose not to report	3	1%	0	0%
Respondent Race/Ethnicity (R-JSHS n = 355, N-JSHS n = 61)				
Asian	80	23%	21	34%
Black or African American	17	5%	2	3%
Hispanic or Latino	34	10%	1	2%
Native American or Alaska Native	2	1%	1	2%
Native Hawaiian or Other Pacific Islander	0	0%	0	0%
White	190	54%	27	44%
Other race or ethnicity (specify):[†]	7	2%	2	3%
Choose not to report	25	7%	6	10%
Respondent Grade Level (R-JSHS n = 351, N-JSHS n = 61)				
9th	10	3%	0	0%
10th	35	10%	0	0%
11th	67	19%	9	15%
12th	131	37%	24	39%
1st Year College Student	96	27%	28	46%
Respondent Eligible for Free/Reduced-Price Lunch (R-JSHS n = 355, N-JSHS n = 61)				
Yes	56	16%	2	3%
No	283	80%	56	92%
Choose not to report	16	4%	3	5%

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

Table 13. 2015 JSHS Student Respondent School Information				
Demographic Category	**R-JSHS Questionnaire Respondents**		**N-JSHS Questionnaire Respondents**	
Respondent School Location (R-JSHS n = 354, N-JSHS n = 52)				
Suburban	208	59%	30	58%
Urban (city)	97	27%	19	37%
Rural (country)	49	14%	3	6%
Frontier or tribal school	0	0%	0	0%
Respondent School Type (R-JSHS n = 336, N-JSHS n = 8)				
Public school	258	77%	0	0%
Private school	64	19%	0	0%
Department of Defense school (DoDDS or DoDEA)	10	3%	8	100%

The highest level of competition students reported achieving in 2015 is illustrated in Table 14. 19% of responding R-JSHS students participated in non-presenting roles (student delegate/observer), whereas 100% of responding N-JSHS students participated in presenting roles. The diverse participation in student roles at R-JSHS and N-JSHS are aligned with the focus of each level. In particular, student delegate and observer roles are intended to facilitate future participation at the R-JSHS level, and N-JSHS is purposed to support most participants to present.

Table 14. 2015 JSHS Student Respondent Roles		
Highest Level of Competition Achieved in 2015	**R-JSHS Questionnaire Respondents (n = 351)**	**N-JSHS Questionnaire Respondents (n = 61)**
Oral Presenter	53%	38%
Poster Presenter	24%	62%
Non-presenting Participant	19%	0%
Non-competitive poster presenter	4%	0%

† One student who completed the N-JSHS questionnaire indicated that the highest level of competition s/he reached in 2014 was non-competitive regional poster presenter.

In FY15 Virginia Tech did not ask JSHS-N or JSHS-R participants and mentors regarding past participation in AEOP programs in administered surveys. This data was also not captured in the CVENT registration system for the N-JSHS participants. This question has been added back into the FY16 evaluation survey for R-JSHS and this data will be collected and reported in the FY16 report.

Mentor Demographics

Table 15 summarizes the 2015 Mentor demographic information. In regard to gender, more responding mentors were female than male (49% vs. 41%). As with the responding students, most of the responding mentors identified

themselves as White (73%). Half of the mentors were teachers (50%) while university educators made up 11% of the mentor respondents as did scientist, engineer, or mathematics professionals (11%). Most of the responding mentors, 59%, served as research mentors, 19% served as competition advisors, and 22% in some other role, most commonly teacher or chaperone. For additional characteristics of the mentors, please see Appendix C.

Table 15. 2015 JSHS Mentor Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 239)		
Female	129	49%
Male	108	41%
Choose not to report	2	1%
Respondent Race/Ethnicity (n = 238)		
Asian	18	8%
Black or African American	7	3%
Hispanic or Latino	16	7%
Native American or Alaska Native	7	3%
Native Hawaiian or Other Pacific Islander	0	0%
White	174	73%
Other race or ethnicity, (specify):[†]	5	2%
Choose not to report	16	7%
Respondent Occupation (n = 234)		
Teacher	117	50%
Other school staff	15	6%
University educator	33	14%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	8	3%
Scientist, Engineer, or Mathematics professional	32	14%
Other, (specify):[‡]	29	12%
Respondent Role in JSHS (n = 86)		
Research Mentor	51	59%
Competition advisor	16	19%
Other, (specify)[§]	19	22%

[†] No responses provided.

[‡] Other = "House Manager," "Research Scientist/Research Instructor," "Teacher/student," "Parent educator," "Parent (n=2)," "Parent, learning coach," "Home maker," "chaperone," "JSHS Regional Coordinator," "Registered Nurse," "Not technically a student cause I graduated in January, but I plan on going on to collage," "Science research and education," "Graduate student," "University support staff," "Director of science institution," "Homeschool parent/teacher," "ed consultant," "farmer, and daughter's learning coach," "Nurse," "Assistant to Regional Director," "College student," "After school mentor/teacher," "IT consultant"

§ Other ="Meeting planner," "Teacher and chaperone (n=3)," "Chaperone (n=10)," "guest or observer (n=2)," "Conference attendee and teacher of Presenters," "supervising teacher," "Local intern coordinator," "mostly observer and chaperone," "parent (n=13)," "JSHS Co-coordinator," "Coordinated poster judging," "Research Teacher," "Course Instructor," "audience," "paper reader," "volunteer (n=3)," "Teacher, parent," "Paper reviewer," "Event planner," "Recruiting students to apply as participants and/or competitors," "program supervisor," "Teacher," "Board of Directors (n=2)," "Co-coordinator," "observer," "poster assistance," "observer chaperone," "Administrative," "staff." "Mentor," "Parent-Mentor," "Sponsor of Competitor," "Region Chaperone," "Assistant regional director," "Regional Director (n=10)," "state director," "Moderator," "regional–administrative, nat-chaperone," "Co-Project Director," "reverse science fair presenter (n=3)," SMART panelist," "program director"

Actionable Program Evaluation

Actionable Program Evaluation is intended to provide assessment and evaluation of program processes, resources, and activities for the purpose of recommending improvements as the program moves forward. This section highlights information outlined in the Satisfaction & Suggestions sections of Tables 4-9. A focus of the Actionable Program Evaluation is efforts toward the long-term goal of JSHS and all of the AEOP to increase and diversify the future pool of talent capable of contributing to the nation's scientific and technology progress. JSHS regional symposia are engaged in outreach efforts to identify underrepresented populations who are capable of succeeding in JSHS. Thus, it is important to consider how JSHS is marketed and ultimately recruits student participants, the factors that motivate students to participate in JSHS, participants' perceptions of and satisfaction with activities, what value participants place on program activities, and what recommendations participants have for program improvement. The following sections report student and mentor perceptions that pertain to current programmatic efforts and recommend evidence-based improvements to help JSHS achieve outcomes related to AEOP programs and objectives—specifically, to help JSHS continue to expand participation from and support STEM education for students from underrepresented groups.

Marketing and Recruiting Underrepresented Populations

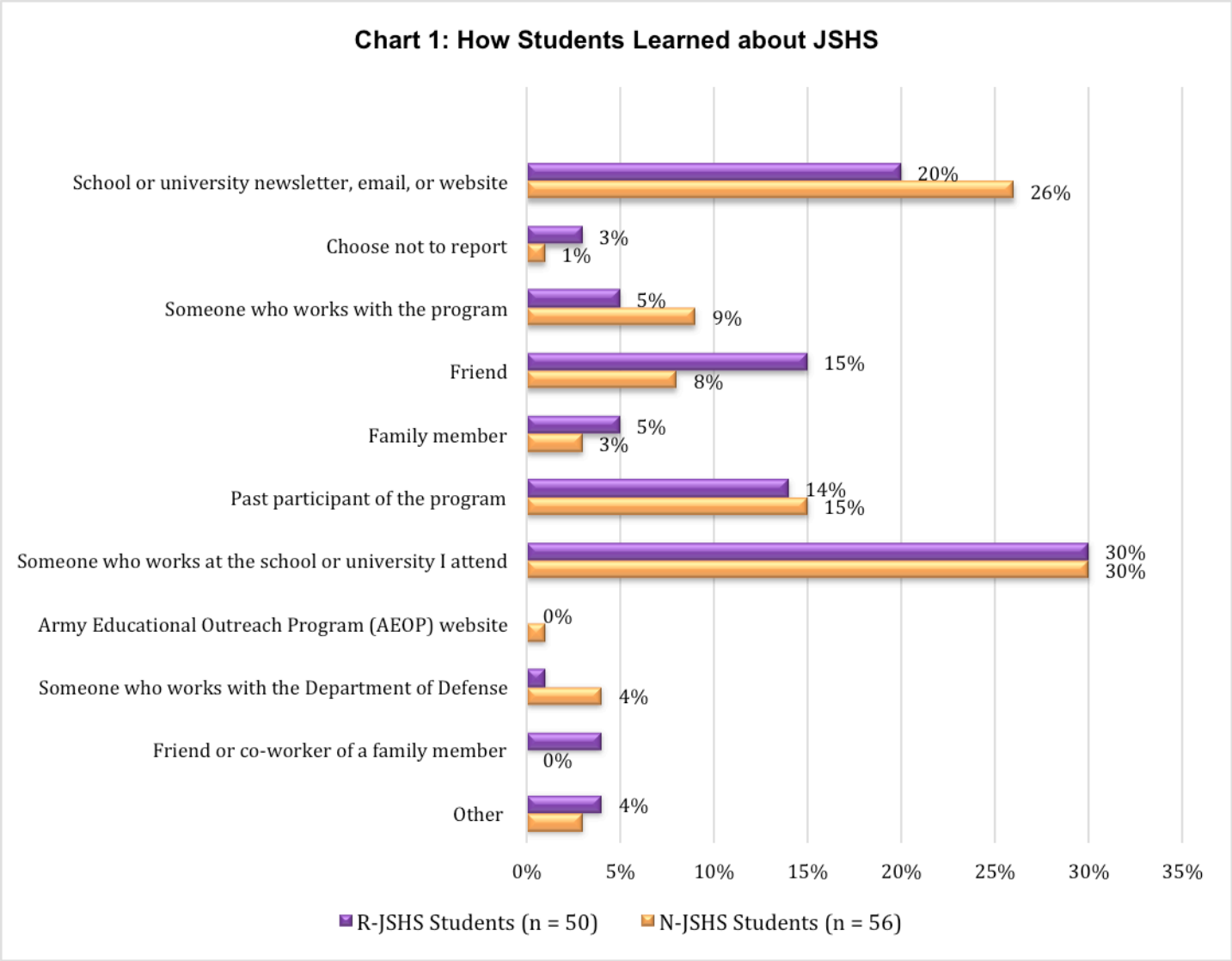
JSHS regional symposia engage in outreach activities specifically targeted to recruiting populations underrepresented in STEM careers. These efforts are largely developed and implemented at a local level. Strategies include activities such as developing partnerships with internal and external mentorship programs, heightening awareness among high schools in diverse areas, hosting workshops at the regional symposium or through externally funded teacher training workshops, and travel support for schools. Program announcements were prepared and published in the fall, or at the start of the academic school year, to invite participation. These announcements were distributed by direct mail and electronic mail to targeted high school teachers, guidance counselors and principals. Other recruitment methods in 2015 included:

- Personal contact and networking with individual teachers and high school administration;
- Presentations at statewide teachers association meetings;
- Advertising via listserves and newsletters reaching science teachers;
- University-hosted websites and newsletters;
- Coordination with university admissions departments that publicize university programs to high schools throughout their states;

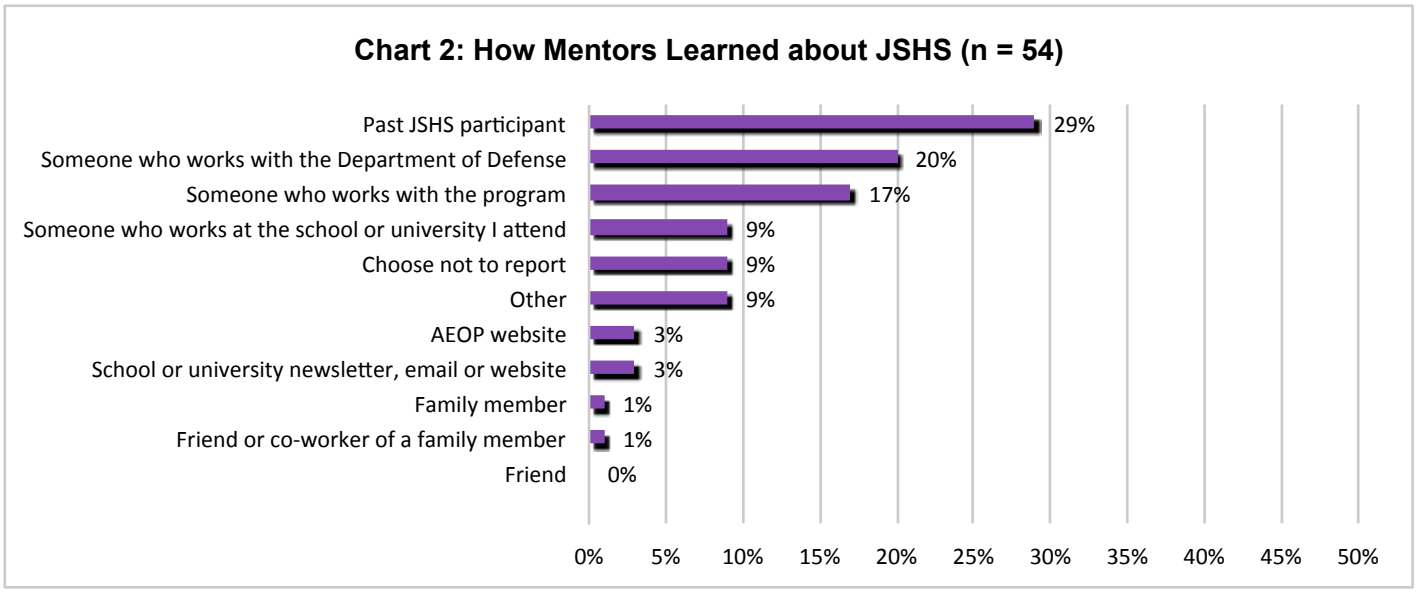
- Partnerships with internal and external mentorship programs to identify students (examples in Connecticut included coordination with Louis Stokes Alliance for Minority Participation (LSAMP) Bridge to the Doctorate, LSAMP Scholars Program, Connecticut Science and Engineering Fair, and UConn Mentor Connection); and
- Coordination with outreach events hosted by undergraduate student groups, including honors groups and groups serving underrepresented populations, such as the National Society of Black Engineers (examples at Rutgers University included The Minority Engineering Educational Task Force (MEET); the Society of Women Engineers (SWE): Society of Hispanic Engineers (SHE), and the Rutgers University Science, Mathematics & Engineering Outreach (RUSMEO).

Students were asked to respond to a questionnaire item asking students to select all of the different ways they heard about JSHS in order to determine what recruitment methods are most effective. Chart 1 summarizes students' responses to this item. The most frequently mentioned source of information about the JSHS program was "someone who works at the school or university I attend" (R-JSHS 30%, N-JSHS 30%). Other significant sources of information about JSHS for N-JSHS student responders were a school or university newsletter or email (26%) and past participants of the program (15%). R-JSHS students also indicated that they learned about JSHS through a school or university newsletter or email (20%) and past participants of the program (15%) although a friend was also a frequently identified source of information for R-JSHS students (15%).

These findings suggest that disseminating information to teachers and directly to students via e-communications are effective means of reaching students. These findings also suggest that the multi-faceted marketing approach used to publicize JSHS may be an effective strategy to recruit students across sub-groups.



Mentors were also asked how they learned about JSHS (see Chart 2). The most frequent responses were personal contacts, including a past JSHS participant (29%), someone who works with the Department of Defense (20%), or someone who works with the program (17%). In addition, 9% learned from someone who works at the school or university I attend, 9% were other, and 9% chose not to report.



Factors Motivating Student Participation

Table 16 conveys the motivating factors for students to participate in JSHS. For the R-JSHS responders, the top two motivating factors were interest in STEM (26%) and the desire to learn something new (16%). Similarly, for the N-JSHS responders, the top two motivating factors were interest in STEM (41%) and the desire to learn something new (18%).

Table 16. Motivating Factors for Students to Participate in JSHS		
Item	**R-JSHS Questionnaire Respondents (n = 50)**	**N-JSHS Questionnaire Respondents (n = 56)**
Teacher or professor encouragement	10%	9%
Interest in science, technology, engineering, or mathematics (STEM)	26%	41%
Learning in ways that are not possible in school	5%	5%
Desire to expand laboratory or research skills	10%	9%
Figuring out education or career goals	3%	3%
Desire to learn something new or interesting	16%	18%
Building college application or resume	7%	4%
Opportunity to use advanced laboratory technology	0%	1%
Having fun	6%	4%
Networking opportunities	3%	9%
Recommendations of past participants	1%	1%
Serving the community or country	3%	4%
The program mentor(s)	1%	0%
An academic requirement or school grade	3%	1%
Opportunity to do something with friends	1%	1%
Earning stipends or awards for doing STEM	3%	3%
Interest in STEM careers with the Army	0%	1%
Other	0%	1%
Choose not to report	1%	1%

Student focus group participants mentioned several motivators that were not on the questionnaire, although most focus group participants indicated that they were motivated to participate by their teachers. Other motivating factors included desire to learn about others' research, attend workshops and hear speakers, school requirements or incentives, and supporting a growing science high school science program. As one student replied:

> *My teacher told me about this symposium and I was really excited about being able to present my research and show people what I did and hear about what others have done.* (R-JSHS Student)

The JSHS Experience

Students were asked to respond to several questionnaire items asking about the nature of their experiences in JSHS and how that experience compared to their STEM learning opportunities in school. When asked what field their JSHS experience focused on, a large majority of all students selected science (R-JSHS 75%; N-JSHS 78%), engineering was the

next most frequently chosen focus (R-JSHS 11%; N-JSHS 16%), followed by technology (R-JSHS 4%; N-JSHS 4%), and mathematics (R-JSHS 7%; N-JSHS 2%). Mentors were asked similar questions about the nature of their students' projects. Overall, their responses paint a similar picture of the JSHS experience (responses to these items can be found in Appendix C).[2]

As Chart 3 indicates, 37% of Regional students and 41% of National students indicated that they designed the entire project on their own. 33% of Regional students and 23% of National students indicated that worked with their mentor to design a project. The remaining students reported working with their mentor and research team to design a project (R-JSHS 17%; N-JSHS 18%), having a choice among various projects suggested by their mentor (R-JSHS 7%; N-JSHS 8%), or being assigned a project by their mentor (R-JSHS 6%; N-JSHS 10%). As previously noted, R-JSHS students are supported as delegates or observers as well as competitors, therefore, 1% of Regional responders did not have a project.

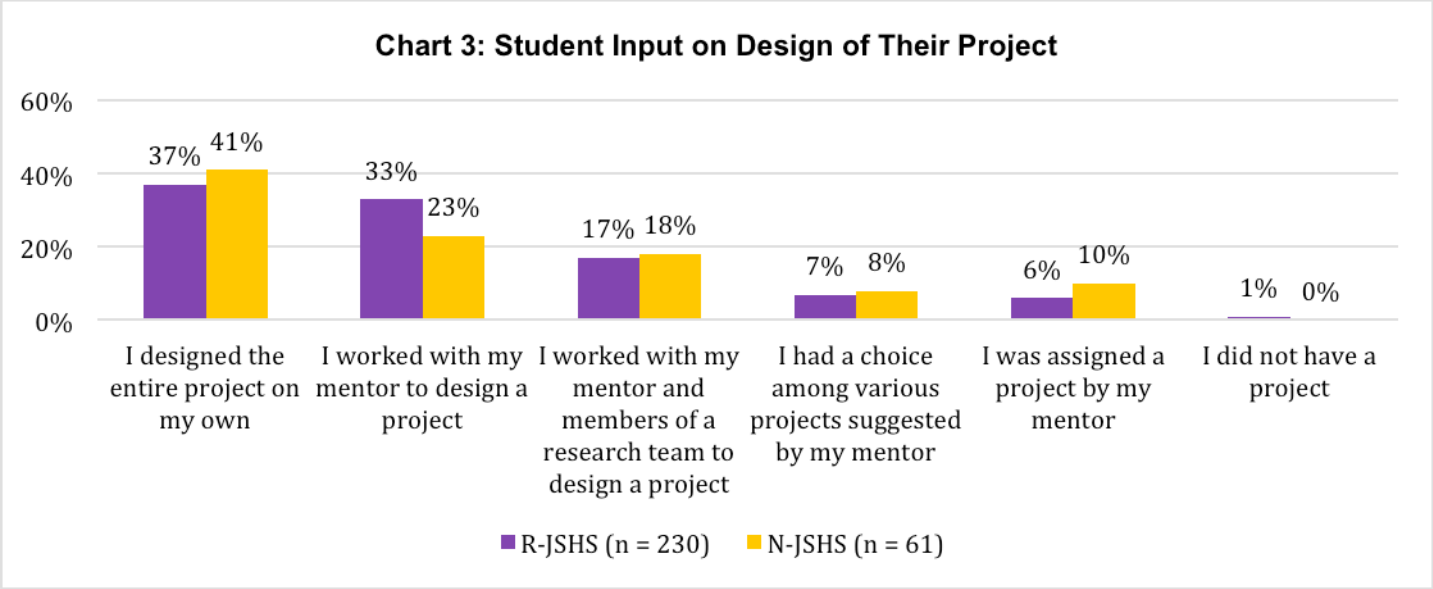
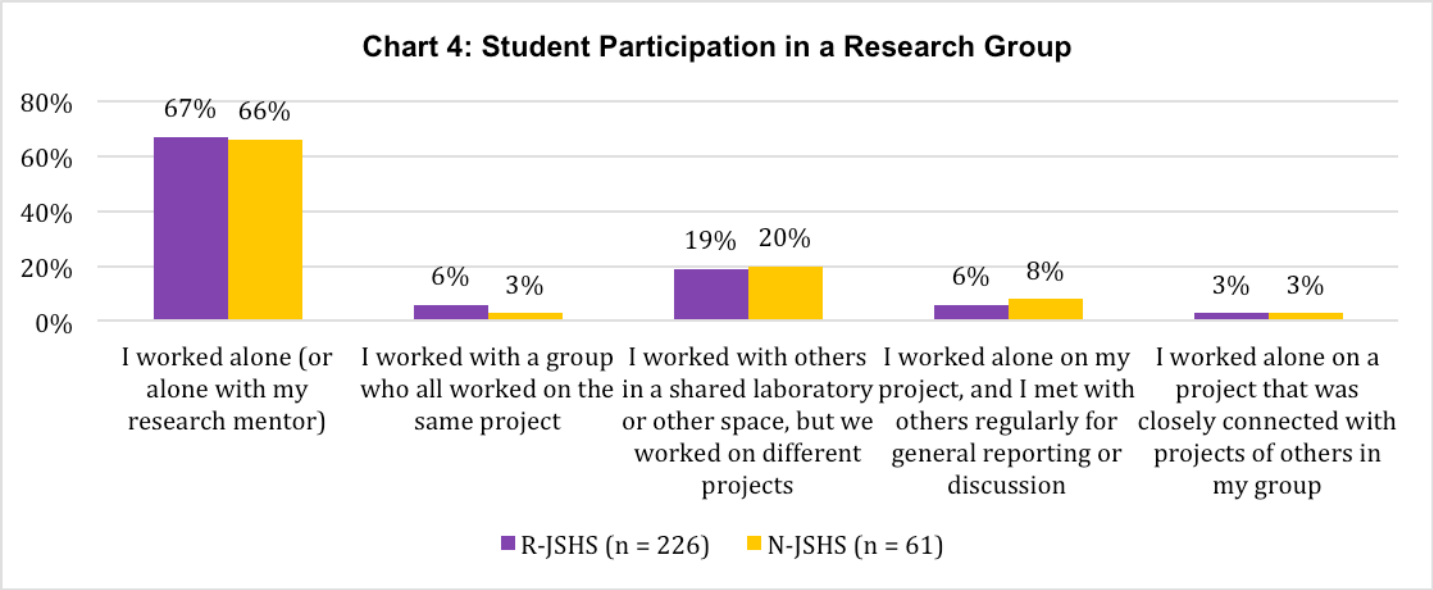


Chart 4 illustrates student participation levels in a research group. Most students worked alone (or alone with their research mentor) on their projects (R-JSHS 67%; N-JSHS 66%). Very few students (R-JSHS 6%; N-JSHS 3%) reported working with a group on the same project. Some reported working in a shared laboratory/space with others, but on different projects (R-JSHS 19%; N-JSHS 20%), or worked alone but met with others regularly to discuss their projects (R-

[2] Because of the low response rates on both the student and mentor questionnaires, it is impossible to determine whether any differences between the two datasets are real or an artifact of which students and mentors provided data. In addition, as mentors typically worked with multiple students, it is not clear which students' mentors were considering when responding to these items.

JSHS 6%, N-JSHS 8%). Finally, again, very few students reported working on a project alone that was closely related to projects of other in their group (R-JSHS 3%; N-JSHS 3%).



As Charts 5 and 6 indicate, students were asked about the nature of STEM-related activities they engaged in during their experience. Most Regional respondents indicated learning about new STEM topics (76%) and communicating with other students about STEM (75%) on most days or every day of the experience. Also, on most days or every day of the experience, 70% of R-JSHS students also reported interacting with STEM professionals, 66% reported applying STEM knowledge to real-life situations, 64% reported learning about different STEM careers, and 75% reported learning about new discoveries in STEM on most days or every day. In contrast, 91% of National respondents reported engaging in learning about new STEM topics on most days or every day. Likewise, on most days or every day of the experience, 85% of National respondents reported interacting with STEM professionals, 89% reported learning about cutting-edge STEM research, and 89% reported learning about different STEM careers. Students who attended N-JSHS were selected based on the quality of their projects. Therefore, it is not surprising that their self-reported JSHS experiences are rated higher.

Although differences between the groups were not statistically tested for each individual activity, a composite score[3] was calculated for the set of activities, titled "Learning about STEM in JSHS."[4] Response categories were converted to a

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

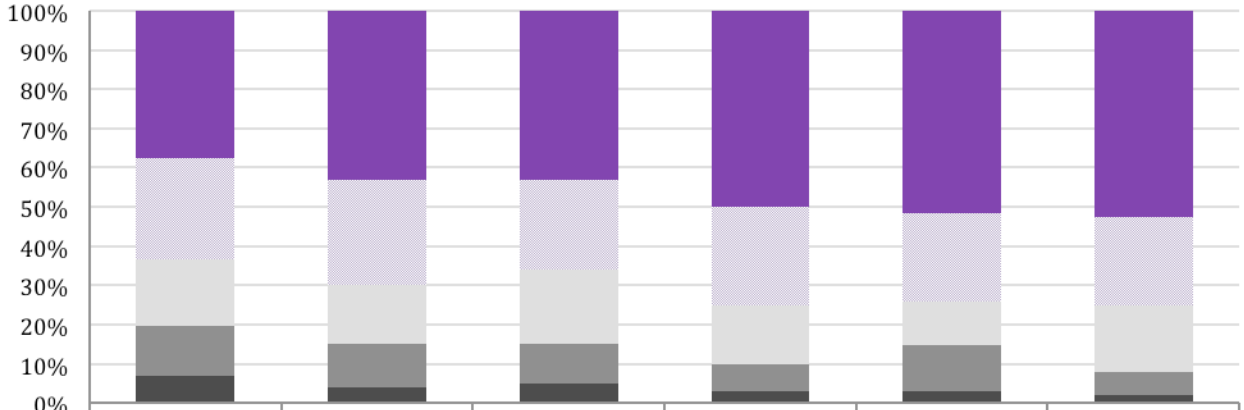
[4] The Cronbach's alpha reliability for these 6 items was 0.922.

scale of 1 = “Not at all” to 5 = “Every day” and the average across all items in the scale was calculated. The composite scores were used to test whether there were differences in student experiences by Regional or National JSHS participation, gender, and race/ethnic group (minority vs. non-minority students). There were not significant differences in Learning about STEM in JSHS by race/ethnic group. However, there were gender and competition level group differences. Females reported learning significantly more about STEM in JSHS compared to males (small effect size of d = 0.333 standard deviations)[5]. Additionally, R-JSHS students on average reported significantly lower scores than N-JSHS students on the “Learning about STEM in JSHS” composite [6] (small effect of d = 0.395 standard deviations).

Mentors were asked similar questions about the nature of their students’ experiences. Overall, their responses more closely resembled Regional students’ responses than National students’ responses, however mentors’ reports of interactions with STEM professionals (34% reported students doing this most days or every day) and learning about STEM careers (41% reported students doing this most days or every day) were substantially lower than students’ reports.

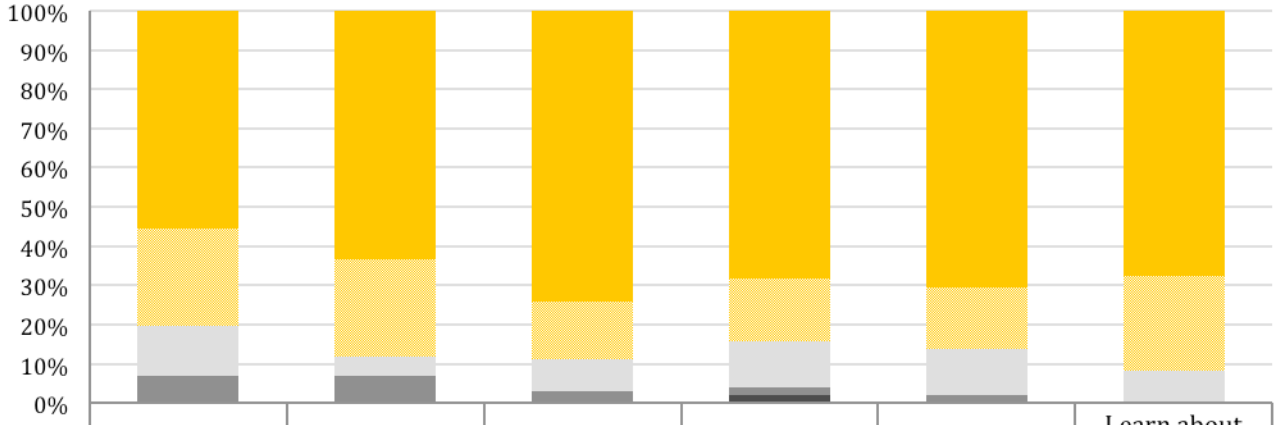
[5] Two-tailed independent samples t-test: $t(405) = 3.35$, $p < 0.001$.
[6] Two-tailed independent samples t-test: $t(408) = 3.99$, $p < 0.001$.

Chart 5: Nature of Student Activities in JSHS for R-JSHS Respondents (n = 325-327)



	Learn about different careers that use STEM	Interact with scientists or engineers	Apply STEM learning to real life situations	Learn about new discoveries in STEM	Communicate with other students about STEM	Learn about new science, technology, engineering, or mathematics (STEM) topics
Every day	38%	43%	43%	50%	52%	53%
Most days	26%	27%	23%	25%	23%	23%
A few times	17%	15%	19%	15%	11%	17%
At least once	13%	11%	10%	7%	12%	6%
Not at all	7%	4%	5%	3%	3%	2%

Chart 6: Nature of Student Activities in JSHS for N-JSHS Respondents (n = 61)



	Apply STEM knowledge to real life situations	Learn about different careers that use STEM	Learn about new discoveries in STEM	Interact with scientists or engineers	Communicate with other students about STEM	Learn about new science, technology, engineering, or mathematics (STEM) topics
Every day	56%	64%	74%	69%	72%	67%
Most days	25%	25%	15%	16%	16%	24%
A few times	13%	5%	8%	12%	12%	8%
At least once	7%	7%	3%	2%	2%	0%
Not at all	0%	0%	0%	2%	0%	0%

Table 17 illustrates how students disseminated their research during their JSHS experience. Most respondents in each group had presented a talk or poster to other students or faculty (R-JSHS 85%; N-JSHS 97%). 72% of Regional students and 80% of National students also reported that they had attended a symposium or conference. 64% of Regional students and 82% of National students also reported presenting a talk or poster at a professional symposium or conference rounding out the top three activities. Additionally, both regional as well as national students won an award or scholarship based on their research (39% and 59%, respectively). 14% of Regional and 26% of National students also reported having written or co-written a paper that was or will be published in a research journal.

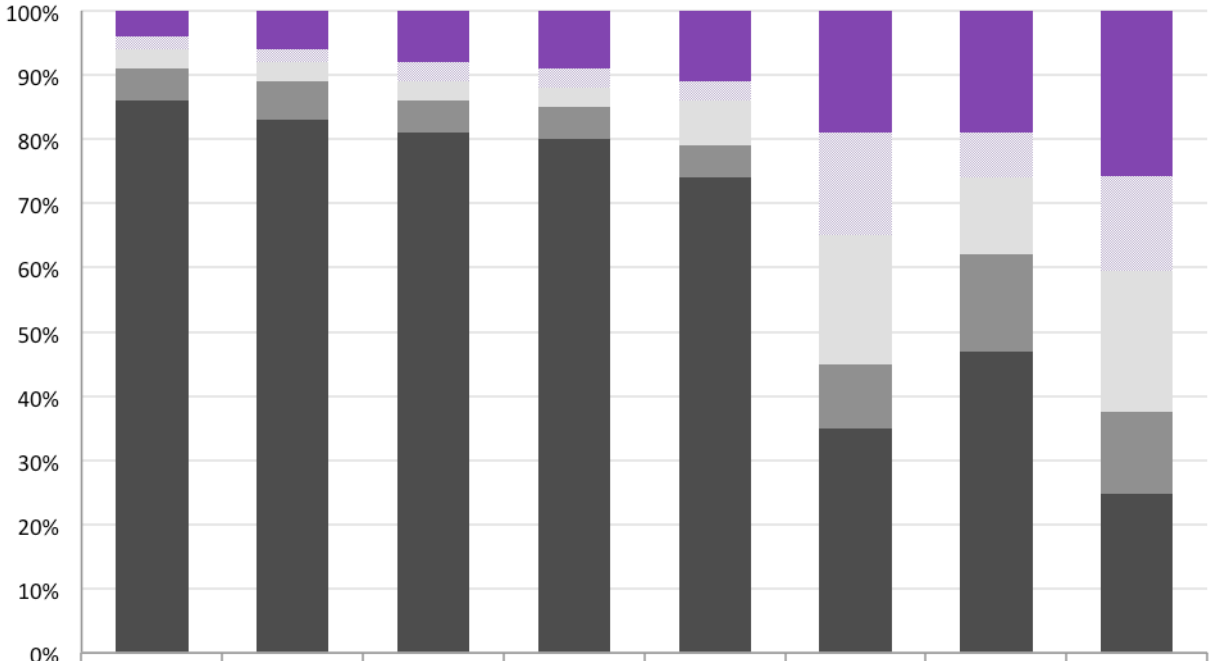
Table 17. Students Engagement with Research Dissemination Activities During JSHS		
	R-JSHS Questionnaire Respondents (n = 254)	N-JSHS Questionnaire Respondents (n = 61)
I presented a talk or poster to other students or faculty	85%	97%
I attended a symposium or conference	72%	80%
I presented a talk or poster at a professional symposium or conference	64%	82%
I won an award or scholarship based on my research	39%	59%
I will attend a symposium or conference	25%	41%
I will present a talk or poster to other students or faculty	28%	36%
I will present a talk or poster at a professional symposium or conference	22%	30%
I wrote or co-wrote a paper that was/will be published in a research journal	14%	26%
I wrote or co-wrote a technical paper or patent	15%	7%
I will write or co-write a technical paper or patent	6%	7%
I will write or co-write a paper that was/will be published in a research journal	14%	26%

Increasing both the number and diversity of students who pursue STEM careers is one goal of the AEOP. Therefore, the student questionnaire asked how many STEM jobs/careers in general as well as DoD STEM jobs/careers they learned about during their JSHS experience. Table 18 illustrates that 24% of Regional students reported learning about at least one STEM job/career, and 29% reported learning about five or more. 34% of Regional students reported learning about at least one DoD STEM job/career, however only 10% reported learning about multiple different STEM jobs/careers in the DoD. In contrast, 70% of National students reported learning about five or more STEM jobs/careers as well as DoD STEM jobs/careers.

Table 18. Number of STEM Jobs/Careers Students Learned about During JSHS				
	R-JSHS Questionnaire Respondents (n = 249)		N-JSHS Questionnaire Respondents (n = 60)	
	STEM Jobs/Careers	DoD STEM Jobs/Careers	STEM Jobs/Careers	DoD STEM Jobs/Careers
None	13%	47%	0%	2%
1	24%	34%	0%	2%
2	19%	14%	8%	8%
3	20%	8%	10%	8%
4	9%	7%	12%	10%
5 or more	29%	10%	70%	70%

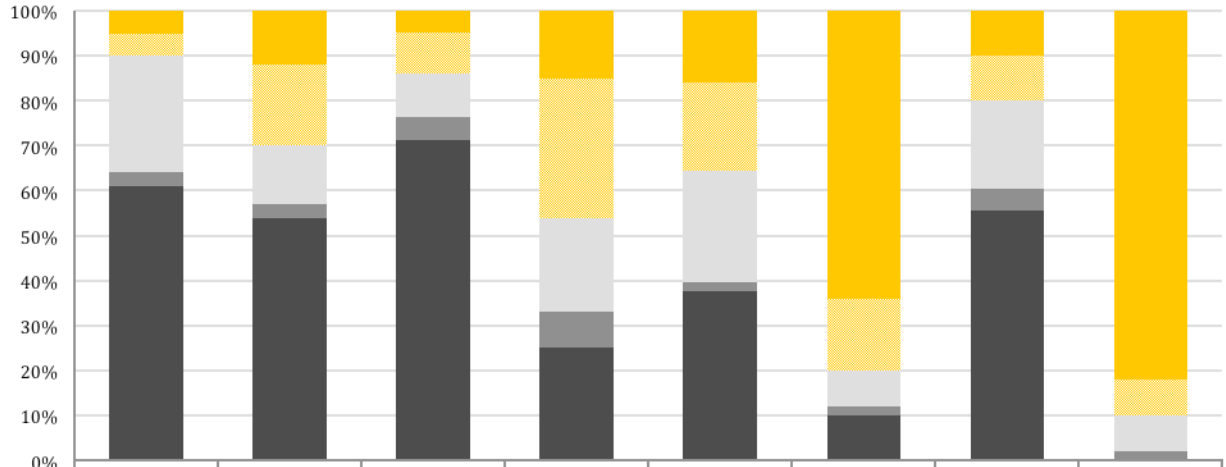
Charts 7 and 8 summarize the reported impact of resources on student awareness of DoD STEM careers. 26% of Regional students reported the greatest impact on awareness was participation in JSHS. In contrast, 82% of National students reported the greatest impact on awareness was participation in JSHS. National students reported the resources had a higher impact on their awareness in all areas except for their mentor and social media than Regional students. It Starts Here! Magazine was reported as having the least impact at only 4% for Regional students and only 5% for National students.

Chart 7: Impact of Resources on R-JSHS Student Awareness of DoD STEM Careers (n = 287-291)



	It Starts Here! Magazine	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP website	Academy of Applied Science (AAS)website	AEOP brochure	Invited speakers or "career" events	My JSHS mentor(s)	Participation in JSHS
Very Much	4%	6%	8%	9%	11%	19%	19%	26%
Somewhat	2%	2%	3%	3%	3%	16%	7%	15%
A little	3%	3%	3%	3%	7%	20%	12%	22%
Not at all	5%	6%	5%	5%	5%	10%	15%	13%
Did not use this resource	86%	83%	81%	80%	74%	35%	47%	25%

Chart 8: Impact of Resources on N-JSHS Student Awareness of DoD STEM Careers (n = 61)



	AEOP on Facebook, Twitter, Pinterest or other	AEOP website	It Starts Here! Magazine	My JSHS mentor(s)	AEOP brochure	Invited speakers or "career" events	Academy of Applied Science (AAS) website	Participation in JSHS
Very Much	5%	12%	5%	15%	16%	64%	10%	82%
Somewhat	5%	18%	9%	31%	20%	16%	10%	8%
A little	26%	13%	10%	21%	25%	8%	20%	8%
Not at all	3%	3%	5%	8%	2%	2%	5%	2%
Did not experience	61%	54%	72%	25%	38%	10%	56%	0%

To further explore students' exposure to STEM career opportunities in the DoD, student participants in the focus groups were asked whether they had learned about these opportunities during JSHS. Ohio R-JSHS students responded that that they had not learned about STEM jobs/careers with the DoD in JSHS. In contrast, New Jersey R-JSHS students responded that they had heard about these careers through speakers and exhibits. For instance:

> *Before coming to JSHS, I didn't realize that the Army did so much research…For me it was really cool to learn about the different areas that they do research [in].* (R-JSHS student)

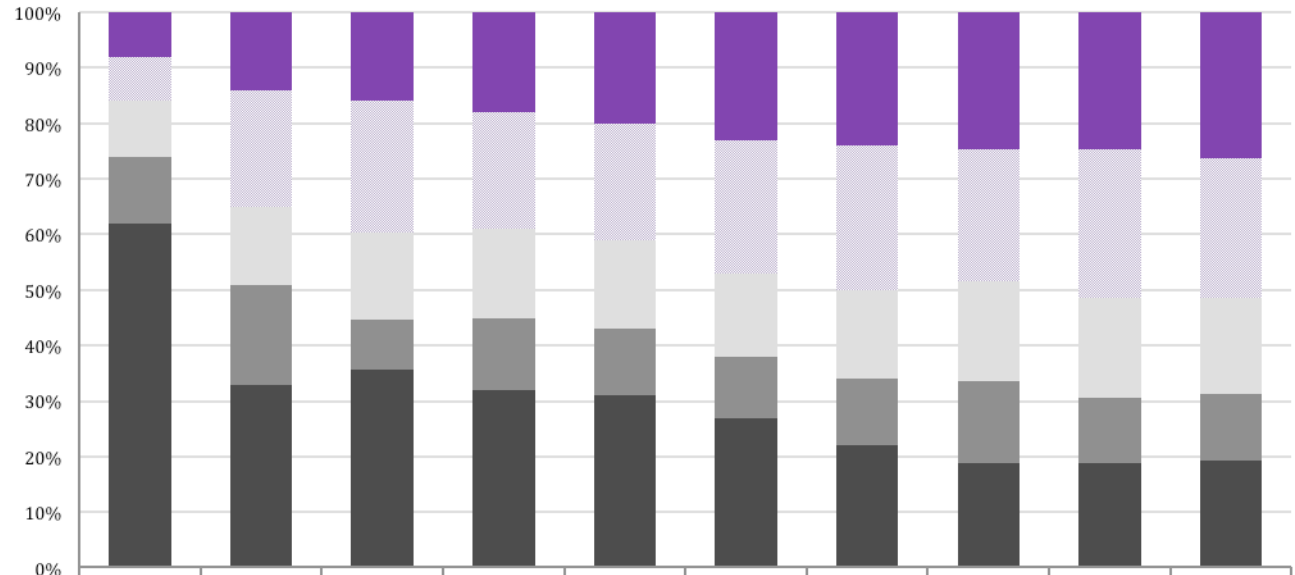
> *I liked the keynote speaker…She talked about her experience…I really liked how she used the questions to tie into her career and what she's accomplished, and how the Army and Navy helped her.* (R-JSHS student)

> *I think before JSHS, I had sort of a misconception that when I thought of the Department of Defense, I didn't really think of engineering. I thought more [of] people on the ground fighting…[The speakers] talked a lot about the involvement of engineers in the DoD…I learned a lot more about career opportunities.* (R-JSHS student)

Students were also asked how often they engaged in various STEM practices in JSHS. Chart 9 shows that 50% or more of Regional students reported having engaged in three of the activities on most days or every day: analyzing data or information (51%); drawing conclusions from an investigation (52%); and coming up with creative explanations or solutions (50%). However, for each of the activities listed, between 19% and 62% of Regional students reported that they had not engaged in the activity at all in JSHS.

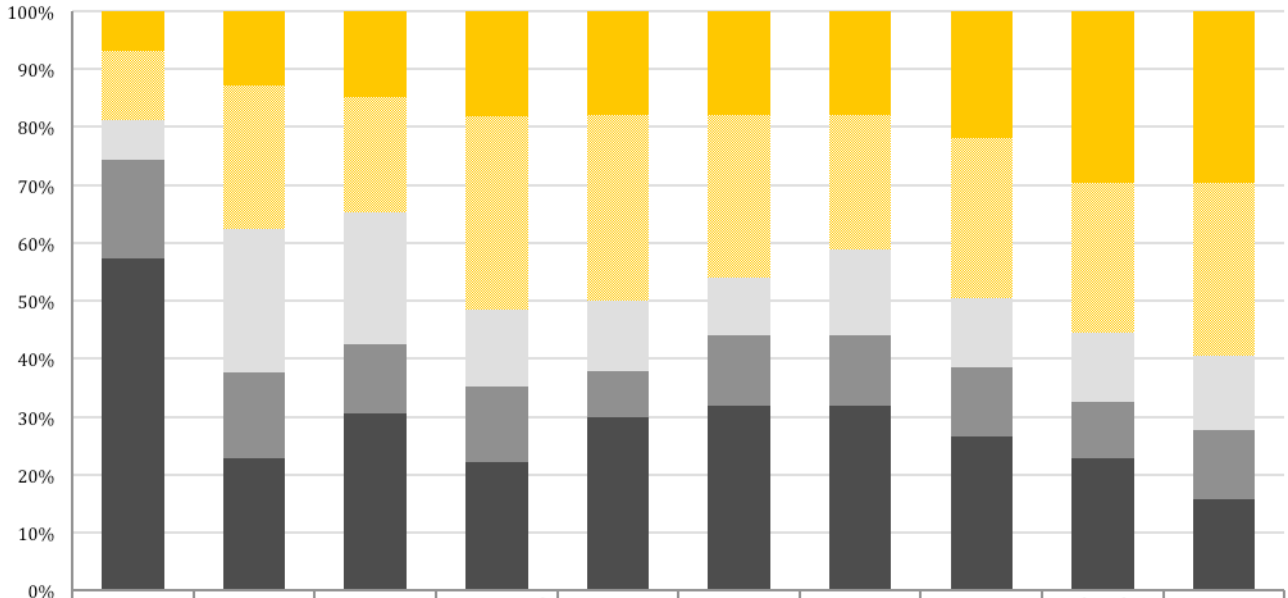
Chart 10 results show that National students were also actively engaged in doing STEM on all or most days in JSHS. For example, on most days or every day, 60% of responding National students reported participating in hands-on activities, 56% indicated identifying questions or problems to investigate, and 51% reported coming up with creative explanations or solutions. However, for each of the activities listed, between 16% and 58% of National students reported that they had not engaged in the activity at all in JSHS.

Chart 9: R-JSHS Student Engagement in STEM Practices in JSHS (n = 304-306)



	Build or make a computer model	Work as part of a team	Use laboratory procedures and tools	Design an investigation	Carry out an investigation	Participate in hands-on STEM activities	Come up with creative explanations or solutions	Identify questions or problems to investigate	Draw conclusions from an investigation	Analyze data or information
Every day	8%	14%	16%	18%	20%	23%	24%	25%	25%	26%
Most days	8%	21%	24%	21%	21%	24%	26%	24%	27%	25%
A few times	10%	14%	16%	16%	16%	15%	16%	18%	18%	17%
At least once	12%	18%	9%	13%	12%	11%	12%	15%	12%	12%
Not at all	62%	33%	36%	32%	31%	27%	22%	19%	19%	19%

Chart 10: N-JSHS Student Engagement in STEM Practices in JSHS (n = 61)



	Build or make a computer model	Work as part of a team	Use laboratory procedures and tools	Come up with creative explanations or solutions	Analyze data or information	Carry out an investigation	Design an investigation	Draw conclusions from an investigation	Identify questions or problems to investigate	Participate in hands-on STEM activities
Every day	7%	13%	15%	18%	18%	18%	18%	22%	30%	30%
Most days	12%	25%	20%	33%	32%	28%	23%	28%	26%	30%
A few times	7%	25%	23%	13%	12%	10%	15%	12%	12%	13%
At least once	17%	15%	12%	13%	8%	12%	12%	12%	10%	12%
Not at all	58%	23%	31%	22%	30%	32%	32%	27%	23%	16%

A composite score was calculated for this set of items, titled "Engaging in STEM Practices in JSHS."[7] Response categories were converted to a scale of 1 = "Not at all" to 5 = "Every day" and the average across all items in the scale was calculated. The composite score was used to test whether there were differences in student experiences by Regional or National JSHS participation, gender, and race/ethnicity group (minority vs. non-minority students). No significant group differences found in terms of Engaging with STEM Practices in JSHS.

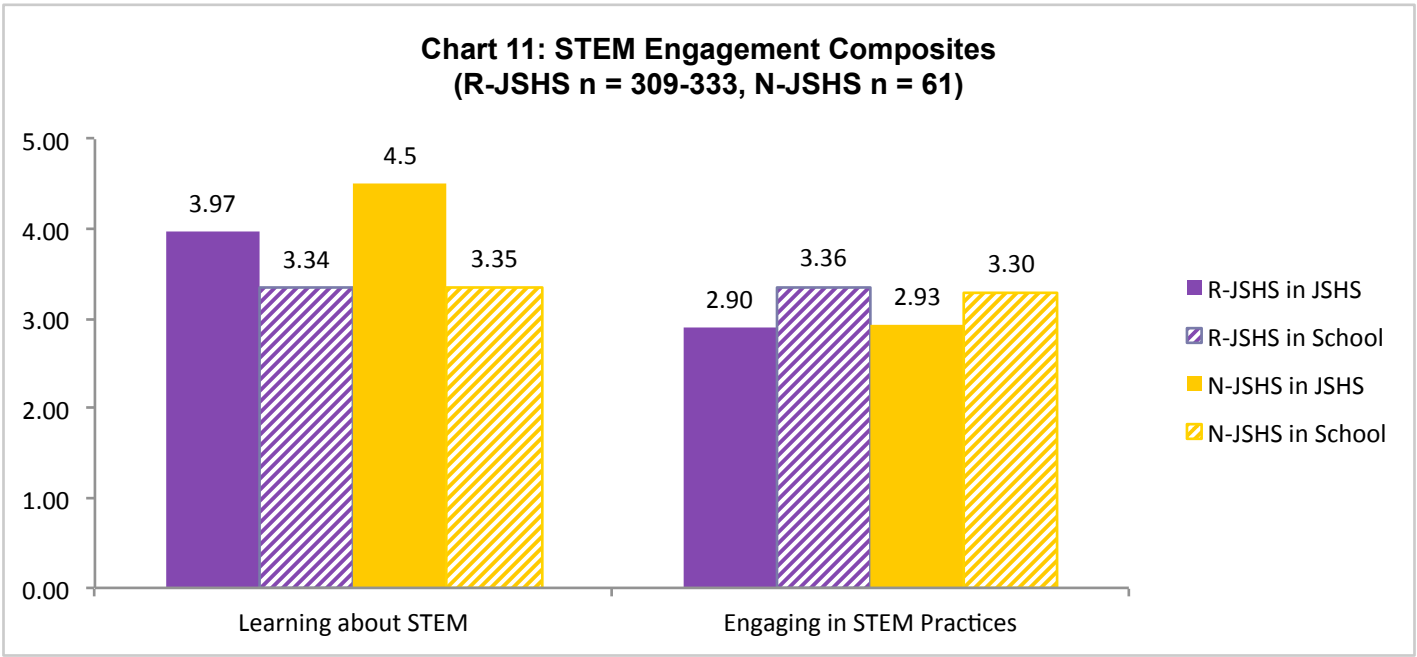
Mentors were asked to respond to parallel items about their students' activities in JSHS. Mentor responses were generally similar to student responses, although mentors tended to report more frequent engagement in some activities and their responses were overall more similar to N-JSHS students' responses than R-JSHS students'. For example, 68% of

[7] The Cronbach's alpha reliability for these 10 items was 0.951.

mentors reported that students participated in hands-on STEM activities, 53% that students used laboratory procedures and tools, and 45% that students designed investigations on most days or every day of their JSHS experience.

To examine how the JSHS experience compares to their typical school experience, students were asked how often they engaged in the same activities in school. The responses were combined into composites[8] that are parallel to the ones asking about JSHS (individual item responses can be found in Appendix B). Students reported greater "Learning about STEM" in JSHS than in school[9] for both Regional (large effect of d = 1.042 standard deviations) and National (large effect of d = 2.427 standard deviations) students. Opposite results were found for the "Engaging in STEM Practices" composite; the "in school" scores were higher[10] than the "in JSHS" version for Regional (medium effect of d = 0.673 standard deviations) and National students (medium effect of d = 0.638 standard deviations) (see Chart 11). These data indicate that JSHS provides students with more intensive STEM learning experiences, but suggest that JSHS students engage in STEM practices frequently in school.

Chart 11: STEM Engagement Composites
(R-JSHS n = 309-333, N-JSHS n = 61)



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

[9] Two-tailed dependent samples t-tests: R-JSHS, $t(348) = 9.72$, $p < 0.001$; N-JSHS, $t(60) = 9.40$, $p < 0.001$.

[10] Two-tailed dependent samples t-tests: R-JSHS, $t(348) = 6.28$, $p < 0.001$; N-JSHS, $t(60) = 2.47$, $p = 0.016$.

The Role of Mentors

Mentors play a critical role in the JSHS program. Mentors provide one-on-one support to students, chaperone students, advise students on educational and career paths, may provide opportunities for students to use laboratory space and/or equipment, and generally serve as STEM role models for JSHS students. Over 70% of mentors responding to the mentor questionnaire reported working with 5 or fewer students, with a range of 0 to 50 students. Mentors were asked whether or not they used a number of strategies when working with students. These strategies comprised five main areas of effective mentoring: [11]

1. Establishing the relevance of learning activities;
2. Supporting the diverse needs of students as learners;
3. Supporting students' development of collaboration and interpersonal skills;
4. Supporting students' engagement in "authentic" STEM activities; and
5. Supporting students' STEM educational and career pathways.

Table 19 indicates that a majority of responding mentors used multiple strategies to establish relevance of learning activities to students. For example, the vast majority tried to learn about the students and their interests at the beginning of the program (84%) and encouraged students to suggest new reading, activities, or projects (79%). Many also helped students become aware of the roles STEM plays in their everyday lives (77%); helped students see how STEM can affect them or their communities (74%); asked students to relate outside events or activities to topics covered in the program (68%), gave students real-life problems to investigate or solve (67%); or selected readings or activities related to students' backgrounds (63%).

[11] Mentoring strategies examined in the evaluation were best practices identified in various articles including:

Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among US students. *Science Education*, *95*(5), 877-907.

Ornstein, A. (2006). The frequency of hands-on experimentation and student attitudes toward science: A statistically significant relation (2005-51-Ornstein). *Journal of Science Education and Technology*, *15*(3-4), 285-297.

Sadler, P. M., Sonnert, G., Hazari, Z., & Tai, R. (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science Education*, *96*(3), 411-427.

Table 19. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 198-203)	
Item	**Questionnaire Respondents**
Becoming familiar with my student(s) backgrounds and interests at the beginning of JSHS	84%
Encouraging students to suggest new readings, activities, or projects	79%
Helping students become aware of the roles STEM plays in their everyday lives	77%
Helping students understand how STEM can help them improve their communities	74%
Asking students to relate outside events or activities to topics covered in JSHS	68%
Giving students real-life problems to investigate or solve	67%
Selecting readings or activities that relate to students' backgrounds	63%

Mentors also reported using a variety of strategies to support the diverse needs of students as learners. As can be seen in Table 20, 82% of mentors reported using a variety of teaching and/or mentoring activities to meet the needs of students while 75% interacted with students and other personnel the same way regardless of their backgrounds. Nearly three-quarters of mentors (74%) reported directing students to other individuals or programs for additional support. treating all students the same way, regardless of gender or race/ethnicity. Over half of responding mentors also reported using strategies such as identifying different learning styles students may have at the beginning of their JSHS experience (61%) and providing extra readings, activities, or learning support for students who lacked essential background skills (59%).

Table 20. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 196-199)	
Item	**Questionnaire Respondents**
Use a variety of teaching and/or mentoring activities to meet the needs of all students	82%
Interact with students and other personnel the same way regardless of their background	75%
Directing students to other individuals or programs for additional support as needed	74%
Identify the different learning styles that my student (s) may have at the beginning of the JSHS experience	61%
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	59%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	55%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	50%

Mentors also used a variety of strategies to support students' development of collaboration and interpersonal skills (see Table 21). For example, 81% of respondents had students give and receive constructive feedback with others while over three-quarters of responding mentors also had students listen to the ideas of others with an open mind (78%) and explain difficult ideas to others (76%).

Table 21. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 198-201)	
Item	**Questionnaire Respondents**
Having my student(s) give and receive constructive feedback with others	81%
Having my student(s) listen to the ideas of others with an open mind	78%
Having my student(s) explain difficult ideas to others	76%
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	72%
Having my student(s) tell other people about their backgrounds and interests	70%

Mentors were also asked to indicate what strategies they used to support student engagement in authentic STEM activities. Over three-quarters of respondents indicated that they allowed students to work independently to improve their self-management skills (82%), provided students with constructive feedback to improve their STEM competencies (81%), and had students search for and review technical research to support their work (78%). Similarly, 75% of mentors indicated that they supervised students while they practiced STEM research skills and that they demonstrated laboratory/field techniques, procedures, and tools for students. Over half of mentors (56%) also reported teaching (or assigning readings) about specific STEM subject matter.

Table 22. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 195-198)	
Item	**Questionnaire Respondents**
Allowing students to work independently to improve their self-management abilities	82%
Providing my student(s) with constructive feedback to improve their STEM competencies	81%
Having my student(s) search for and review technical research to support their work	78%
Supervising my student(s) while they practice STEM research skills	75%
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	75%
Teaching (or assigning readings) about specific STEM subject matter	56%

Finally, mentors were asked to report on the mentoring strategies they used to support students' STEM educational and career pathways (see Table 23).[12] The majority of responding mentors reported using strategies such as asking students about their educational and career interests (84%), providing guidance to students about educational pathways that would prepare them for a STEM career (74%), recommending extracurricular programs that align with their educational goals (69%), and helping students with their resume, application, personal statement, and/or interview preparations (69%).

Given the AEOP goal of increasing participants' awareness of DoD STEM career opportunities, it is noteworthy that less than half of mentors (46%) reported discussing STEM career opportunities with the DoD or other government agencies. Likewise, although an AEOP goal is to increase participants' awareness of AEOP opportunities, only 36% of mentors reported recommending other AEOPs that align with student goals. It should be noted, however that these responses represent an increase in mentor activities from FY14 when only 30% reported discussing STEM careers within the DoD or other government agencies and 18% reported recommending other AEOPs to students.

Table 23. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 192-196)

Item	Questionnaire Respondents
Asking my student(s) about their educational and/or career goals	84%
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	74%
Recommending extracurricular programs that align with students' goals	69%
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	69%
Discussing STEM career opportunities in private industry or academia	67%
Helping students build a professional network in a STEM field	60%
Discussing the economic, political, ethical, and/or social context of a STEM career	60%
Recommending student and professional organizations in STEM to my student(s)	58%
Discussing STEM career opportunities within the DoD or other government agencies	46%
Recommending Army Educational Outreach Programs that align with students' goals	36%

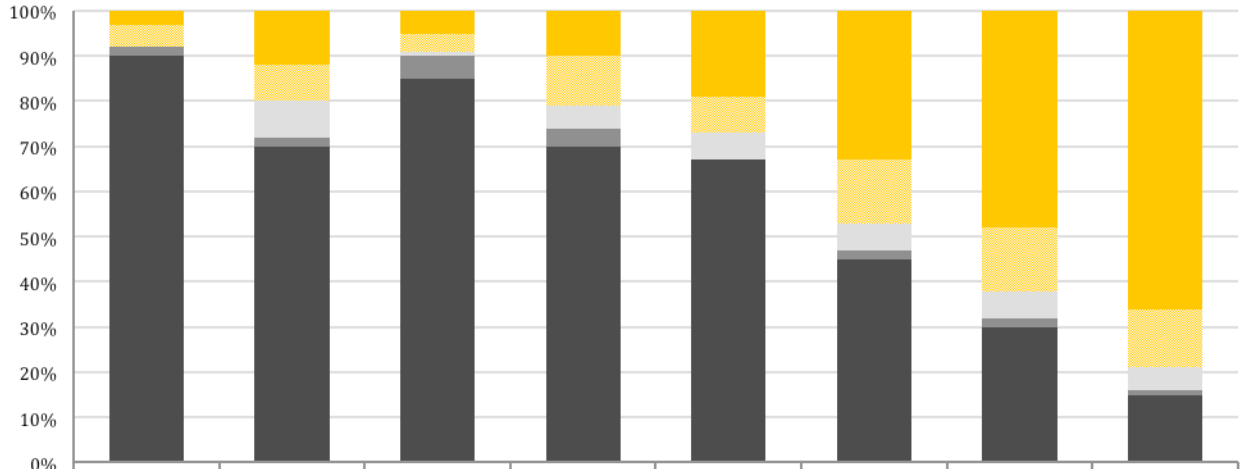
Another item on the questionnaire asked mentors which of the AEOP programs they explicitly discussed with their students during JSHS (see Table 24). Not surprisingly, the most frequently discussed program was JSHS (67. Few responding mentors indicated discussing other specific AEOPs with students. Of those mentors who did report discussing specific AEOPs, the most frequently discussed programs were UNITE (19%) and SMART (16%).

[12] The student questionnaire included subset of these items. The student data are similar to the mentor data, and can be found in Appendix B.

Table 24. Mentors Explicitly Discussing AEOPs with Students (n = 202-212)	
Item	**Questionnaire Respondents**
Junior Science & Humanities Symposium (JSHS)	67%
I discussed AEOP with my student(s) but did not discuss any specific program	19%
UNITE	19%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	16%
Science & Engineering Apprenticeship Program (SEAP)	12%
Research & Engineering Apprenticeship Program (REAP)	11%
Undergraduate Research Apprenticeship Program (URAP)	10%
GEMS Near Peer Mentor Program	8%
High School Apprenticeship Program (HSAP)	7%
College Qualified Leaders (CQL)	5%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	5%

In an effort to understand what resources are most valuable to JSHS participants, mentors were asked to respond to a questionnaire item asking them how useful various resources were in their efforts to expose students to other AEOPs. Chart 14 illustrates that participation in JSHS (66%) the JSHS program administrator or site coordinator (48%), and invited speakers or career events (33%) were most often rated as "very much" useful. Most responding mentors were unfamiliar with AEOP materials such as the It Starts Here! Magazine, which 90% of responding mentors had not experiences. Likewise, 85% of mentors had not experienced AEOP on social media, and 70% had not experienced the AEOP brochure.

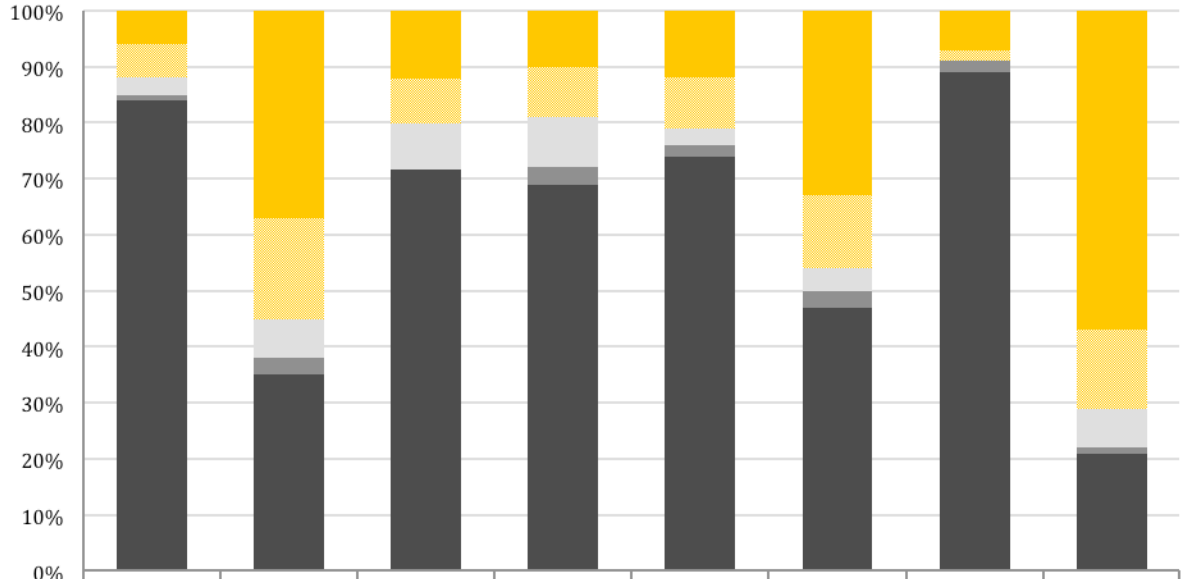
Chart 12: Usefulness of Resources for Exposing Students to AEOPs (n = 208-218)



	It Starts Here! Magazine	AEOP website	AEOP on Facebook, Twitter, Pinterest, or other social media	AEOP brochure	Academy of Applied Science website (AAS)	Invited speakers or career events	JSHS program administration or site coordinator	Participation in JSHS
Very Much	3%	12%	5%	10%	19%	33%	48%	66%
Somewhat	5%	8%	4%	11%	8%	14%	14%	13%
A little	0%	8%	1%	5%	6%	6%	6%	5%
Not at all	2%	2%	5%	4%	0%	2%	2%	1%
Did not experience	90%	70%	85%	70%	67%	45%	30%	15%

Another questionnaire item asked mentors how useful these resources were for exposing students to DoD STEM careers (see Chart 13). Again, mentors were most likely to rate participation in JSHS as useful, with 57% indicating this was "very much" useful. Likewise, 37% of mentors found the JSHS program administrator or site coordinator very useful in exposing students to DoD STEM careers, and 33% found invited speakers or career events very useful for this purpose. Large proportions (69-84%) of mentors again reported not having experienced AEOP materials.

Chart 13: Usefulness of Resources for Exposing Students to DoD STEM Careers (n = 206-214)

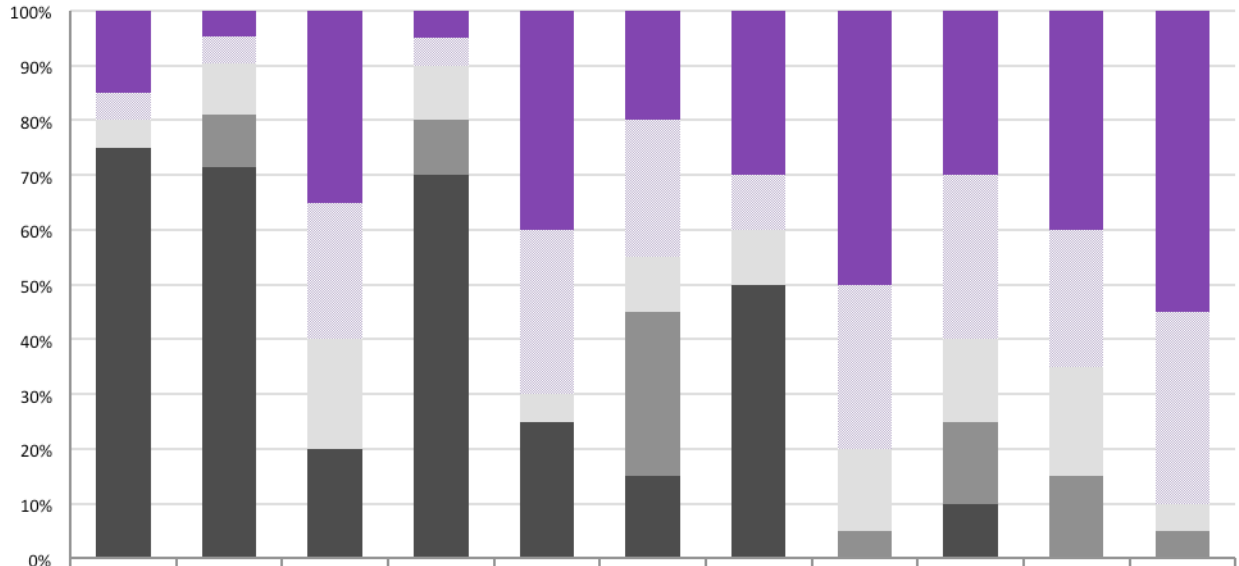


	AEOP on Facebook, Twitter, Pinterest, or other social media	JSHS program leads or site coordination	AEOP website	AEOP brochure	Academy of Applied Science (AAS) website	Invited speakers or "career" events	It Starts Here! Magazine	Participation in JSHS
Very Much	6%	37%	12%	10%	12%	33%	7%	57%
Somewhat	6%	18%	8%	9%	9%	13%	2%	14%
A little	3%	7%	8%	9%	3%	4%	0%	7%
Not at all	1%	3%	0%	3%	2%	3%	2%	1%
Did not experience	84%	35%	71%	69%	74%	47%	89%	21%

Satisfaction with JSHS

Both students and mentors were asked how satisfied they were with a number of features of the JSHS program. Chart 14 displays Regional students' responses to this question. Over half of responding Regional students were somewhat or very much satisfied with the student oral presentations (55%) while half (50%) were very satisfied with student poster presentations. Less than half (40%) were very satisfied with social events and invited speaker presentations while 35% reported being very satisfied with features such as feedback from VIPs and peers (35%), tours of field trips (30%), and the judging process (30%). Another 30% of students indicated being not at all satisfied with feedback from judges while 15% were not at all satisfied with the judging process. It should be noted that large proportions of students did not experience features such as panel or round table discussions (70%), team-building activities (75%), and career exhibits (75%).

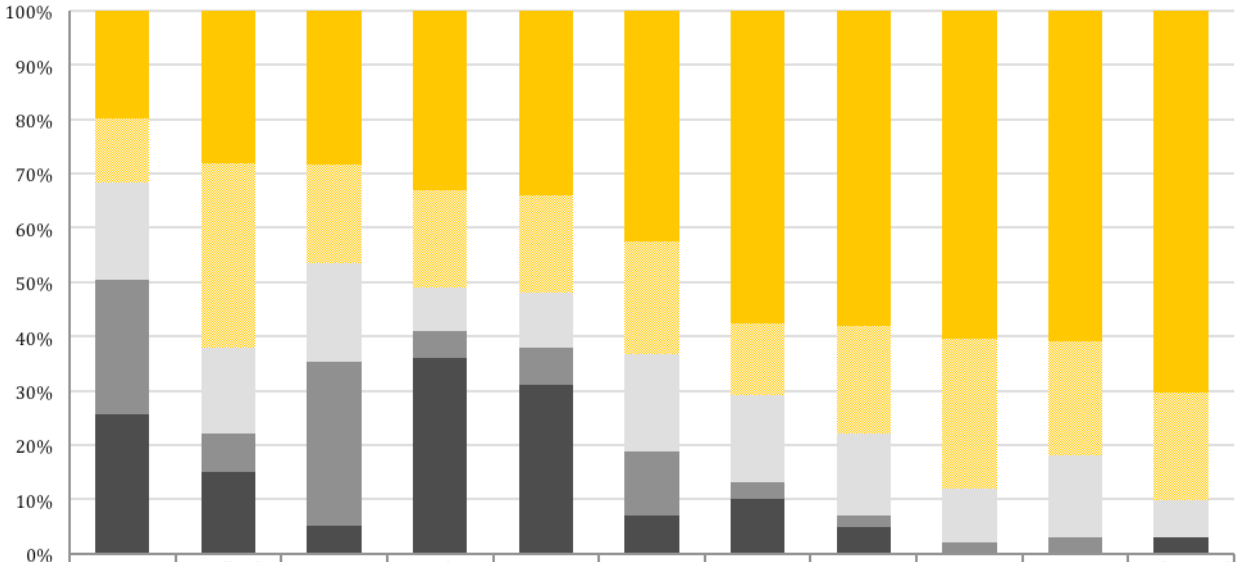
Chart 14: R-JSHS Student Satisfaction with R-JSHS Program Features (n = 20)



	Career Exhibits	Team Building Activities	Feedback from VIPs and Peers	Panel or Roundtable Discussions	Social Events	Feedback from Judges	Tours or Field Trips	Student Poster Pres.	Judging Process	Invited Speaker Pres.	Student Oral Pres.
Very Much	15%	5%	35%	5%	40%	20%	30%	50%	30%	40%	55%
Somewhat	5%	5%	25%	5%	30%	25%	10%	30%	30%	25%	35%
A little	5%	10%	20%	10%	5%	10%	10%	15%	15%	20%	5%
Not at all	0%	10%	0%	10%	0%	30%	0%	5%	15%	15%	5%
Did not experience	75%	75%	20%	70%	25%	15%	50%	0%	10%	0%	0%

N-JSHS students were also asked about their satisfaction with features of R-JSHS. National students respondents tended to be somewhat more satisfied than R-JSHS respondents with features such as oral presentations (71%), invited speaker presentations (61%), and tours or field trips (61%). As can be seen in Chart 15, these students also indicated being not at all satisfied with some features, including the judging process (30%), student poster presentations (16%), and feedback from VIPs and peers (16%).

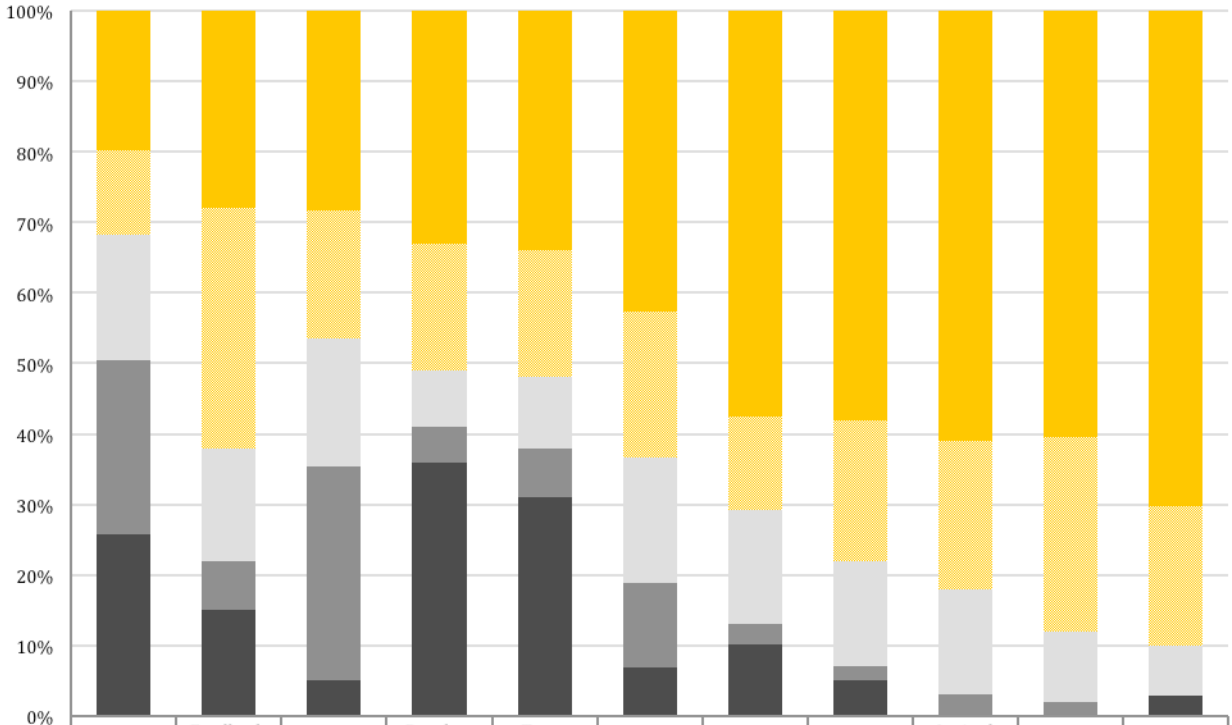
Chart 15: N-JSHS Student Satisfaction with R-JSHS Program Features (n = 61)



	Feeback from Judges	Feedback from VIPs and Peers	Judging Process	Panel or Roundtable Discussions	Team Building Activities	Student Poster Pres.	Career Exhibits	Social Events	Tours or Field Trips	Invited Speakers	Student Oral Research Pres.
Very Much	20%	28%	28%	33%	34%	43%	57%	58%	61%	61%	71%
Somewhat	12%	34%	18%	18%	18%	21%	13%	20%	28%	21%	20%
A little	18%	16%	18%	8%	10%	18%	16%	15%	10%	15%	7%
Not at all	25%	7%	30%	5%	7%	12%	3%	2%	2%	3%	0%
Did not experience	26%	15%	5%	36%	31%	7%	10%	5%	0%	0%	3%

As can be seen in Chart 16, 50% or more of responding National students were “very much” or “somewhat” satisfied with all but two (judging and feedback from judges) of the listed features of the N-JSHS. Oral presentations were rated as “very much” satisfying by an overwhelming 71% of responding students and “somewhat” satisfying by an additional 20%. Other program features rated as “very much” or “somewhat” satisfying by most (51% or more) student responders were: tours and field trips (89%); speakers (82%); social events (78%); career exhibits (70%); poster presentations (64%); team building (52%); panel/roundtable discussions (51%); and feedback from VIPs and peers (62%). Similar to their responses regarding R-JSHS, 30% of N-JSHS students were not at all satisfied with the judging process and 25% were not at all satisfied with feedback from judges.

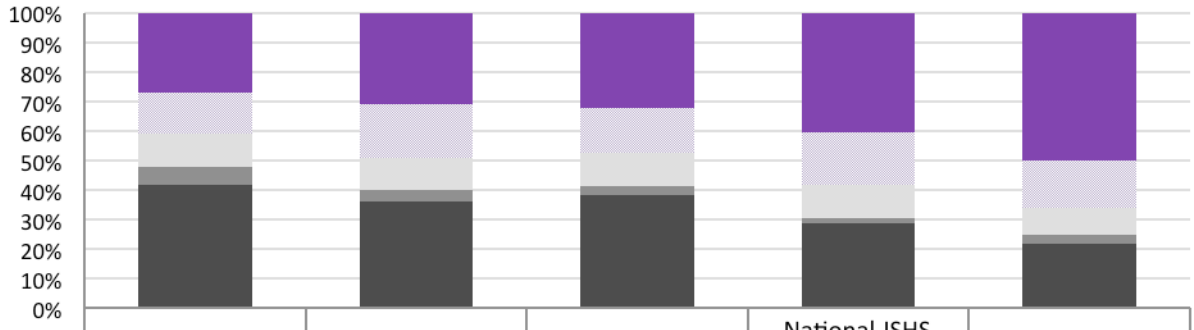
Chart 16: N-JSHS Student Satisfaction with N-JSHS Program Features (n = 60-61)



	Feedback from Judges	Feedback from VIPs and Peers	Judging Processes	Panel or Roundtable Discussions	Team Building Activities	Student Poster Pres.	Career Exhibits	Social Events	Invited Speaker Pres.	Tours or Field Trips	Student Oral Pres.
Very Much	20%	28%	28%	33%	34%	43%	57%	58%	61%	61%	71%
Somewhat	12%	34%	18%	18%	18%	21%	13%	20%	21%	28%	20%
A little	18%	16%	18%	8%	10%	18%	16%	15%	15%	10%	7%
Not at all	25%	7%	30%	5%	7%	12%	3%	2%	3%	2%	0%
Did not experience	26%	15%	5%	36%	31%	7%	10%	5%	0%	0%	3%

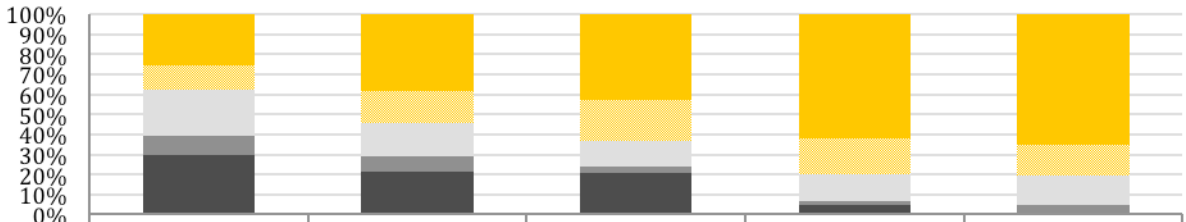
Students were asked their opinions on the usefulness of JSHS resources available to them. There appears to be differences between Regional and National students, with National students reporting the resources as more useful. For example, Chart 17 shows that 66% of Regional students reported that the paper submissions and competition guidelines were “very much” or “somewhat” useful whereas chart 20 shows that 81% of National students reported that the paper submission and competition guidelines were “very much” or “somewhat” useful. More than half of the National students found the National JSHS Groundrules for Student Presentations (80%), oral presentation tips (63%), and sample papers (54%) “very much” or “somewhat “useful, compared to 59%, 47%, and 49% of Regional students, respectively. Also, for each resource listed, there was also a sizeable portion (22% to 42%) of Regional students who reported that they did not experience the resource.

Chart 17: Usefulness of JSHS Resources for R-JSHS Students (n = 284-286)



	Selected Articles - Conducting Research	Oral Presentation Tips	Sample Papers	National JSHS Groundrules for Student Presentations	Paper Submissions and Competition Deadlines
Very Much	27%	31%	32%	41%	50%
Somewhat	14%	18%	15%	18%	16%
A little	11%	11%	11%	11%	9%
Not at all	6%	4%	3%	2%	3%
Did not experience	42%	36%	38%	29%	22%

Chart 18: Usefulness of JSHS Resources for N-JSHS Students (n = 61)



	Selected Articles - Conducting Research	Sample Papers	Oral Presentation Tips	National JSHS Groundrules for Student Presentations	Paper Submissions and Competition Deadlines
Very Much	26%	38%	43%	62%	66%
Somewhat	12%	16%	20%	18%	15%
A little	23%	16%	13%	13%	15%
Not at all	10%	8%	3%	2%	5%
Did not experience	30%	21%	21%	5%	0%

Table 25 reports on students' satisfaction with access to their mentor. Over half (57%) of responding Regional students indicated their mentor was always available compared to 37% of responding National students. However, 11% of Regional and 12% of National students reported that their mentor was never available. All Regional students indicated that they had a mentor, but 10% of National students reported not having a mentor.

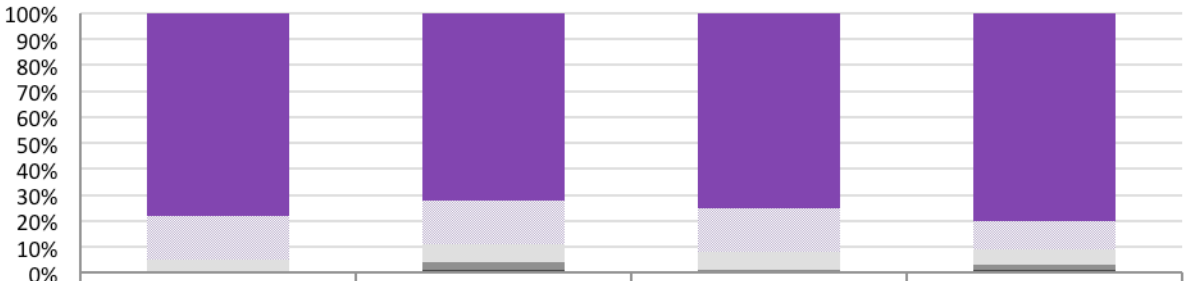
Table 25. Student Reports of Availability of Mentors

Item	R-JSHS Questionnaire Respondents (n = 217)	N-JSHS Questionnaire Respondents (n = 61)
The mentor was always available	57%	37%
The mentor was available more than half of the time	15%	18%
The mentor was available about half of the time of my project	9%	12%
The mentor was available less than half of the time	9%	12%
The mentor was never available	11%	12%
I did not have a mentor	0%	10%

Charts 19 and 20 report student responses to questionnaire items asking them about their satisfaction with various features of their JSHS experience. The vast majority of reporting Regional as well as National students indicated being "very much" or "somewhat" satisfied with each of the features. Most notably, 91% of Regional students reported being "very much" or "somewhat" satisfied with their working relationship with their mentor and 92% reported being "very

much" or "somewhat" satisfied with the amount of meaningful research. 97% of National students reported being "very much" or "somewhat satisfied" with the research experience overall and 99% "very much" or "somewhat" satisfied with the time they spent doing meaningful research.

Chart 19: R-JSHS Student Satisfaction with Their Experience (n = 217-218)

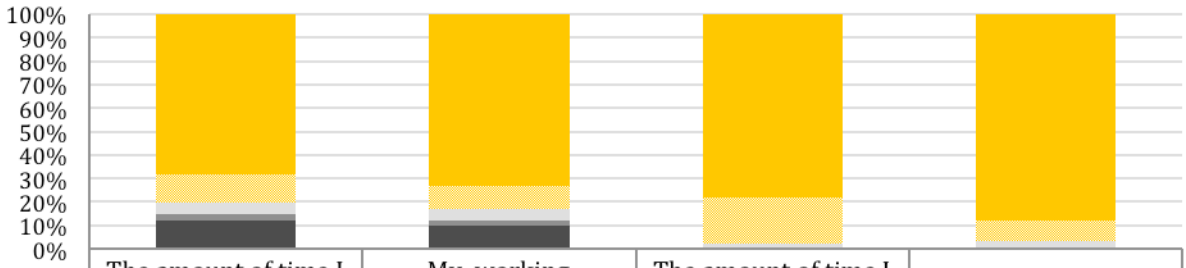


	The research experience overall	The amount of time I spent with my research mentor	The amount of time I spent doing meaningful research	My working relationship with my mentor
Very Much	78%	72%	75%	80%
Somewhat	17%	17%	17%	11%
A little	5%	7%	7%	6%
Not at all	0%	3%	1%	2%
Did not experience	0%	1%	0%	1%

JSHS experience satisfaction items were combined into a composite variable[13] to assess for differences between groups of students. No statistical differences were found by gender, race/ethnicity, or program level (National vs. Regional) in terms of student satisfaction with their JSHS experience.

[13] The Cronbach's alpha reliability for these 4 items was 0.882.

Chart 20: N-JSHS Student Satisfaction with Their Experience (n = 61)



	The amount of time I spent with my research mentor	My working relationship with my mentor	The amount of time I spent doing meaningful research	The research experience overall
Very Much	69%	74%	79%	79%
Somewhat	12%	10%	20%	8%
A little	5%	5%	2%	3%
Not at all	3%	2%	0%	0%
Did not experience	12%	10%	0%	0%

An open-ended item on the questionnaire asked student about their overall satisfaction with their JSHS experience. Of the 167 Regional students and 49 National students who provided a response to this question, 119 (71%) Regional respondents and 33 (67%) National respondents commented on only positive aspects of the program. Many of these responses were simple affirmations of the student's experience in the program such as "I love JSHS. I am very satisfied with it!" (R-JSHS student) or "Wow!!!! It's something I will forever remember and has shaped my life and future in un-measurable ways" (N-JSHS student). Other students were more specific about what they enjoyed about the program. The most frequently mentioned source of satisfaction was connecting with other students interested in STEM (mentioned by 13 R-JSHS respondents and 9 N-JSHS respondents). Other areas of particular satisfaction included learning about careers, networking with STEM professionals, and learning about others' research and STEM in general. For example:

> *I absolutely loved JSHS. I have never had an experience like it before in my life and I am so thankful to have been a part of it. I can't wait to come back next year and the year after that! The judges were nice, the hosts were nice, and most of the other students were nice. I felt like the little project I had been building…had finally come to life and [the ideas] weren't just in my head. They were real, good ideas and people actually want to hear what I came up with because I can actually make something that would benefit society in some way. It was like a basketball game for STEM. I felt like I was on the All Stars team.* (R-JSHS Student)

I had a wonderful experience with JSHS. I enjoyed learning about research conducted by the Army and other government organizations in the fields of engineering and nano-technology. (R-JSHS Student)

Participating in JSHS was among the most defining moments of my high school career. I learned so much about different STEM fields from listening to all of the speakers and student presenters. I also learned a lot about the different AEOP programs and am very interested in the SMART program especially. Additionally, the feedback I got from my judges were really helpful in developing future plans for my project. My JSHS experience will always be one I look back to with the fondest memories. Thank you for making it possible. (N-JSHS Student)

It has always been a dream of mine to participate in an event such as this…[I] learned a lot from m peers. They simplified their projects in order for people to truly understand and grasp the concept of their research. The atmosphere was filled with the love for science, math, and technology, and I was just simply amazed with ever aspect. (N-JSHS Student)

Most other respondents also included positive comments but offered some caveats (40 R-JSHS, or 24%; 10 N-JSHS, or 30%) while a small number of students offered no positive comments in their responses (8 R-JSHS, or 5%; 6 N-JSHS, or 12%). These caveats were focused on judging issues and dissatisfaction with the poster sessions. Fourteen R-JSHS students (8%) had concerns about judging. Concerns and suggestions included vague judging standards, ensuring a consistent number of judges per presenter, lack of judge feedback to presenters, perception of judging bias, and suggestions that judges' areas of expertise be matched with presenters. At the National level, student dissatisfaction focused on the poster sessions (10 N-JSHS, or 30%), with a particular emphasis on the lack of time for judging, the small number of judges, and the lack of categories for posters. For example:

Although I enjoyed the JSHS experience and am very glad I participated, the judging standards that our judges were held to were very vaguely defined, and did not help my classmates or me afterwards. From the two judged I had, I only received one score sheet back, and even that judge had not graded me in any presentation criteria, she only took notes. (R-JSHS Student)

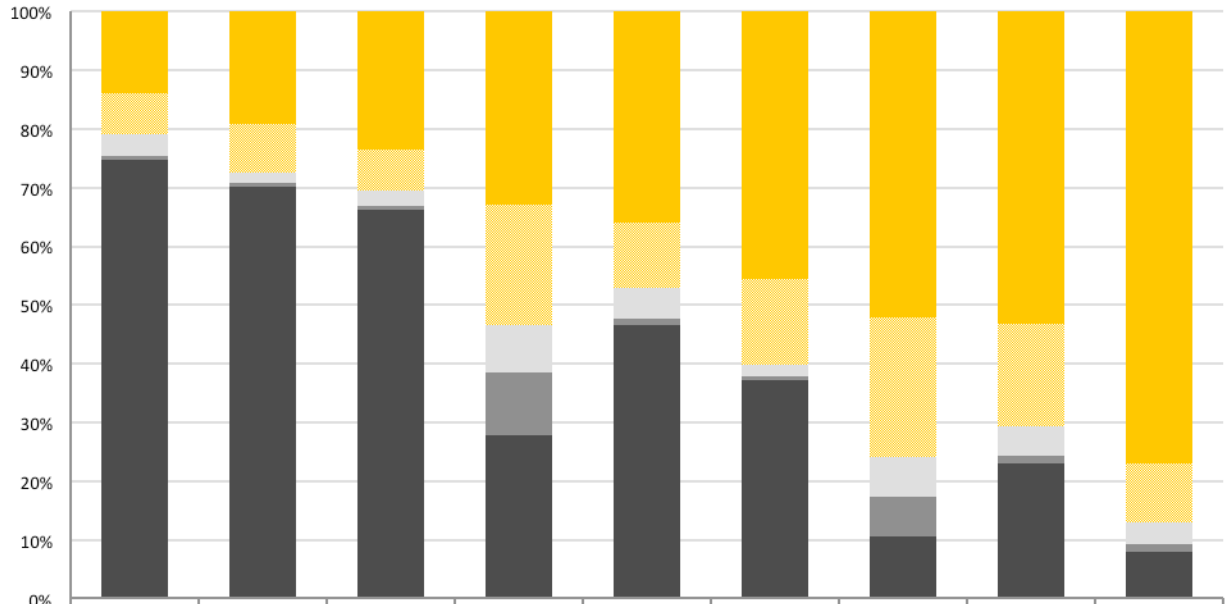
The speaker competition was very well run. However, the poster competition was not. I only received two official judges and was told I had to leave to get on the bus without much care. Considering I spent 5 years on my research and many, many hours of my mentors' time preparing for this competition, I was very disappointed in this response. While the poster competition may be secondary to the speaker competition, it encompasses a larger number of participants that all have quality research. 1 ½ hours is not long enough for the judges to judge 121 projects…I think that the poster competition can be a very good positive competition, but right now it needs improvement. (N-JSHS Student)

"Every year, I have nothing but great words for this program. I really hope that JSHS is around 30 years from now. I would love to come back as a judge or as a speaker." – N-JSHS Student

Students were also asked to respond to an open-ended questionnaire item asking how the program could be improved. Most of the 156 R-JSHS and 50 N-JSHS offered at least one suggestion fro improvement, although 2 R-JSHS respondents and 1 N-JSHS respondent indicated that no improvements were necessary. Similar to student responses about their overall satisfaction, judging practices were an area that many students (48 R-JSHS, or 31%; 16 N-JSHS, or 32%). felt could be improved. Students particularly indicated that they would like more feedback from judges, more judges for poster sessions, that scoring sheets be returned to them with feedback, that judging be standardized, and that judges' fields of expertise be matched with presenters' fields of research. Some potential modifications to the poster sessions were also suggested by the 20 R-JSHS respondents (13%) and 23 N-JSHS respondents (46%). R-JSHS students emphasized the need for a sufficient number of qualified judging and that they wished for more awards for posters. N-JSHS students responded that there should be more space and time for poster sessions, that there should be various categories for posters, more awards for posters, more time for students to view posters, more judging time, and less peer review because of "vote trading" among students. Another commonly mentioned suggested improvement was to provide more opportunities to meet and socialize with other students, particularly at N-JSHS (11 R-JSHS, or 7%; 18 N-JSHS, or 36%). This is especially significant in light of the fact that connecting with peers was identified as one of the primary benefits of R-JSHS (33% of respondents) and N-JSHS (52%) in another open-ended questionnaire item. Other suggested improvements included altering the timing, location, and organization of the events (12% of R-JSHS respondents; 32% of N-JSHS respondents), having more or a wider variety of presentations from STEM professionals (8% of R-JSHS respondents; 6% of N-JSHS respondents), more hands-on activities (10% of R-JSHS respondents; 8% of N-JSHS respondents), improving the marketing of JSHS (10% of R-JSHS respondents; 2% of N-JSHS respondents), and clarifying rules and expectations via communications and the website (7% of R-JSHS respondents; 8% of N-JSHS respondents). Other suggestions, offered by fewer than 5% of students included including ensuring that the humanities component of JSHS is recognized and included (R-JSHS), providing tips or examples of papers and presentations (R-JSHS), providing assistance in identifying mentors (R-JSHS), making winners' papers available on the website (R-JSHS), ensuring that students' work is their own and/or providing separate categories for mentored versus un-mentored projects (N-JSHS), and providing a forum for collaborative projects (N-JSHS).

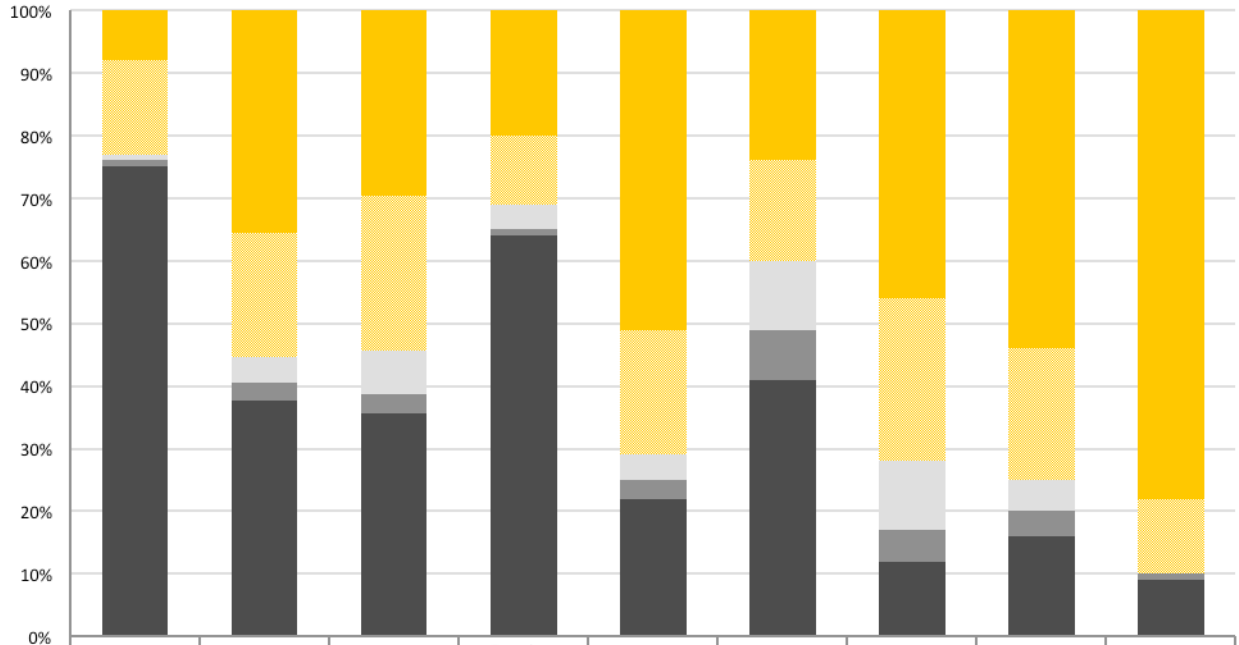
Charts 21 (Regional) and 22 (National) summarize satisfaction as reported by the mentors with JSHS program features. Many mentors reported being "very much" or "somewhat" satisfied with the program features they experienced. For example, regarding student oral presentations, 87% of Regional mentors and 90% of National mentors reported they were "very much" or "somewhat" satisfied. 71% of both Regional and National mentors reported being "very much" or "somewhat" satisfied with invited speaker presentations. Also, 76% of Regional and 72% of National mentors reported being "very much" or "somewhat" satisfied with the judging process. However, many mentors from both Regional and National also reported that they did not experience several of the components.

Chart 21: Mentor Satisfaction with R-JSHS Program Features (n = 157-161)



	Career Exhibits	Panel or Roundtable Discussions	Team Building Activities	Feedback from Judges	Tours or Field Trips	Student Poster Presentations	Judging Process	Invited Speaker Presentations	Student Oral Presentations
Very Much	14%	19%	24%	33%	36%	46%	52%	53%	77%
Somewhat	7%	8%	7%	21%	11%	15%	24%	18%	10%
A little	4%	2%	3%	8%	5%	2%	7%	5%	4%
Not at all	1%	1%	1%	11%	1%	1%	7%	1%	1%
Did not experience	75%	70%	66%	28%	47%	37%	11%	23%	8%

Chart 22: Mentor Satisfaction with N-JSHS Program Features (n = 81-83)



	Team Building Activities	Tours or Field Trips	Career Exhibits	Panel or Roundtable Discussions	Invited Speaker Presentations	Feedback from Judges	Judging Process	Student Poster Presentations	Student Oral Presentation
Very Much	8%	36%	30%	20%	51%	24%	46%	54%	78%
Somewhat	15%	20%	25%	11%	20%	16%	26%	21%	12%
A little	1%	4%	7%	4%	4%	11%	11%	5%	0%
Not at all	1%	3%	3%	1%	3%	8%	5%	4%	1%
Did not experience	75%	38%	36%	64%	22%	41%	12%	16%	9%

Like the student questionnaire, the mentor questionnaire included open-ended items asking mentors for their opinions about the program. In one item, mentors were asked to the three most important benefits of JSHS; 118 mentors responded to this question. Over a third of responding mentors (39%) responded that the opportunity for students to build presentation skills was a key benefit of JSHS. Likewise, 27% responded that the opportunity for students to connect with like-minded peers was a benefit, and 26% that meeting and networking with STEM professionals is a benefit to students. Mentors also frequently mentioned the opportunity for students to conduct research and develop their research skills (21%), and the opportunity to see other students' research (21%) is benefits to JSHS. Another 8% of responding mentors cited learning about careers and student recognition and rewards for their work, while 7% indicated that the opportunity for students to develop data analysis skills as benefits. Other benefits (mentioned by fewer than 5% of respondents) included the opportunity for teacher networking, teacher involvement in research, DoD information, student teamwork and communication, student writing skills, and increasing student motivation and commitment to science. These themes were echoed in focus groups and rapid interviews. As three mentors said:

The barriers are broken here; there's no distinction of who or what or where [students] come from, but it's a matter of the project they share with one another. (JSHS Mentor)

I like the fact that it's not just a competition that you go to, compete, and go home. [Students] get to interact at both the research level and socially. They kind of feed off of each other in terms of ideas". (JSHS Mentor)

"I see [JSHS] as a golden opportunity for those kids that really put in the extra effort especially in the sciences to show off and stand out in high school other than just the athletes." (JSHS Mentor)

Mentors were also asked to respond to an open-ended item asked them to describe three ways JSHS could be improved for future participants. Of the 94 mentors individuals who responded to this question, about 25% suggested improvements to the judging process or selection of judges, including ensuring that judges come from a diversity of backgrounds and disciplines, standardizing judging procedures, ensuring that students receive feedback from judges, and avoiding judging bias. Other fairly frequently mentioned suggestions that were also mentioned by students included providing more opportunities for student interactions (9%), and improving poster sessions by having more and more qualified judges available (10%). Six percent of respondents suggested that JSHS be more widely promoted, 5% that information about other programs be incorporated into JSHS, and 5% that JSHS provide more assistance to students and teachers in identifying mentors. Other suggestions (mentioned by 5% or fewer of respondents) included allowing more students to attend as observers, providing more awards, and distinguishing between original student research and mentored research. Focus group participants echoed these themes. For example:

I think the judges – the ones they have – for the most part, are good. But they just don't cover the fields the students are working in. When you get a grad student who's done less work than some of the kids asking them questions, that's not right." (JSHS Mentor)

"[Something] that would help in my situation is a mentor network for my students…This year we'd beat down a couple of different paths, and got nowhere with finding a mentor for one of my students. We worked it out, but it wasn't the most ideal." (JSHS Mentor)

Mentors were also asked to comment on their overall satisfaction with their JSHS experience. Of the 103 mentors who responded to this question, nearly all (93%) of the responses included a positive comment about the program. For example:

> *"Excellent program, I hope the US government will always support this outstanding and much needed program!"* (JSHS Mentor)

> *"I believe this is a very valuable and beneficial experience for the students who participate. It reinforces their love of STEM and helps them connect with other students who are like them as well as professionals who represent what they could become."* (JSHS Mentor)

> *"The experience at [the symposium] has been nothing but first class. Our student researchers look forward to participating in this prestigious symposium. The U.S. Army has been instrumental in its success, and the students who attend benefit a great deal. There is no doubt that this symposium is supporting and promoting STEM education and careers."* (JSHS Mentor)

> *"This is the best event I've found to introduce students with a passion for STEM to careers in STEM. They come back energized, excited about science and what it looks like beyond a high school curriculum."* (JSHS Mentor)

While some respondents offered caveats (20%) here were no consistent themes among their suggestions, which included distinguishing between original student research and mentored research, providing more AEOP information, assisting schools in rural and low-income areas to access technology and mentors, having more DoD research presentations, improving judging, and various logistical issues including the timing and location of events.

Outcomes Evaluation

The evaluation of JSHS included measurement of several outcomes relating to AEOP and program objectives, including impacts on students' STEM competencies (e.g., knowledge and skills), STEM identity and confidence, interest in and intent for future STEM engagement (e.g., further education, careers), attitudes toward research, and their knowledge of and interest in participating in additional AEOP opportunities.[14] STEM competencies are necessary for a STEM-literate

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

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

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

citizenry. STEM competencies include foundational knowledge, skills, and abilities in STEM, as well as the confidence to apply them appropriately. STEM competencies are important for those engaging in STEM enterprises, but also for all members of society as critical consumers of information and effective decision makers in a world that is heavily reliant on STEM. The evaluation of JSHS measured students' self-reported gains in STEM competencies and engagement in opportunities intended to develop what is considered to be a critical STEM skill in the 21st Century—collaboration and teamwork.

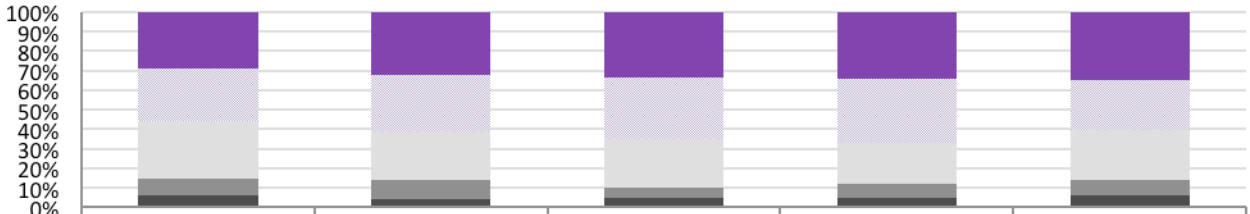
STEM Knowledge and Skills

A vast majority of responding JSHS students reported gains in their STEM knowledge as a result of the JSHS program as summarized in Charts 23 and 24. However, National students tended to report greater impacts than Regional students which may be explained by the inherent differences between Regional and National students. For example, "extreme" or "large" gains were reported by 61% of Regional students and 80% of National students on knowledge of research conducted in a STEM topic or field, and by 66% of Regional students and 75% of National students on their knowledge of what everyday research work is like in STEM. Students reported similar patterns of impact on their knowledge of how scientists and engineers work on real problems in STEM (R-JSHS 64%; N-JSHS 74%) and their knowledge of research processes, ethics, and rules for conduct in STEM (R-JSHS 56%; N-JSHS 63%).

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

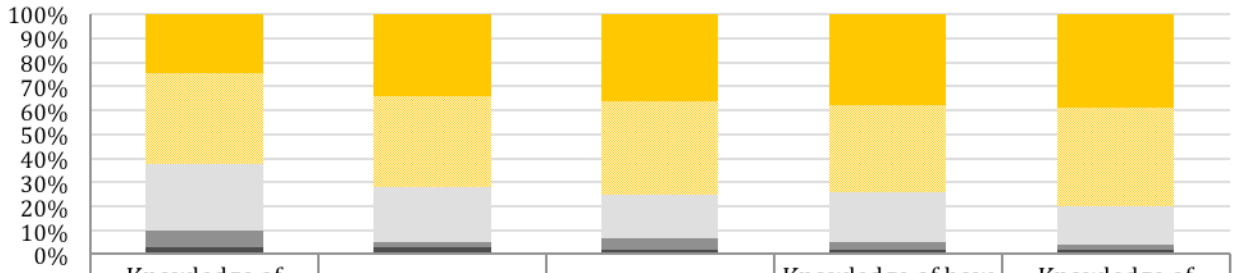
Report of the Academic Competitiveness Council (ACC). (2007). U.S. Department of Education. Available on the Department's Web site at: http://www.ed.gov/about/inits/ed/competitiveness/acc-mathscience/index.html.

Chart 23: R-JSHS Student Reports of Impacts on STEM Knowledge (n = 269-272)



	In depth knowledge of a STEM topic(s)	Knowledge of research processes, ethics, and rules for conduct in STEM	Knowledge of what everyday research work is like in STEM	Knoweldge of research conducted in a STEM topic or field	Knowledge of how scientists and engineers work on real problems in STEM
Extreme gain	29%	32%	33%	34%	35%
Large gain	27%	29%	31%	32%	26%
Some gain	29%	25%	25%	21%	26%
A little gain	9%	10%	5%	7%	8%
No gain	6%	4%	5%	5%	6%

Chart 24: N-JSHS Student Report of Impacts on STEM Knowledge (n = 61)



	Knowledge of research processes, ethics, and rules for conduct in STEM	In depth knowledge of a STEM topic(s)	Knowledge of what everyday research work is like in STEM	Knowledge of how scientists and engineers work on real problems in STEM	Knowledge of research conducted in a STEM topic or field
Extreme gain	25%	34%	36%	38%	39%
Large gain	38%	38%	39%	36%	41%
Some gain	28%	23%	18%	21%	16%
A little gain	7%	2%	5%	3%	2%
No gain	3%	3%	2%	2%	2%

These Impacts on STEM Knowledge student questionnaire items were combined into a composite variable[15] to test for differences between subgroups of students. Significant differences were found between National and Regional students with National students on average reporting greater gains in JSHS impacts on their STEM knowledge (small effect size, d = 0.396 standard deviations).[16] There were also significant gender differences with females reporting greater increases in STEM knowledge compared to males (small effect size, d = 0.358 standard deviations)[17]. There were no differences by race/ethnicity.

Table 26 shows the percentage of responding students reporting large or extreme gains in STEM competencies - science-related practices. Over 60% of the responding Regional and National students reported large or extreme gains on most items; for example, using knowledge and creativity to suggest a testable hypothesis for an observation (R-66%; N-65%); designing procedures for an experiment (R-62%; N-61%); carrying out procedures for an experiment and recording data accurately (R-64%; N-76%); organizing data in charts or graphs to find patterns and relationships (R-64%; N-72%); Considering different interpretations (R-61%; N-67%); supporting an explanation with data (R-67%; N-69%); supporting an explanation with relevant knowledge (R-67%; N-67%); identifying the strengths and limitations of explanations (R-

[15] The Cronbach's alpha reliability for these 5 items was 0.941.
[16] Two-tailed independent samples *t*-test, $t(408) = 4.00$, $p < 0.001$.
[17] Two-tailed independent samples *t*-test, $t(405) = 3.60$, $p < 0.001$.

62%; N-62%); defending an argument (R-60%; N-62%); identifying the strengths and limitations of data (R-62%; N-65%); and finally, communicating (R-68%; N-80%). In contrast, less than half of responding Regional and National students reported large or extreme gains on making a model (R-47%; N-48%) and using computer models (R-41%; N-46%).

Table 26. Students Reporting Large or Extreme Gains in their STEM Competencies – Science Practices		
Item	**R-JSHS Questionnaire Respondents (n = 69-71)**	**N-JSHS Questionnaire Respondents (n = 61)**
Asking a question that can be answered with one or more scientific experiments	59%	63%
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	66%	65%
Making a model of an object or system showing its parts and how they work	47%	48%
Designing procedures for an experiment that are appropriate for the question to be answered	62%	61%
Identifying the limitations of the methods and tools used for data collection	59%	71%
Carrying out procedures for an experiment and recording data accurately	64%	76%
Using computer models of objects or systems to test cause and effect relationships	41%	46%
Organizing data in charts or graphs to find patterns and relationships	64%	72%
Considering different interpretations of data when deciding how the data answer a question	61%	67%
Supporting an explanation for an observation with data from experiments	67%	69%
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	67%	67%
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	62%	62%
Defending an argument that conveys how an explanation best describes an observation	60%	62%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	62%	65%
Integrating information from technical or scientific texts and other media to support your explanation of an observation	59%	60%
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	68%	80%

Table 27 shows the percentage of responding students reporting large or extreme gains in STEM competencies - engineering-related practices. Over 65% of the responding Regional and National students reported large or extreme gains on most items; for example; using knowledge and creativity (R-67%; N-78%); communicating information (R-81%; N-68%); supporting solutions with knowledge (R-71%; N-68%); identifying limitations (R-70%; N-68%); carrying out procedures (R-65%; N-74%); identifying the strengths and limitations of explanations (R-70%; N-74%); designing

procedures (R-69%; N-71%); consider different interpretations (R-75%; N-65%); identify strengths and limitation of solutions (R-70%; N-71%); and finally, defend an argument (R-69%; N-65%). In contrast, only half or less of responding Regional and National students reported large or extreme gains on using computer models (R-50%; N-45%).

Table 27. Students Reporting Large or Extreme Gains in their STEM Competencies – Engineering Practices		
Item	**R-JSHS Questionnaire Respondents (n = 57)**	**N-JSHS Questionnaire Respondents (n = 61)**
Integrating information from multiple sources to support your solution to a problem	60%	71%
Using knowledge and creativity to propose a testable solution for a problem	67%	78%
Making a model of an object or system to show how they work	62%	55%
Communicating information about your design processes and/or solutions in different formats (e.g., orally, written, graphically, mathematically)	81%	68%
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	71%	68%
Identifying the limitations of the methods and tools used for data collection	70%	68%
Carrying out procedures for an experiment and recording data accurately	65%	74%
Defining a problem that can be solved by developing a new or improved object, process, or system	72%	62%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	70%	74%
Using computer models of an object or system to investigate cause and effect relationships	50%	45%
Designing procedures for an experiment that are appropriate	69%	71%
Considering different interpretations of the data when deciding if a solution works as intended	75%	65%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	70%	71%
Organizing data in charts or graphs to find patterns and relationships	67%	64%
Supporting a proposed solution (for a problem) with data from experiments	70%	62%

Defend an argument that conveys how a solution best meets design criteria	69%	65%

While mentors' reports of student gains in science practices, National students' reports, and Regional students' reports were generally aligned in terms of which practices evidenced the greatest gains, mentors tended to report somewhat greater gains than students for engineering practices. These inconsistencies may be due to the influence of low mentor response rates described previously or to differences in perspectives between students and mentors.

For gains in STEM competencies in Science and Engineering composite scores were calculated.[18] These composites were used to assess if the JSHS program had differential impacts depending on student group membership. Significant differences by Regional and National grouping were found with National students reporting greater impacts on both Science and Engineering skills (small effect of d = 0.248 for Science; medium effect of d = 0.476 for Engineering)[19]. There was also a significant difference in Science Skills by gender with females reporting significantly greater impact (medium effect of d = 0.4.4 standard deviations)[20]. There were no significant differences in Engineering Skills by gender. And no significant differences were found by race/ethnicity for Science or Engineering practices.

The student questionnaire also asked students about the impact of JSHS on their "21st Century Skills". As can be seen in Charts 25 and 26, a vast majority of Regional as well as National student respondents reported "extreme" or "large" gains for sticking with a task (R-73%; N-63%); making changes when things do not go as planned (R-73%; N-76%), communicating effectively (R-73%; N-79%); and viewing failure as an opportunity to learn (R-73%; N-69%). A majority also reported "extreme" or "large" gains in learning to work independently (R-65%; N-51%), setting goals and reflecting (R-69%; N-78%); working well with people (R-63%; N-70%); and including others' perspectives when making decisions (R-62%; N-72%).

A composite variable of these 8 items focusing on 21st Century Skills[21] was created to test for differences between student subgroups. Significant differences were found by participation level and gender. Students participating in National programs reported significantly greater JSHS impacts on their 21st Century Skills than Regional students (small effect size, d = 0.268)[22]. And females reported significantly greater JSHS impacts compared to males (small effect size, d = 0.362)[23]. There were no significant differences in 21st Century Skills by race/ethnicity.

[18] The science practices composite (16 items) has a Cronbach's alpha reliability of 0.977; the engineering practices composite (16 items) has a Cronbach's alpha reliability of 0.973.

[19] Two-tailed independent samples t-test: Science Skills $t(408) = 2.50$, $p = .013$; Engineering Skills $t(408) = 4.81$, $p < .001$.

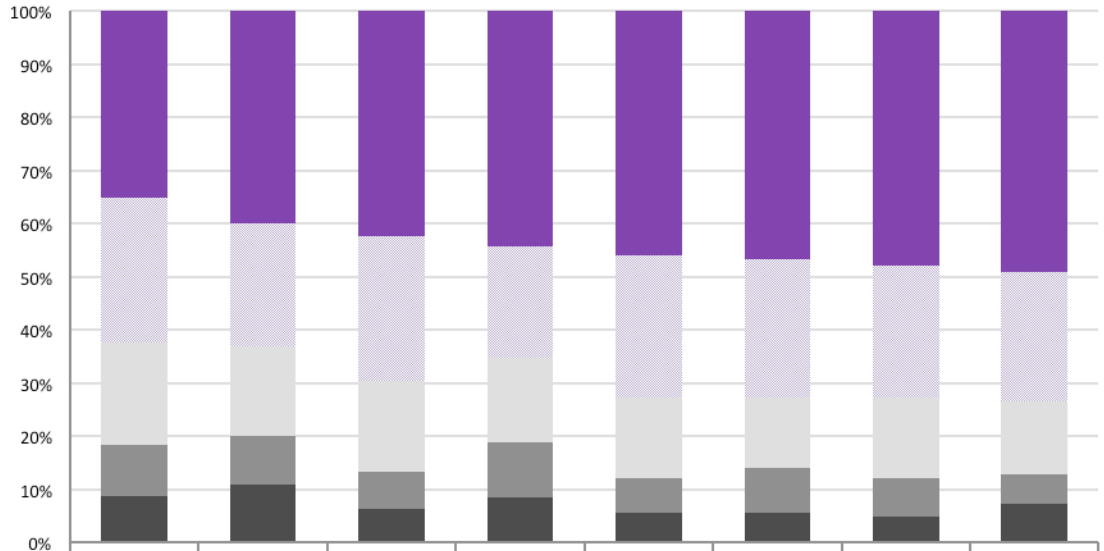
[20] Two-tailed independent samples t-test, $t(334) = 4.99$, $p < .001$.

[21] The 21st Century Skills composite had a Cronbach's alpha reliability of .946.

[22] Two-tailed independent samples t-test, $t(408) = 2.71$, $p = .007$.

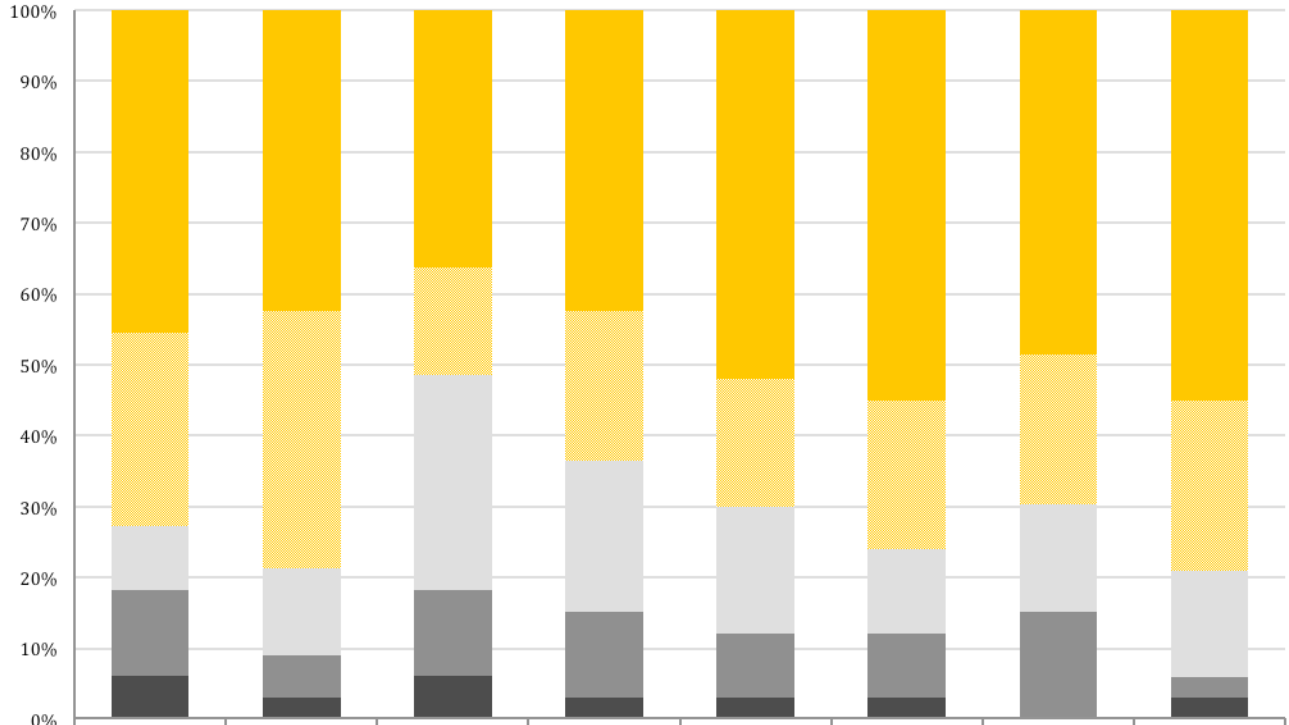
[23] Two-tailed independent samples t-test, $t(344) = 3.36$, $p = .007$.

Chart 25: R-JSHS Student Report of Impacts on 21st Century Skills (n = 248-250)



	Including others perspectives when making decisions	Working well with people from all backgrounds	Setting goals and reflecting on performance	Learning to work independently	Viewing failure as an opportunity to learn	Communicating effectively with others	Making changes when things do not go as planned	Sticking with a task until it is finished
Extreme gain	35%	40%	42%	44%	46%	47%	48%	49%
Large gain	27%	23%	27%	21%	27%	26%	25%	24%
Some gain	19%	17%	17%	16%	15%	13%	15%	14%
A little gain	10%	9%	7%	10%	6%	8%	7%	6%
No gain	9%	11%	6%	8%	6%	6%	5%	7%

Chart 26: N-JSHS Student Report of Impacts on 21st Century Skills (n = 61)



	Including others' perspectives when making decisions	Setting goals and reflecting on performance	Learning to work independently	Sticking with a task until it is finished	Working well with people from all backgrounds	Making changes when things do not go as planned	Viewing failure as an opportunity to learn	Communicating effectively with others
Extreme gain	45%	42%	36%	42%	52%	55%	48%	55%
Large gain	27%	36%	15%	21%	18%	21%	21%	24%
Some gain	9%	12%	30%	21%	18%	12%	15%	15%
A little gain	12%	6%	12%	12%	9%	9%	15%	3%
No gain	6%	3%	6%	3%	3%	3%	0%	3%

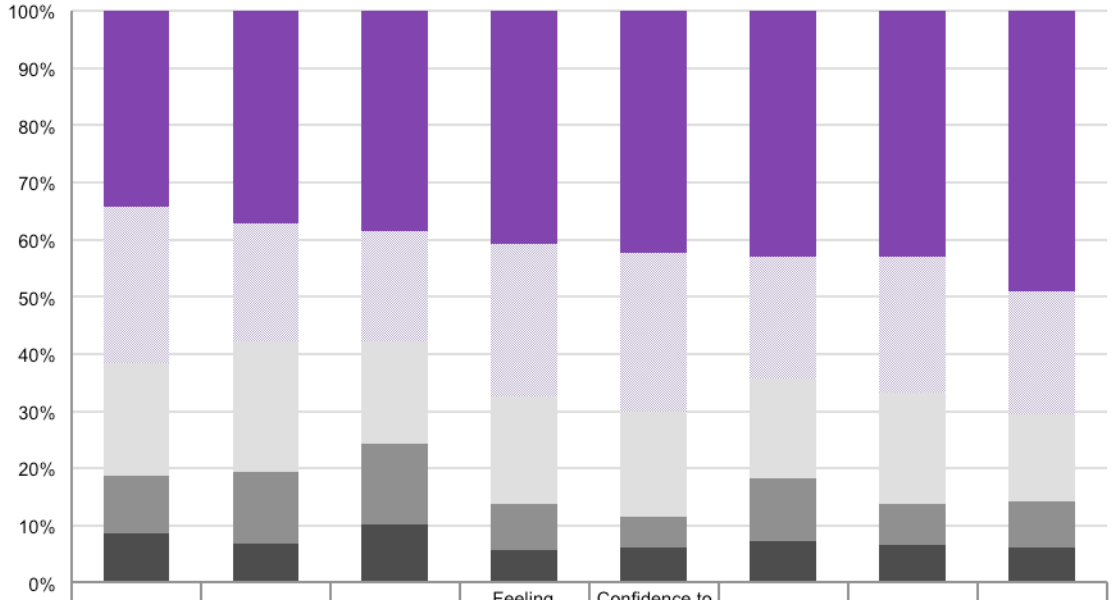
Mentors were also asked about the impact of JSHS on students' 21st Century Skills. Mentors identified communicating effectively with others and learning to work independently as the top two areas of student gains. Otherwise, mentors' responses resembled students' responses, with the mean mentor response generally falling between the Regional and National student means.

STEM Identity and Confidence

The student questionnaire included a series of items intended to measure the impact of JSHS on students' STEM identity. Students are unlikely to purse STEM further in their education and/or careers if they do not see themselves as

capable of succeeding in STEM[24], so, deepening students' STEM knowledge and skills is important for increasing the likelihood. These data are shown in Charts 27 and 28 and strongly suggest that the program has had a positive impact in this area. A large majority of Regional as well as National students reported "extreme" or "large" gains in every category. For example, desire to build relationships (R-71%; N-72%); connecting STEM to personal (R-67%; N-69%); and feeling more prepared (R-68%; N-80%).

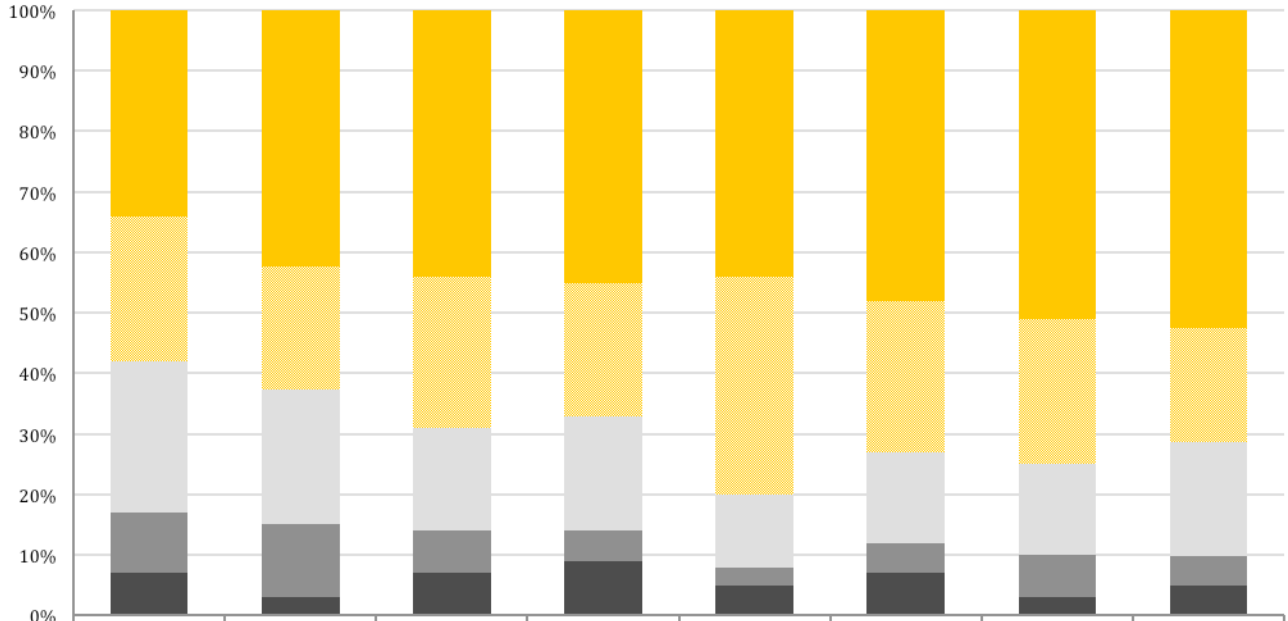
Chart 27: R-JSHS Student Report of Impacts on STEM Identity (n = 244-247)



	Patience for the slow pace of STEM research	Interest in a new STEM topic	Deciding on a path to pursue a STEM career	Feeling prepared for more challenging STEM activities	Confidence to try out new ideas or procedures on my own in a STEM project	Sense of accomplishing something in STEM	Connecting a STEM topic or field to my personal values	Desire to build relationships with professionals in a field
Extreme gain	34%	37%	39%	41%	42%	43%	43%	49%
Large gain	27%	21%	19%	27%	28%	21%	24%	22%
Some gain	20%	23%	18%	19%	18%	17%	20%	15%
A little gain	10%	13%	14%	8%	5%	11%	7%	8%
No gain	9%	7%	10%	6%	6%	7%	7%	6%

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

Chart 28: N-JSHS Student Report of Impacts on STEM Identity (n = 59)



	Deciding on a path to pursue a STEM career	Interest in a new STEM topic	Connecting a STEM field or topic to my personal values	Patience for the slow pace of STEM research	Feeling prepared for more challenging STEM activities	Confidence to try out new ideas or procedures on my own in a STEM project	Sense of accomplishing something in STEM	Desire to build relationships with mentors who work in STEM
Extreme gain	34%	42%	44%	45%	44%	48%	51%	53%
Large gain	24%	20%	25%	22%	36%	25%	24%	19%
Some gain	25%	22%	17%	19%	12%	15%	15%	19%
A little gain	10%	12%	7%	5%	3%	5%	7%	5%
No gain	7%	3%	7%	9%	5%	7%	3%	5%

Composite scores were generated for the STEM identity composite[25] to assess whether the JSHS program had differential impacts on subgroups of students. Students participating in National programs reported significantly greater JSHS impacts on their STEM Identity than Regional students (small effect size, d = 0.385)[26]. And females reported significantly greater JSHS impacts compared to males (small effect size, d = 0.284)[27]. There were no significant differences in STEM Identity by race/ethnicity.

[25] The Cronbach's alpha reliability for these 8 items was 0.949.

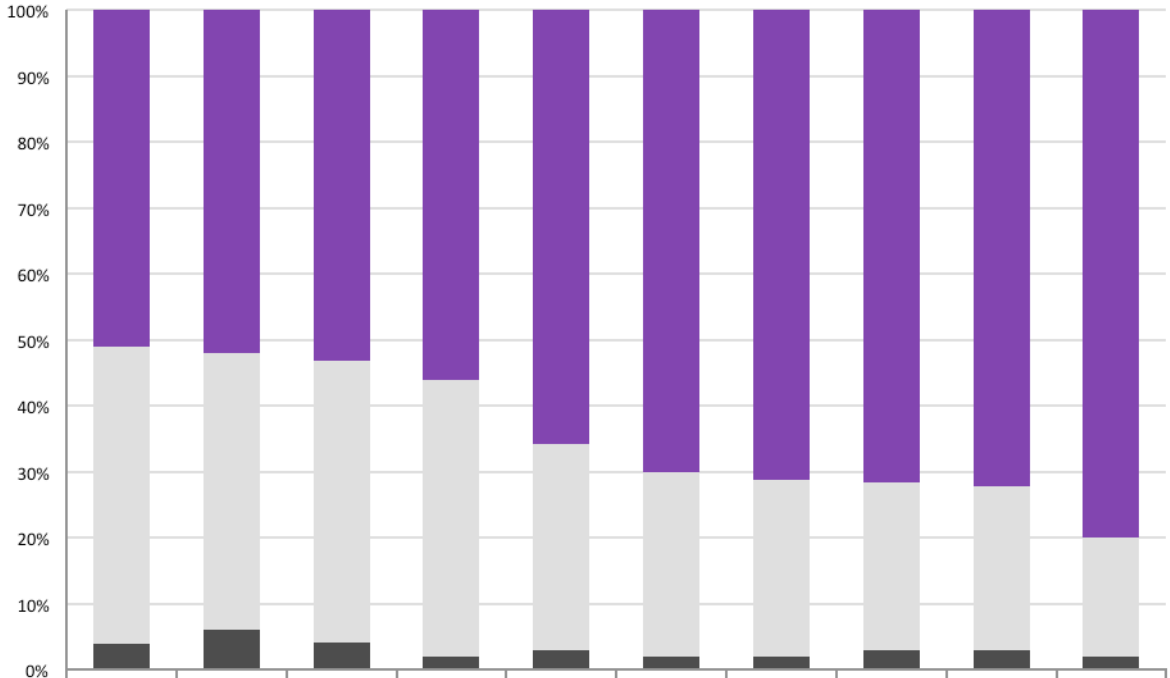
[26] Two-tailed independent samples t-test, $t(408) = 3.89$, $p < .001$.

[27] Two-tailed independent samples t-test, $t(405) = 2.86$, $p = .004$.

Interest and Future Engagement in STEM

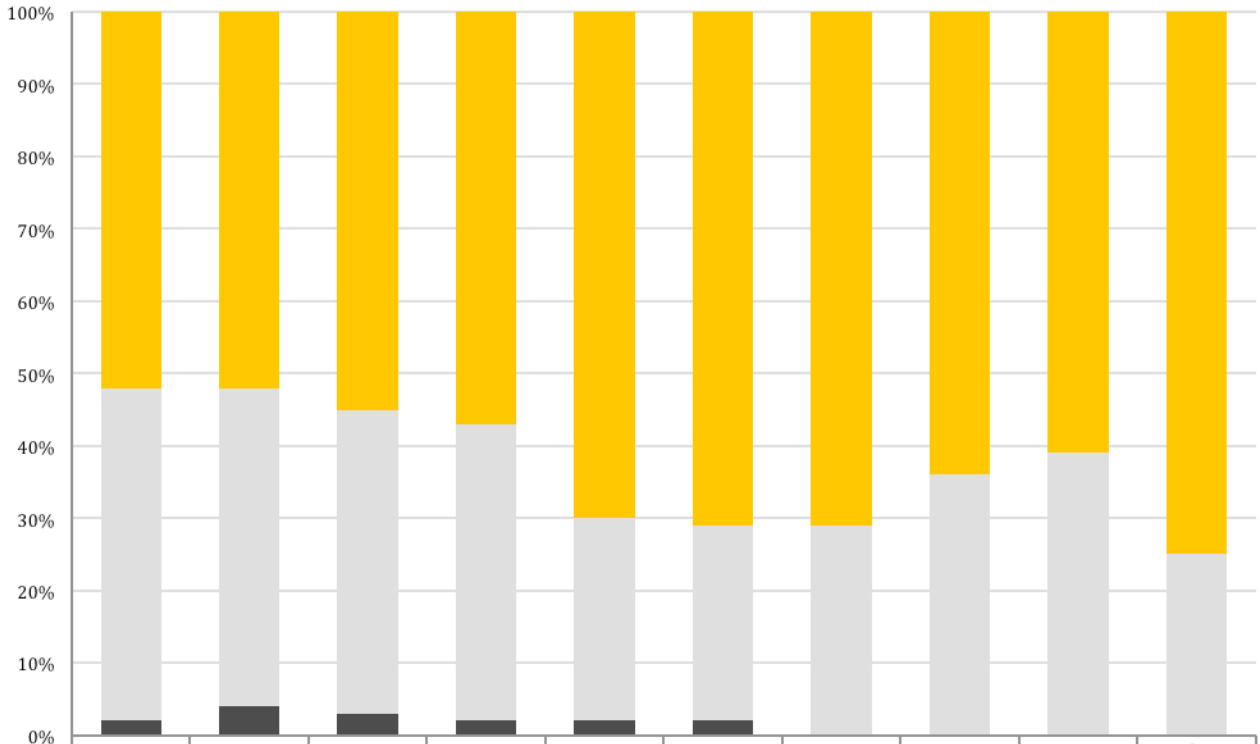
The questionnaire asked students to reflect on if the likelihood of their engaging in STEM activities outside of school changed as a result of their experience. As a key goal of the AEOP program is to develop a STEM-literate citizenry, students need to be engaged, both in and out of school, with high-quality STEM activities. Over half of Regional (Chart 29) as well as National (Chart 30) students reported they were "more likely" to engage in every activity outside of school. Also, over 70% reported they were "more likely" to engage in several of the activities. For example, students reported being more likely to work on a STEM project or experiment in a university or professional setting (R-80%; N-75%); participate in a STEM club, student association, or professional organization (R-72%; N-70%); talk with friends or family about STEM (R-72%; N-71%); and mentor or teach other students (R-70%; N-71%).

Chart 29: Change in Likelihood R-JSHS Students Will Engage in STEM Activities Outside of School (n = 238-239)



	Watch or read non-fiction STEM	Use a computer to design or program something	Tinker (play) with a mechanical or electrical device	Work on solving mathematical or scientific puzzles	Take an elective (not required) STEM class	Mentor or teach other students about STEM	Help with a community service project related to STEM	Talk with friends or family about STEM	Participate in a STEM camp, club, or competition	Work on a STEM project or experiment in a university or professional setting
More likely	51%	52%	53%	56%	66%	70%	71%	72%	72%	80%
About the same	45%	42%	43%	42%	31%	28%	27%	26%	25%	18%
Less likely	4%	6%	4%	2%	3%	2%	2%	3%	3%	2%

Chart 30: Change in Likelihood N-JSHS Students Will Engage in STEM Activities Outside of School (n = 59)



	Tinker (play) with a mechanical or electrical device	Watch or read non-fiction STEM	Use a computer to design or program	Work on solving mathematical or scientific puzzles	Participate in a STEM camp, club, or competition	Talk with friend or family about STEM	Mentor or teach other students about STEM	Help with a community service project that relates to STEM	Take an elective (not required) STEM class	Work on a STEM project or experiment in a university or professional setting
More likely	52%	52%	55%	57%	70%	71%	71%	64%	61%	75%
About the same	46%	44%	42%	41%	28%	27%	29%	36%	39%	25%
Less likely	2%	4%	3%	2%	2%	2%	0%	0%	0%	0%

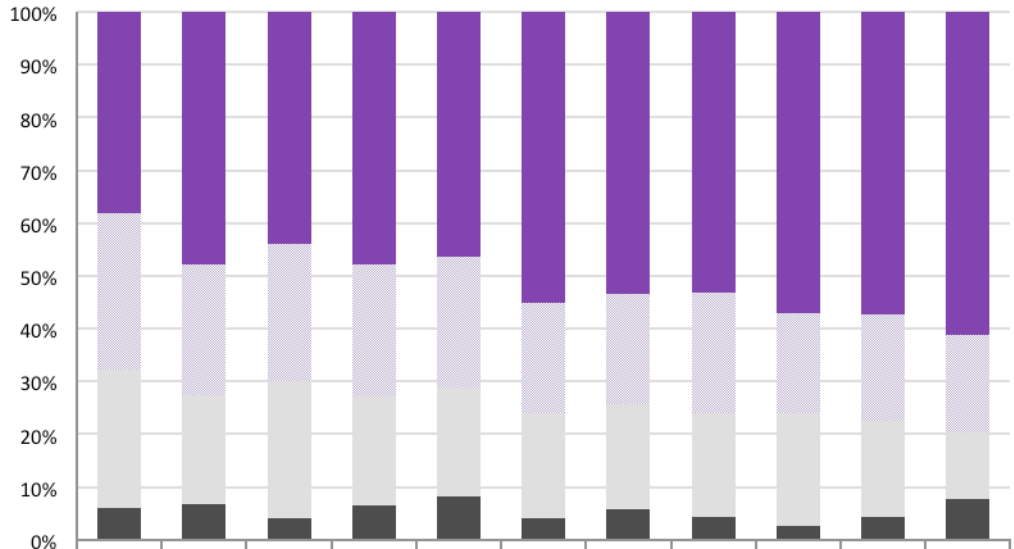
These items were used to create a composite score[28] used for comparing subgroups of students. Students participating in National programs reported significantly greater JSHS impacts on their likelihood to engage in STEM activities than

[28] These 10 items had a Cronbach's alpha reliability of 0.930.

Regional students (small effect size, d = 0.362)[29]. Females reported significantly greater JSHS impacts compared to males (small effect size, d = 0.219)[30]. There were no significant differences in likelihood of engaging in STEM activities by race/ethnicity.

The questionnaire also examined student interest level in participating in future AEOP programs. Charts 31 and 32 summarize student responses. Very few students expressed that they would be "not at all" interested in future programs. In contrast, many students expressed that they would be "very much" or "somewhat" interested in future programs. For example, JSHS (R-78%; N-91%) and SMART (R-38%; N-59%).

Chart 31: R-JSHS Student Interest in Future AEOP Programs (n = 232-237)

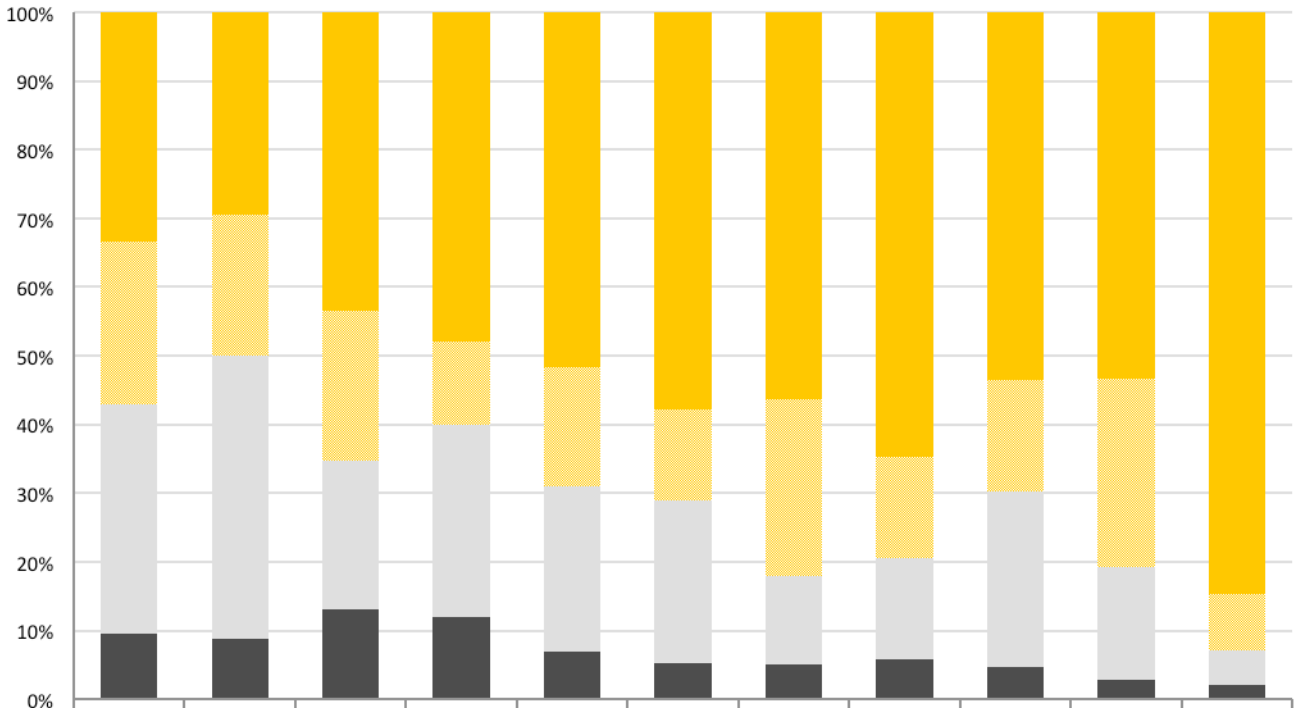


	UNITE	GEMS Near Peer Mentor Program	GEMS	CQL	NDSEG	HSAP	REAP	SEAP	URAP	SMART	JSHS
Very Much	14%	18%	19%	19%	19%	23%	24%	26%	27%	28%	60%
Somewhat	11%	9%	11%	10%	10%	9%	9%	11%	9%	10%	18%
A little	9%	8%	11%	8%	9%	8%	9%	9%	10%	9%	12%
Not at all	2%	3%	2%	3%	3%	2%	3%	2%	1%	2%	8%

[29] Two-tailed independent samples t-test, $t(408) = 3.66$, $p < .001$.

[30] Two-tailed independent samples t-test, $t(405) = 2.20$, $p = .028$.

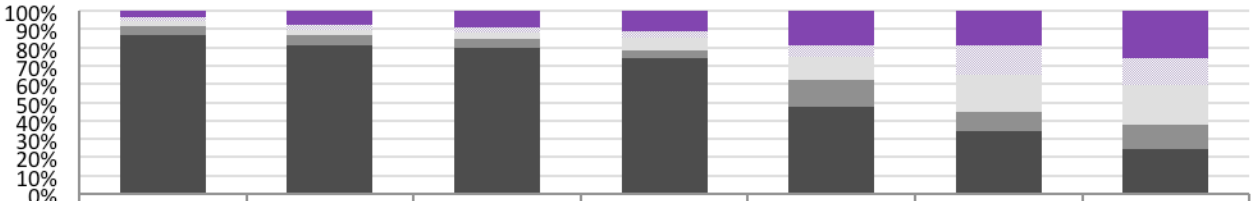
Chart 32: N-JSHS Student Interest in Future AEOP Programs (n =60)



	UNITE	GEMS	HSAP	GEMS Near Peers	CQL	REAP	SEAP	NDSEG	URAP	SMART	JSHS
Very Much	7%	10%	10%	12%	15%	22%	22%	22%	23%	39%	83%
Somewhat	5%	7%	5%	3%	5%	5%	10%	5%	7%	20%	8%
A little	7%	14%	5%	7%	7%	9%	5%	5%	11%	12%	5%
Not at all	2%	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%

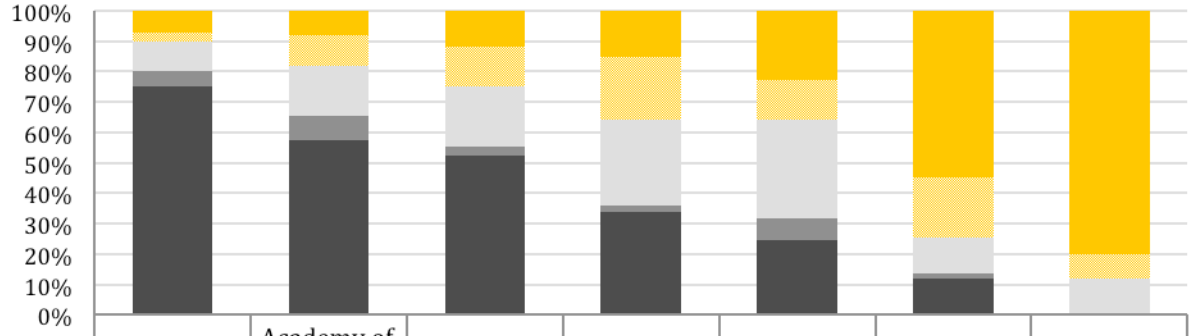
Students were asked which resources impacted their awareness of the various AEOPs. As can be seen in Charts 33 and 34, simply participating in JSHS was most likely to be rated as impacting their awareness "somewhat" or "very much," although National students tended to report greater impacts than did Regional students. In addition to JSHS participation, National students' ratings of invited speakers or career events tended to be higher than Regional students' ratings. Among National students, invited speakers or career events appeared particularly influential, with 56% of students reporting "very much" impact and another 20% reporting "somewhat." Most R-JSHS students reported not having heard of AEOP materials such as the It Starts Here! Magazine (86%), the AEOP website (81%), and the AEOP brochure (74%). N-JSHS were more likely to have experienced AEOP materials including the AEOP website (43% had experienced) and the AEOP brochure (66% had experienced).

Chart 33: Impact of Resources on R-JSHS Student Awareness of AEOPs (n = 287-291)



	It Starts Here! Magazine	Army Educational Outreach Program (AEOP) website	Academy of Applied Science (AAS) website	AEOP brochure	My JSHS mentor(s)	Invited speakers or career events during JSHS	Participation in JSHS
Very Much	4%	8%	9%	11%	19%	19%	26%
Somewhat	2%	3%	3%	3%	7%	16%	15%
A little	3%	3%	3%	7%	12%	20%	22%
Not at all	5%	5%	5%	5%	15%	10%	13%
Did not use	86%	81%	80%	74%	47%	35%	25%

Chart 34: Impact of Resources on N-JSHS Student Awareness of AEOPs (n = 61)



	It Starts Here! Magazine	Academy of Applied Science (AAS) website	AEOP website	AEOP brochure	My JSHS mentor(s)	Invited speakers or "career" events	Participation in JSHS
Very Much	7%	8%	12%	15%	23%	56%	80%
Somewhat	3%	10%	13%	21%	13%	20%	8%
A little	10%	16%	20%	28%	33%	12%	12%
Not at all	5%	8%	3%	2%	7%	2%	0%
Did not experience	75%	57%	53%	34%	25%	12%	0%

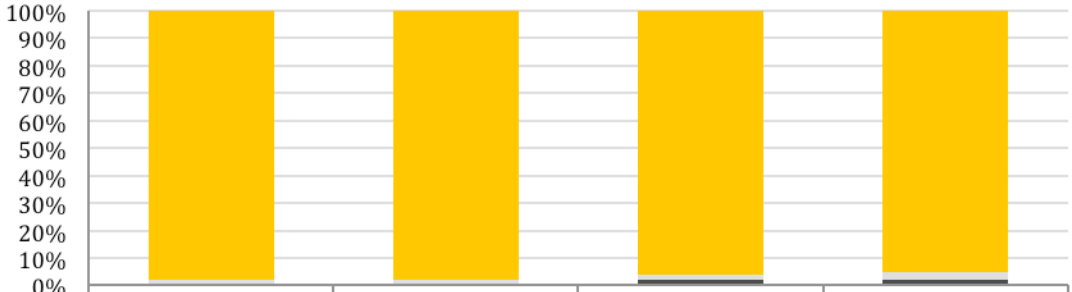
Attitudes toward Research

The questionnaire also asked students about their opinions of what DoD researchers do and the value of DoD research more broadly as attitudes about the importance of DoD research are an important prerequisite to continued student interest in the field and potential involvement in the future. The data indicate that most responding students have favorable opinions (see Charts 35 and 36). A vast majority of students "strongly agree or agree" with each statement, including that DoD researchers solve real-world problems (R-77%; N-96%), DoD research is valuable to society (R-75%; N-95%); advance fields (R-74%; N-98%); and develop new technologies (R-73%; N-98%).

Chart 35: R-JSHS Student Opinions about DoD Researchers and Research (n = 230-232)

	DoD researchers develop new, cutting edge technologies	DoD researchers advance science and engineering fields	DoD research is valuable to society	DoD researchers solve real-world problems
Strongly agree or agree	73%	74%	75%	77%
Neither agree nor disagree	26%	25%	24%	22%
Strong disagree or disagree	1%	1%	0%	2%

Chart 36: N-JSHS Student Opinions about DoD Researchers and Research (n = 60)



	DoD researchers advance science and engineering fields	DoD researchers develop new, cutting edge technologies	DoD researchers solve real-world problems	DoD research is valuable to society
Strongly agree or agree	98%	98%	96%	95%
Neither agree nor disagree	2%	2%	2%	3%
Strong disagree or disagree	0%	0%	2%	2%

Education and Career Aspirations

Students were asked about their education aspirations both before and after JSHS. As can be seen in Table 28, when asked to think back on how far they wanted to go in school before participating in JSHS, 7% of Regional students indicated graduating from high school, 14% finishing college, and 79% getting more education after college. In contrast, after R-JSHS, all students (100%) wanted to go beyond high school graduation and pursue post-secondary study, 8% wanted to attend and graduate from college with a bachelor's degree, and 91% wanted to get more education after completing their first college degree. All National students aspired to extend their education beyond college prior to N-JSHS. After participating in N-JSHS, all respondents intended to continue their education after college, however 33% indicated wanting to earn an M.D./Ph.D. degree compared to only 18% of students before they participated in N-JSHS.

Table 28. Student Education Aspirations				
	R-JSHS Questionnaire Respondents (n = 242)		N-JSHS Questionnaire Respondents (n = 60)	
	Before JSHS	After JSHS	Before JSHS	After JSHS
Graduate from high school	7%	0%	0%	0%
Go to a trade or vocational school	0%	0%	0%	0%
Go to college for a little while	1%	1%	0%	0%
Finish college (get a Bachelor's degree)	14%	8%	0%	2%
Get more education after college	9%	12%	5%	3%
Get a master's degree	15%	14%	18%	10%
Get a Ph.D.	22%	31%	30%	33%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	17%	15%	23%	15%
Get a combined M.D. / Ph.D.	11%	15%	18%	33%
Get another professional degree (law, business, etc.)	5%	4%	5%	3%

In terms of career aspirations, students were asked what kind of work they expect to be doing at age 30, both reflecting on what their aspiration was before participating in JSHS and after JSHS (see Table 29). Among each group, the most common aspirations before JSHS were also most popular after JSHS. For example, medicine (R-23% before and 23% after; N-25% before and 22% after) and engineering (R-14% before and 21% after; N-15% before and 17% after). Also notable was that fewer students in each group selected "undecided" for their response (R-13% before and 7% after; N-8% before and 5% after).

Table 29. Student Career Aspirations				
	R-JSHS Questionnaire Respondents (n = 83)		N-JSHS Questionnaire Respondents (n = 58)	
	Before JSHS	After JSHS	Before JSHS	After JSHS
Medicine (e.g., doctor, dentist, veterinarian, etc.)	23%	23%	25%	22%
Science (no specific subject)	6%	4%	5%	4%
Biological science	7%	8%	10%	14%
Engineering	14%	21%	15%	17%
Business	2%	2%	2%	2%
Technology	0%	0%	2%	2%
Teaching, non-STEM	2%	1%	0%	0%
Social science (e.g., psychologist, sociologist)	2%	3%	2%	2%
Computer science	4%	4%	5%	4%
Earth, atmospheric or oceanic science	1%	2%	0%	0%
Environmental science	2%	2%	3%	7%
Teaching, STEM	1%	1%	0%	0%
Art (e.g., writing, dancing, painting, etc.)	4%	3%	0%	0%
Health (e.g., nursing, pharmacy, technician, etc.)	5%	5%	0%	0%
Military, police, or security	1%	0%	0%	0%
Skilled trade (carpenter, electrician, plumber, etc.)	0%	0%	0%	0%
Physical science (e.g., physics, chemistry, astronomy, materials science)	5%	5%	18%	17%
Mathematics or statistics	1%	2%	5%	4%
Law	3%	2%	0%	0%
Undecided	13%	7%	8%	5%
Other†	5%	6%	0%	2%

† Before, R-JSHS other includes "journalism," "animal behavior research, "directing," "biochemistry", "biomedical engineering", "physical activity", "cinematographer", & "forensic science." After, R-JSHS other includes "journalism," "animal behavior research, "directing," "biochemistry", and "psychology". After, N-JSHS other includes "Management"

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

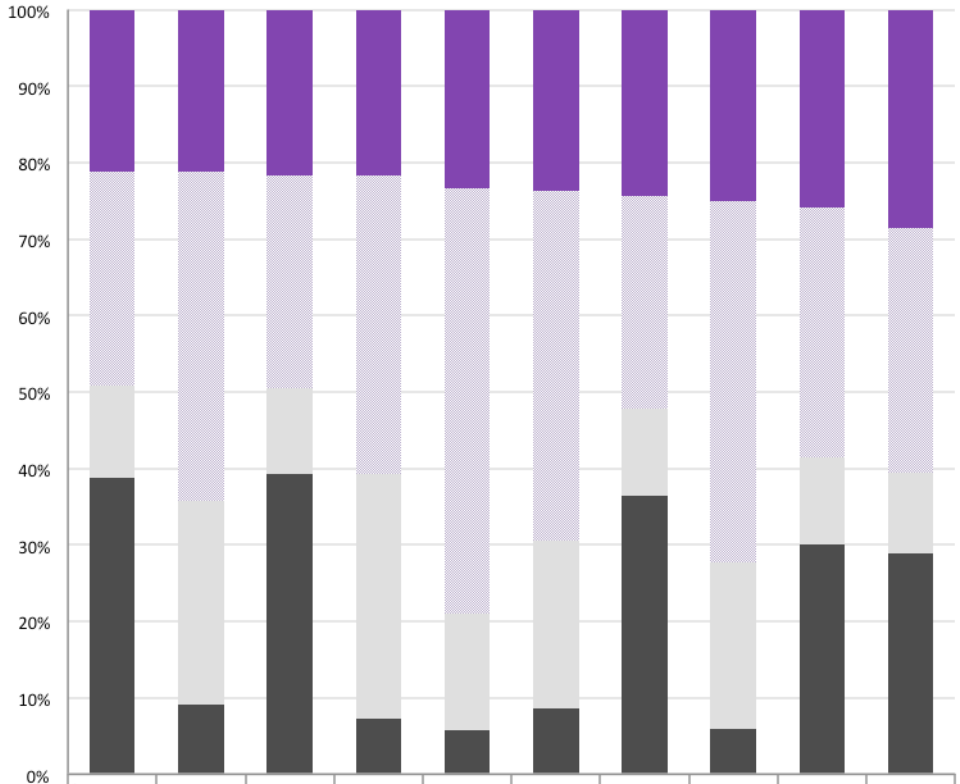
Table 30 shows that nearly all Regional students and all National students expect to use STEM somewhat in their career when they are age 30. Specifically, 77% of Regional students reported expecting to use STEM 76-100% of the time in their work and 93% of National students reported expecting to use STEM 76-100% of the time in their work. Only 2% of Regional students reported not expecting to use STEM in their work at all and no National students reported not expecting to use STEM in their work at all.

Table 30. Students Expecting to use STEM in Their Work at Age 30		
	R-JSHS Questionnaire Respondents (n = 243)	N-JSHS Questionnaire Respondents (n = 60)
Not at all	2%	0%
Up to 25% of the time	5%	2%
Up to 50% of the time	16%	5%
Up to 75% of the time	28%	25%
Up to 100% of the time	49%	68%

Overall Impact

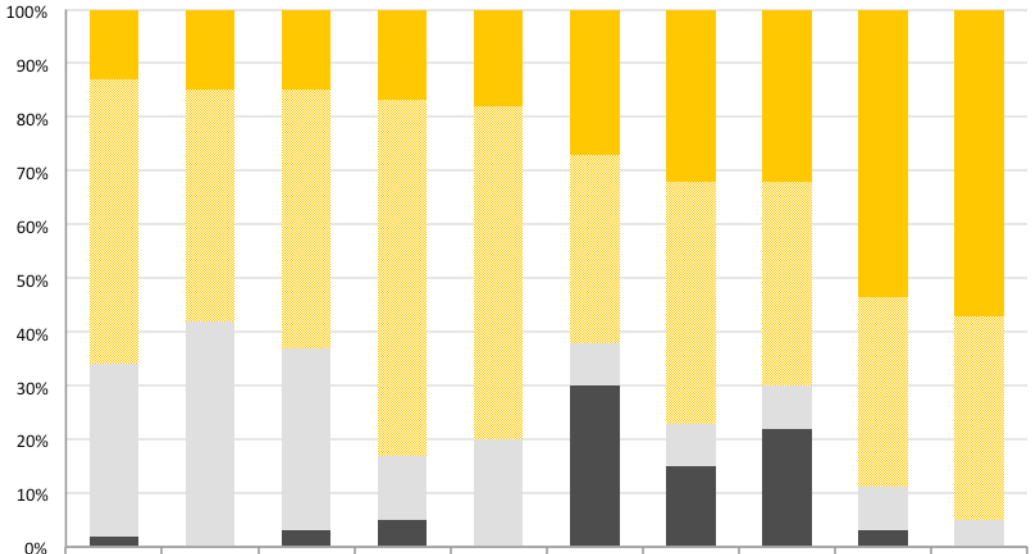
Finally, students were asked their opinions about the overall impact of participating in JSHS. Both Regional and National students thought the program had substantial impacts on them (see Charts 37 and 38). For example, respondents reported that JSHS contributed to or was the primary reason for having a greater appreciation of DoD STEM research (R-61%; N-95%); more aware of DoD research and careers (R-59%; N-88%); interest outside of school (R-72%; N-80%); more confident (R-79%; N-84%); more interested in STEM classes (R-61%; N-58%); more interested in other AEOPs (R-50%; N-62%); more interested in a STEM degree (R-64%; N-63%). Also, 49% of Regional students and 70% of National students reported that JSHS contributed to or was the primary reason for more interested in a STEM career.

Chart 37: R-JSHS Student Opinions of Impacts (n = 219-222)



	I am more interested in pursuing a STEM career with the DoD	I am more interested in earning a STEM degree	I am more interested in other AEOPs	I am more interested in taking STEM classes in school	I am more confident in my STEM knowledge, skills, and abilities	I am more interested in pursuing a career in STEM	I am more aware of other AEOPs	I am more interested in STEM activities outside of school	I am more aware of DoD STEM research and careers	I have a greater appreciation of DoD STEM research
Agree - JSHS was primary resason	21%	21%	22%	22%	23%	24%	24%	25%	26%	29%
Agree - JSHS contributed	28%	43%	28%	39%	56%	46%	28%	47%	33%	32%
Disagree - happened, but not because of JSHS	12%	27%	11%	32%	15%	22%	11%	22%	11%	10%
Disagree - did not happen	39%	9%	39%	7%	6%	9%	36%	6%	30%	29%

Chart 38: N-JSHS Student Opinions of JSHS Impacts (n = 60)



	I am more interested in pursuing a career in STEM	I am more interested in taking STEM classes in school	I am more interested in earning a STEM degree	I am more confident in my STEM knowledge	I am more interested in STEM activities outside of school requirements	I am more interested in other AEOPs	I am more aware of other AEOPs	I am more interested in pursuing a STEM career with the Army or DoD	I have a greater appreciation of Army or DoD STEM research and careers	I am more aware of Army or DoD STEM research and careers
Agree - JSHS was primary reason	13%	15%	15%	17%	18%	27%	32%	32%	53%	57%
Agree - JSHS contributed	53%	43%	48%	67%	62%	35%	45%	38%	35%	38%
Disagree - happened, but not because of JSHS	32%	42%	34%	12%	20%	8%	8%	8%	8%	5%
Disagree - did not happen	2%	0%	3%	5%	0%	30%	15%	22%	3%	0%

Overall JSHS Impact survey items were combined into a composite variable[31] to assess differences between student subgroups. There were no significant gender or racial/ethnic differences in terms of Overall JSHS Impact. National students did however report having experienced significantly higher overall impact from JSHS compared to Regional students (moderate effect of d = 0.591 standard deviations).[32] This finding is similar to 2014 results and not surprising since National students participated in both regional and national activities, allowing for greater exposure to JSHS experiences. Regional level success by National competition students may have also played a role in this difference.

An open-ended item on the questionnaire asked students to list the three most important ways they benefited from JSHS; 174 R-JSHS and 50 N-JSHS students provided at least one answer to the question. Student responses addressed a

[31] The Cronbach's alpha reliability for these 10 items was 0.936.

[32] Two-tailed independent samples t-test, $t(408) = 5.97$, $p < 0.001$.

variety of themes. The two most often-cited benefits by both Regional and National students were opportunities to connect with peers interested in STEM (33% of R-JSHS and 52% of N-JSHS respondents) and building confidence and developing presentation skills (48% of R-JSHS and 44% of N-JSHS respondents). For example:

> *"JSHS gave me the opportunity to present my research to experts across all scientific disciplines; JSHS gave me the opportunity learn about other fields of science outside my research expertise, [and] I was able to meet other like-minded young scientists and collaborate on solving real-world problems"* (R-JSHS student)

> *"[JSHS] helped me form a network of student scientists"* (N-JSHS student)

Other commonly mentioned benefits among Regional students included impacts on their knowledge and understanding of STEM (30%), exposure to others' research (25%), learning about careers (20%), networking with STEM professionals, the opportunity to conduct research (16%), (13%), and receiving feedback on their research from professionals (11%). National students frequently cited learning about DoD careers and research (40%), networking with professionals, (26%), and learning about others' research (20%) as benefits of JSHS.

Similar themes emerged from student focus groups and rapid interviews. For example:

> *"Presenting in front of people helps with presentation skills. It definitely will help in college. Also, just being around others and getting out of your comfort zone, and talking with others, and making new friends from around the state [are benefits]."* (R-JSHS Student)

> *"It's not just valuable for students going into engineering but also for other no matter what career path they end up choosing. It's not just about learning the science and engineering concepts, but it's about presenting and sharing your ideas. I feel like that's a very important skill to have for anyone."* (R-JSHS Student)

> *One of the major [benefits] is that you also get feedback from people who are professionals….They encourage you and at the same time they tell you what you're doing wrong, and that is really helpful because it is at such a professional level.* (R-JSHS student)

> *"It widens your mind it terms of science, it widens your mind in terms of personal experience, and prepares you for being a top-notch achiever in college."* (JSHS alumnus)

Summary of Findings

The FY15 evaluation of JSHS collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in Table 31.

Table 31. 2015 JSHS Evaluation Findings	
JSHS continued to serve students from historically underrepresented and underserved populations. However, there is room for growth in diversity of participants, as well as in program participation overall.	JSHS experienced a 30% decrease in applications to the program and a 21% decrease in participants overall in FY15. JSHS was successful in attracting participation of female students—a population that is historically underrepresented in engineering fields. Regional symposia registration data indicate that over half (56%) of JSHS participants in reporting symposia were female. JSHS had limited success in attracting students from historically underserved minority race/ethnicity and low-income groups. Regional symposia registration data indicate that 9% of students in reporting regions identified themselves as Black/African American and as Hispanic/Latino. Somewhat smaller proportions of student questionnaire respondents identified themselves as Black/African American or Hispanic or Latino (R-JSHS 5%; N-JSHS 3%). While 10% of R-JSHS questionnaire respondents identified themselves as Hispanic/Latino, only 3%
	of N-JSHS respondents identified with this group. The vast majority of N-JSHS student questionnaire respondents (92%) reported that they did not qualify for free or reduced-priced lunches – a commonly used indicator of low-income status. In contrast, 16% of R-JSHS respondents reported qualifying for free or reduced-price lunch. Students from 148 Title I schools participated in JSHS at the regional and national levels, although the program failed to meet its FY15 goal of 20% participation by Title I schools.
	Most regional student questionnaire respondents attended public schools (R-JSHS 77%; data unavailable for N-JSHS students). Although well over a third of respondents attended schools in urban or rural settings (R-JSHS 41%; N-JSHS 43%), which tend to have higher numbers or proportions of underrepresented and underserved groups, over half attended suburban schools (R-JSHS 59%; N-JSHS 58%).

	There was a 30% decrease in the number of applicants in FY15 as compared to FY14, and overall participation was 21% lower in FY15. The program failed to meet its FY15 goal of a 10% increase in the number of participating high schools and, in fact, there was an 8% decline in the number of schools participating in FY15.
	Students participated in regional symposia at 12 HBCU/MSIs nationwide.
JSHS engaged an extensive group of adult participants as mentors, STEM ambassadors, and volunteers, although there is little indication of racial/ethnic diversity among adult participants.	Approximately 1,000 in-service teachers, 35 pre-service teachers, 1,200 college/university personnel (a 33% decrease from the 1,800 college/university personnel who participated in FY14), 300 Army/DoD scientists/engineers, and 460 other adult volunteers served as research mentors or STEM ambassadors in JSHS. Of those who responded to the questionnaire, a large majority (73%) identified themselves as White, with the 3% identifying as Black/African American and 7% as Hispanic/Latino.
Actionable Program Evaluation	
JSHS marketing seems to target K-12 teachers/schools primarily and teacher recommendations appear to be particularly important for student recruitment.	JSHS employed multi-faceted marketing and recruitment strategies to participate in regional symposia. Efforts originating with AAS and regional JSHS directors included personal contact with teachers and high school administrators, printed and electronic promotional materials distributed by direct mail and email, university websites, and targeted marketing at other STEM-related regional initiatives (for example university chapters of the National Society of Black Engineers and the Society of Women Engineers).
	Teacher information appears to be crucial for recruiting students into JSHS. Nearly a third of students reported learning about the JSHS program from someone who works at the school they attend (R-JSHS 30%; N-JSHS 30%). Other significant sources were school or university newsletters (R-JSHS 26%; N-JSHS 20%). Personal connections such as past program participants were another fairly frequently cited source of information (R-JSHS 14%; N-JSHS 15%).
Many students are motivated to participate in JSHS by an interest in STEM and the desire to learn something new.	Both R-JSHS and N-JSHS students were most frequently motivated to participate in JSHS an interest in STEM (R-JSHS 26%; N-JSHS 41%). The next most frequently mentioned highly motivating factor was a desire to learn something new (R-JSHS 16%; N-JSHS 18%). Although students tended to learn about JSHS from their teachers or school staff, this was not reported as a highly motivating factor for participation (R-JSHS 10%; N-JSHS 9%).

JSHS students reported engaging in meaningful STEM learning through hands-on and collaborative activities, although N-JSHS and female students reported learning significantly more than other R-JSHS and male students.	The majority of R-JSHS and N-JSHS students reported in engaging in a variety of activities on most days or every day of their JSHS experience. For instance, 76% of R-JSHS students and 91% of N-JSHS students reported learning about new STEM topics, 75% of R-JSHS and 88% of N-JSHS reported communicating with other students about STEM topics, and 70% of R-JSHS and 85% of N-JSHS students reported interacting with scientists or engineers on most days or every day of their JSHS experience. The differences between N-JSHS and R-JSHS students in overall learning about STEM were statistically significant and female participants reported learning significantly more in JSHS than did males.
	Students reported engaging in a variety of STEM practices during their JSHS experience. For example, students reported participating in hands-on activities (R-JSHS 47%; N-JSHS 60%), identifying problems to investigate (R-JSHS 49%; N-JSHS 56%), and drawing conclusions from an investigation (R-JSHS 52%; 50% N-JSHS) on most days or every day of their JSHS experience.
	R-JSHS and N-JSHS students reported having greater opportunities to learn about STEM in JSHS than they typically have in school. However, responding students from both groups also reported slightly lower levels of engagement in STEM practices in their JSHS experience than they typically have in school.
	Mentors reported using a diversity of strategies to help make learning activities relevant to students, support the needs of diverse learners, develop collaboration and interpersonal skills, and engage students in "authentic" STEM activities.
JSHS informed students about STEM careers in general and, to a lesser extent, about DoD STEM careers specifically. The number of adults working in JSHS decreased in FY15.	Students reported learning about STEM careers in their JSHS experience, although R-JSHS students reported learning about fewer DoD STEM careers than about general STEM careers. While 58% of R-JSHS and 92% of N-JSHS students reported learning about 3 or more STEM jobs or careers, only 25% of R-JSHS had learned about 3 or more DoD STEM careers while 88% of N-JSHS students had learned about 3 or more DoD STEM careers. Only 2% of N-JSHS students reported learning about DoD STEM careers while 47% of R-JSHS students had not learned about any of these careers.

	The overall number of adults supporting the JSHS program delivery decreased by 17% in FY15. Although 84% of mentors reported providing guidance about educational pathways that will prepare students for STEM careers, less than half of mentors (46%) reported discussing STEM career opportunities with the DoD or other government agencies with their students. It should be noted, however that these responses represent an increase in these type of mentor activities from FY14 when only 30% reported discussing STEM careers within the DoD or other government agencies and 18% reported recommending other AEOPs to students.
Students and mentors valued the JSHS experience, although students were less satisfied with judging practices than with other JSHS features.	Large majorities of both R-JSHS students and N-JSHS students reported being very much satisfied with features of their research experience including their working relationship with mentors (80% R-JSHS; 89% N-JSHS) and the research experience overall (78% R-JSHS; 89% N-JSHS).
	Students responding to open-ended questionnaire items particularly valued opportunities to connect with like-minded peers afforded by JSHS and identified providing more of these opportunities as an area for improvement.
	The majority of responding mentors indicated being either somewhat or very much satisfied with those program features they experienced. Student oral presentations were a particular area of satisfaction for mentors, with 90% of responding mentors reporting being at least somewhat satisfied with this feature. Many mentors also commented on the benefits the program in open-ended questionnaire responses, emphasizing the opportunity for students to engage in real-world STEM learning and research and networking with STEM professionals and other students.
	In FY15, JSHS participants' dissatisfaction with the judging process and feedback from judges increased from FY14. Student participants were less satisfied with judging than with other features of JSHS. Over a quarter (30%) of both N-JSHS students expressed that they were not at all satisfied with judging processes at R-JSHS (increased from 3% respectively in FY14 for R-JSHS participants and 0% N-JSHS participants regarding their experience at R-JSHS). Additionally, 30% of R-JSHS and 25% of N-JSHS participants were not satisfied with feedback received from judges (compared to 11% and 21% respectively in FY14. Judge selection and judging practices were also a theme in students' open-ended responses on the questionnaire, where students identified this as an area in need of improvement. In contrast, only 5% of responding mentors indicated that they were not satisfied with the judging process as a feature of JSHS.
Outcomes Evaluation	

JSHS students reported positive program impacts on their STEM knowledge and competencies.	A majority of R-JSHS and N-JSHS students reported large or extreme gains on their in-depth knowledge of a STEM topic or field; knowledge of research, processes, ethics, and rules for conduct in STEM; knowledge of what everyday research work is like in STEM; knowledge of how scientists and engineers work on real problems in STEM; and knowledge of research conducted in a STEM topic or field. N-JSHS students tended to report greater impacts than did R-JSHS students in these areas.
	Many students also reported extreme impacts on their STEM competencies, or abilities to "do STEM." Over half of both R-JSHS and N-JSHS students reported extreme gains in their abilities to do things such as communicate about their experiments and explanations in different ways (63% R-JSHS; 80% N-JSHS), organize data in charts and graphs to find patterns and relationships (64% R-JSHS; 72% N-JSHS); use knowledge and creativity to suggest a testable explanation for an observation (66% R-JSHS; 65% N-JSHS), and ask a question that can be answered with one or more scientific experiments (59% R-JSHS; 63% N-JSHS).
JSHS participants reported gains in students' 21st Century Skills.	Most responding students reported large or extreme gains in nearly all 21st Century Skills. These skills included communicating effectively with others (73% R-JSHS; 79% N-JSHS), viewing failure as an opportunity to learn (73% R-JSHS; 69% N-JSHS), and setting goals and reflecting on performance (69% R-JSHS; 78% N-JSHS). Overall, N-JSHS students and females reported significantly greater impacts on their 21st Century Skills than did R-JSHS students and males.
JSHS participants reported gains in their confidence and identity in STEM, and in their interest in engaging in STEM in the future.	A majority of both R-JSHS and N-JSHS students reported large or extreme gains in factors associated with confidence and STEM identity. Students reported these gains in areas such as feeling more prepared for more challenging STEM activities (68% R-JSHS; 80% N-JSHS), desire to build relationships with STEM mentors (71% R-JSHS; 72% N-JSHS), and confidence to try out new ideas or procedures on their own (70% R-JSHS; 73% N-JSHS), Overall, N-JSHS and female students reported significantly larger gains than R-JSHS and male students in STEM identity and confidence. Students also reported being more likely to engage in additional STEM activities both in and outside of school. A majority of students indicated that as a result of JSHS, they were more likely to engage in activities such as working on a STEM project or experiment in a university of professional setting (80% R-JSHS; 75% N-JSHS); taking an elective STEM class (66% R-JSHS; 61% N-JSHS), and mentor or teach other students about STEM (70% R-JSHS; 71% N-JSHS).

	Overall, N-JSHS and female students reported significantly larger gains than R-JSHS and male students in these areas. Another impressive finding was that 26% of N-JSHS students indicated plans to write or co-write a paper that will be published in a research journal. This indicates the impact of their JSHS experience goes well beyond the actual engagement with the program itself.
JSHS students reported higher education aspirations after participating in JSHS, although their career aspirations showed little change.	After participating in JSHS, students indicated being more likely to go further in their schooling than they would have before JSHS. For R-JSHS students, the proportion of students wanting to complete college increased from 92% to 99% from before JSHS to after JSHS participation. The proportion of N-JSHS students aspiring to a combined M.D./Ph.D. increased from 18% before JSHS to 33% after.
	Students were asked to indicate what kind of work they expected to be doing at age 30, both before and after JSHS participation. A vast majority of students aspired to STEM careers both before and after JSHS participation, although there was a decrease in the number of students who were undecided about their career aspirations (13% to 7% R-JSHS; 8% to 5% N-JSHS).
Although JSHS students were largely unaware of other AEOP initiatives, students showed some interest in future AEOP opportunities.	Most students and mentors were unaware of other AEOP initiatives, however 52% of R-JSHS students and 79% of N-JSHS students indicated that participating in JSHS contributed to their awareness of other AEOPs, and most (50% R-JSHS; 67% N-JSHS credited JSHS with increasing their interest in participating in other AEOPs in the future.
	Most mentors had not participated in and were not aware of AEOP initiatives other than JSHS. Only 36% of mentors reported recommending other AEOPs to students that align with student goals.
	Besides participation in JSHS, students credit invited speaker and career events (41% R-JSHS; 76% N-JSHS) and their JSHS mentors (26% R-JSHS; 13% N-JSHS) with impacting their awareness of other AEOPs at least somewhat. Over a third (36%) of N-JSHS students also credited the AEOP brochure with impacting their awareness of other programs at least somewhat, however only 14% of R-JSHS students reported that the brochure impacted their awareness and 74% of R-JSHS students reported never hearing about the AEOP brochure.

JSHS participants reported positive opinions of DoD research and DoD researchers and reported increased interest in pursuing a STEM career with the DoD.	The participation of Army/DoD laboratories grew to 65 in FY15, a 7% increase from FY14. Nearly all N-JSHS students and about three-quarters of R-JSHS students expressed agreement that DoD research is valuable to society, that DoD researchers solve real-world problems, that DoD researchers develop new, cutting edge technologies, and the DoD researchers advance science and engineering fields. In addition, nearly half of R-JSHS students (49%) and 70% of N-JSHS students indicated that participating in JSHS increased their interest in pursuing a STEM career with the DoD.

Recommendations

Evaluation findings indicate that FY15 was a successful year overall for the JSHS program. Notable successes for the year include the continued high participation rate for females, continued participation by other groups traditionally under-represented in STEM fields, and high levels of mentor and student satisfaction with the programs. Both students and mentors reported participant gains in STEM knowledge and competencies and gains in students' 21st Century Skills as a result of the JSHS experience, and students emerged from the program with more interest in pursuing Army and DoD STEM careers.

While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY16 and beyond:

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

1. Although the applicant placement rate increased from 55% to 62% from FY14 to FY15, it is concerning that there was a 30% decrease in the number of applicants in FY15 as compared to FY14, and overall participation was 21% lower. It is recommended that JSHS track the number of applicants and placement rates at each regional site to insure more consistent placement rates across the portfolio (i.e. Illinois – Chicago had only 20% placement rate compared to 100% at other sites such as South Carolina). One strategy would be for AAS to work with regional sites to support increasing their capacity to accept more participants in the low placement rate regions.

2. The program failed to meet its goal of a 10% increase in the number of participating high schools and, in fact, there was an 8% decline in the number of schools participating in FY15. Of the 46 regional events held, 18 regions showed a 27% increase over the previous year in the total number of participating high schools. Another 14 regions showed a 37% decrease since FY14. While there are a variety of intervening factors associated with these phenomena, including weather impacts, competing activities, and impacts of school budget cuts on students' ability to travel, program administrators should be mindful of these decreases in participation and particularly the effect they may have on engaging students from underserved and underrepresented populations.

3. AAS may want to support states to reach out and cast broader nets for recruiting participants – beyond the local area of the competition or host. The program may wish to investigate student recruitment practices from the regions that demonstrated growth in FY15 and identify scalable recruitment and marketing strategies that could be applied across regions. Likewise, the program may wish to investigate strategies from regions with decreasing participation with the aim of identifying longitudinal changes in regional practices that may have affected student participation rates. Some recommended strategies to grow the diversity of student participants to increase the number of underrepresented students include conducting outreach to schools with high populations of underrepresented students to make them aware of JSHS and reaching out to academically prepared and competitively eligible underrepresented students to encourage actual participation in JSHS.

4. AEOP objectives include expanding participation of populations historically underrepresented in STEM careers. Since no program-wide demographic data was available from FY14, however, it is not possible to determine whether there was any change in participation of these groups from FY14 to FY15. Collecting demographic information on students participating in the R-JSHS through Cvent will enable a more accurate representation of the JSHS participation pool and concerted efforts should be made by program administrators to ensure that demographic data for all JSHS participants is compiled annually. JSHS failed to meet its FY15 goal for attracting Title I schools (associated with low-income status students) to the program. Of the 1,020 schools participating 15% were Title I schools, falling short of its FY15 goal of 20%. The program should continue to collect information and strategies from specific regional symposia as well as other AEOPs that successfully attract underrepresented and underserved students. This information should be disseminated to the larger JSHS community of regional directors. Additionally, the program may with to consider ways to build on previous efforts to strengthen its outreach to schools that serve large proportions of underrepresented groups of students (e.g., urban schools, Title I schools). JSHS might also consider the possibility of engaging with target districts through the AEOP's strategic outreach initiative opportunities, which provide limited financial support to assist in the ability of a target community to engage with the AEOPs.

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

1. The frequency with which students expressed dissatisfaction with judging practices and judging feedback during their JSHS experience (including the increased dissatisfaction from FY14 to FY15) suggests that there may be a need to direct additional resources to judge recruitment and training. While participation of DoD STEM personnel was constant from FY14 to FY15, there was a 33% decrease in the participation of college/university personnel from FY14 to FY15. The program may wish to further investigate practices of regions that were successful in attracting larger numbers of and greater diversity of judges with the aim of identifying practices that may be scaled across regions. Additionally, the program may wish to consider whether current judging practices established by the program are adequate to ensure standardization of judging practices nationwide and consider additional methods to standardize judging and reduce students' perception of judging bias. The program may wish to consider, for instance, creating

judging rubrics, providing enhanced judging training or orientation, and providing methods for judges to easily provide both oral and written feedback to students. Currently, the feedback at regional level JSHS competitions is varied and is mostly verbal in format.

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

1. In order to create a robust pipeline of AEOP programs in which students' progress from other AEOPs into JSHS and beyond, the program may want to consider innovative ways to work with other AEOPs to create a more seamless continuum of programs. One finding that is cause for concern is that although many participants expressed interest in other AEOP programs, most students had never heard of AEOP programs outside of JSHS. Large numbers of students at R-JSHS events reported not having seen the AEOP brochure. This is especially concerning since the FY15 APR indicates that AEOP resources were distributed to all regional symposia. Coupled with this is student reliance on teachers or mentors for information about AEOPs and mentor reports of having little familiarity with AEOPs other than JSHS. The program may wish to consider devising methods to disseminate AEOP information directly to teachers and mentors before the regional events as well as communicating expectations to regional symposia concerning the distribution of AEOP materials at events to ensure that all mentors, teachers, and students have access to structured opportunities that both describe the other AEOPs and provide information to students on how they can apply to them.

2. Evaluation data indicate that nearly half (47%) of R-JSHS students did not hear about any Army or DoD STEM career opportunities during their JSHS experience. Since R-JSHS mentors were reported to be a useful source of information about DoD STEM careers it would be useful for the program to devise ways to familiarize mentors with resources available to expose students to DoD STEM careers. A large majority of N-JSHS (80%) students indicated that invited speakers or career events were a key resource for learning about DoD STEM careers, however over a third (35%) of R-JSHS students reported not having experienced these resources. Because of the potential marked impact of this resource on student awareness of DoD STEM careers, the program may wish to consider innovative ways to connect regional students with DoD STEM professionals, including creating web-based video profiles of DoD STEM professionals, creating virtual lab tours hosted by DoD STEM professionals, and devising strategies to facilitate regional symposia's efforts to engage DoD STEM professionals as speakers at events.

3. The R-JSHS experience comprises the entirety of the JSHS experience for most students, however consistent differences between R-JSHS and N-JSHS student responses suggest that N-JSHS may have a greater impact on students than R-JSHS. While some of these differences are likely due to initial differences in interest and/or ability between students who are selected to go on to N-JSHS and those who are not, other differences may be related to differences in the availability/quality of mentor support or the availability/quality of activities at each symposium. The program should consider what guidance and support can be provided to regional directors, mentors, and other

supporters of R-JSHS to facilitate the identification of mentors (particularly in rural areas and other areas with logistical barriers to accessing university and other professional STEM resources), active engagement in STEM activities, useful feedback from judges, and feelings of success that support a positive STEM identity among students who are not selected for N-JSHS.

4. Participation in the AEOP evaluation continues to be an area of concern. While student and mentor participation rates rose slightly from FY14 to FY15, the continued relatively low rates of participation threaten the generalizability of results. Improved communication with individual program sites about expectations for the evaluation may help. A recommendation was made in the FY14 evaluation report as follows: "Given the large number of participants in the Regional competitions, it may be worth randomly sampling students to respond to the questionnaire, and rechanneling efforts into getting a high response rate from the sample." Although there is no indication that this recommendation was acted upon in FY15, it may be a strategy to consider going forward. It is recommended that JSHS consider requiring regional sites to provide time for participants to complete the AEOP evaluation questionnaire during regional symposia.

Appendices

Appendix A

FY15 JSHS Evaluation Plan

Questionnaires

Purpose:
As per the approved FY15 AEOP APP, the external evaluation of JSHS (data collected by VT and analyzed by Purdue University) includes two post-program questionnaires:

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

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

The questionnaires were aligned with:

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

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

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

Site Visits/Onsite Focus Groups

Purpose:
As per the approved FY15 AEOP APP, the external evaluation of JSHS (data collected by VT and analyzed by Purdue University) includes site visit/onsite focus groups at two JSHS regional events.

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

Evaluation Activities during JSHS Site Visits:

- One or two 45 minute focus group with 6-8 youth participants;
- One 45-minute focus group with 6-8 mentors;
- 30-60 minutes to observe the program (specifically, to see students engaged in program activities, preferably with their mentors); and
- 10-15 minute transitions between each evaluation activity for moving groups in and out and providing evaluators with time to organize paperwork and take nature breaks.
- Evaluators may also conduct rapid (3-5 minute) interviews with a strategic sampling of participants.

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

Ideally, each student focus group will be inclusive of

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

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

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

Data Analyses

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

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

Appendix B

FY15 JSHS Student Questionnaire Data Summaries

National Youth Data Summary

So that we can determine how diverse students respond to participation in AEOP programs, please tell us about yourself and your school. What grade will you start in the fall? (select one) (Avg. = , SD =)		
	Freq.	**%**
4th	0	0%
5th	0	0%
6th	0	0%
7th	0	0%
8th	0	0%
9th	0	0%
10th	0	0%
11th	9	15%
12th	24	39%
College freshman	28	46%
College sophomore	0	0%
College junior	0	0%
College senior	0	0%
Graduate program	0	0%
Other, (specify)	0	0%
Choose not to report	0	0%
Total	**52**	**100%**

What is your gender?		
	Freq.	**%**
Male	18	30%
Female	43	70%
Choose not to report	0	0%
Total	**61**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	1	2%

Asian	21	34%
Black or African American	2	3%
Native American or Alaska Native	1	2%
Native Hawaiian or Other Pacific Islander	1	2%
White	27	44%
Other race or ethnicity, (specify):	2	3%
Choose not to report	6	10%
Total	**61**	**100%**

Note. Other = "Asian/Latina"

Do you qualify for free or reduced lunches at school?		
	Freq.	**%**
Yes	2	3%
No	56	92%
Choose not to report	3	5%
Total	**61**	**100%**

Which best describes the location of your school?		
	Freq.	**%**
Frontier or tribal school	0	0%
Rural (country)	3	6%
Suburban	30	58%
Urban (city)	19	37%
Total	**61**	**100%**

What kind of school do you attend?		
	Freq.	**%**
Public school	0	0%
Private school	0	0%
Home school	0	0%
Online school	0	0%
Department of Defense school (DoDDS or DoDEA)	8	100%
Total	**8**	**100%**

In which REGIONAL JSHS event did you/your student(s) participate? (Select ONE)						
	Freq.	%			Freq.	%
Alabama	2	3%		New Jersey—North New Jersey	3	5%
Alaska	2	3%		New York – Rutgers	1	2%
Arizona	3	5%		New York – Long Island	1	2%
Arkansas	2	3%		New York – Metro	1	2%
California—Southern California	0	0%		New York – Upstate	2	3%
Connecticut	1	2%		North Carolina	0	0%
DoD Dependent Schools-Europe	4	7%		North Central	1	2%
DoD Dependent Schools-Pacific	3	5%		New England – Northern	2	3%
District of Columbia	1	2%		New England – Southern	1	2%
Florida	2	3%		Ohio	1	2%
Georgia	1	2%		Pennsylvania	1	2%
Hawaii	3	5%		Philadelphia	0	0%
Illinois	2	3%		Puerto Rico	1	2%
Illinois – Chicago	1	2%		South Carolina	2	3%
Indiana	1	2%		Tennessee	0	0%
Intermountain – CO, MT, ID, NV, UT	0	0%		Texas	2	3%
Iowa	1	2%		Virginia	2	3%
Kansas – Nebraska – Oklahoma	0	0%		Washington	2	3%
Kentucky	2	3%		West Virginia	1	2%
Louisiana	0	0%		Wisconsin	2	3%
Maryland	2	3%		Wyoming – Eastern Colorado	0	0%
Michigan	1	2%				
Missouri	1	2%				
				Total	61	100%

How did you learn about JSHS? (Check all that apply)						
	Freq.	%			Freq.	%
Army Educational Outreach Program (AEOP) website	1	1%		Friend or co-worker of family member	0	0%
Friend	6	8%		School or university newsletter, email, or website	19	26%
Family member	2	3%		Past participant of program	11	15%
Someone who works with the program	7	9%		Someone who works at the school or university I attend	22	30%
Someone who works with the Department of Defense (Army, Navy, Air Force)	3	4%		Other	2	3%
Choose not to report	1	1%				
				Total	56	100%

Why did you want to participate in JSHS?	
Teacher or professor encouragement	15 (9%)
An academic requirement or school grade	1 (1%)
Desire to learn something new or interesting	29 (18%)
The program mentor(s)	0 (0%)
Building college application or resume	7 (4%)
Networking opportunities	14 (9%)
Interest in science, technology, engineering, or mathematics (STEM)	41 (26%)
Interest in STEM careers with the Army	2 (1%)
Having fun	7 (4%)
Earning stipends or awards for doing STEM	5 (3%)
Opportunity to do something with friends	1 (1%)
Opportunity to use advanced laboratory technology	2 (1%)
Desire to expand laboratory or research skills	15 (9%)
Learning in ways that are not possible in school	8 (5%)
Serving the community or country	6 (4%)
Recommendations of past participants	1 (1%)
Figuring out education or career goals	4 (3%)
Other (specify)	1 (1%)
Choose not to report	1 (1%)

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Learn about new science, technology, engineering, or mathematics (STEM) topics	1 (2%)	4 (7%)	9 (15%)	22 (36%)	25 (41%)	61	**4.08**	0.99
Apply STEM knowledge to real life situations	2 (3%)	6 (10%)	18 (30%)	21 (34%)	14 (23%)	61	**3.64**	1.05
Learn about new discoveries in STEM	3 (5%)	11 (18%)	22 (36%)	16 (26%)	9 (15%)	61	**3.28**	1.08
Learn about different careers that use STEM	5 (8%)	19 (31%)	24 (39%)	4 (7%)	9 (15%)	61	**2.89**	1.14
Interact with scientists or engineers	16 (27%)	12 (20%)	2 (33%)	6 (10%)	6 (10%)	60	**2.57**	1.27
Communicate with other students about STEM	6 (10%)	8 (13%)	9 (15%)	15 (25%)	23 (38%)	61	**3.67**	1.36

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

How often do you do each of the following in JSHS this year?								
	1	2	3	4	5	n	Avg.	SD
Learn about new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	0 (0%)	5 (8%)	15 (25%)	41 (67%)	61	**4.59**	0.64
Apply STEM knowledge to real life situations	0 (0%)	4 (7%)	8 (13%)	15 (25%)	34 (56%)	61	**4.30**	0.94
Learn about new discoveries in STEM	0 (0%)	2 (3%)	5 (8%)	9 (15%)	45 (74%)	61	**4.59**	0.78
Learn about different careers that use STEM	0 (0%)	4 (7%)	3 (5%)	15 (25%)	39 (64%)	61	**4.46**	0.87
Interact with scientists or engineers	1 (2%)	1 (2%)	7 (12%)	10 (16%)	42 (69%)	61	**4.49**	0.89

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

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Use laboratory procedures and tools	2 (3%)	5 (8%)	27 (44%)	22 (36%)	5 (8%)	61	**3.38**	0.88
Participate in hands-on STEM activities	2 (3%)	12 (20%)	20 (33%)	22 (36%)	5 (8%)	61	**3.26**	0.98
Work as part of a team	0 (0%)	5 (8%)	22 (362)	22 (36%)	12 (20%)	61	**3.67**	0.89

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

How often do you do each of the following in JSHS this year?								
	1	2	3	4	5	n	Avg.	SD
Use laboratory procedures and tools	19 (31%)	7 (12%)	14 (23%)	12 (20%)	9 (15%)	61	**2.75**	1.46
Participate in hands-on STEM activities	10 (16%)	7 (12%)	8 (13%)	18 (30%)_	18 (30%)	61	**3.44**	1.44
Work as part of a team	14 (23%)	9 (15%)	15 (25%)	15 (25%)	8 (13%)	61	**2.90**	1.36

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

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Identify questions or problems to investigate	2% (1)	12% (7)	36% (22)	33% (20)	18% (11)	61	**3.54**	0.98
Design an investigation	8% (5)	15% (9)	51% (31)	21% (13)	5% (3)	61	**3.00**	0.95
Carry out an investigation	7% (4)	10% (6)	44% (27)	31% (19)	8% (5)	61	**3.25**	0.98
Analyze data or information	2% (1)	2% (1)	36% (22)	48% (29)	13% (8)	61	**3.69**	0.79
Draw conclusions from an investigation	2% (1)	2% (1)	48% (29)	41% (25)	8% (5)	61	**3.52**	0.74
Come up with creative explanations or solutions	5% (3)	10% (6)	42% (25)	25% (15)	18% (11)	60	**3.42**	1.06
Build or make a computer model	36% (22)	26% (16)	20% (12)	13% (8)	5% (3)	61	**2.25**	1.22

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

How often do you do each of the following in JSHS this year?								
	1	2	3	4	5	n	Avg.	SD
Identify questions or problems to investigate	14 (23%)	6 (10)	7 (12%)	16 (26%)	18 (30%)	61	**3.30**	1.55
Design an investigation	19 (32%)	7 (12%)	6 (10%)	17 (28%)	11 (18%)	61	**2.85**	1.54
Carry out an investigation	19 (32%)	7 (12%)	6 (10%)	17 (28%)	11(18%)	61	**2.90**	1.56
Analyze and interpret data or information	18 (30%)	5 (30%)	7 (12%)	19 (32%)	11 (18%)	61	**3.00**	1.54
Draw conclusions from an investigation	13 (27%)	7 (12%)	7 (12%)	17 (28%)	13 (22%)	61	**3.07**	1.54
Come up with creative explanations or solutions	13 (22%)	8 (13%)	8 (13%)	20 (33%)	11 (18%)	61	**3.13**	1.44
Build or make a computer model	35 (58%)	10 (17%)	4 (7%)	7 (12%)	4 (7%)	61	**1.92**	1.32

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

How USEFUL were each of the following JSHS resources provided at JSHS.org?								
	0	1	2	3	4	n	Avg.	SD
National JSHS Groundrules for Student Presentations	3 (5%)	1 (2%)	8 (13%)	11 (18%)	38 (62%)	61	**4.31**	1.09
Paper Submissions and Competition Deadlines	0 (0%)	3 (5%)	9 (15%)	9 (15%)	40 (66%)	61	**4.41**	0.92
Sample Papers	13 (21%)	5 (8%)	10 (16%)	10 (16%)	23 (38%)	61	**3.41**	1.57
Oral Presentation Tips	13 (21%)	2 (3%)	8 (13%)	12 (20%)	26 (43%)	61	**3.59**	1.57
Selected Articles - Conducting Research	18 (30%)	6 (10%)	14 (23%)	7 (11%)	16 (26%)	61	**2.95**	1.58

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), excluded from analysis, 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

How much did each of the following resources help you learn about Army Educational Outreach Programs (AEOPs)?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Academy of Applied Science (AAS) website	35 (57%)	5 (8%)	10 (16%)	6 (10%)	5 (8%)	61	**2.03**	1.38
Army Education Outreach Program (AEOP) website	32 (53%)	2 (3%)	12 (20%)	8 (13%)	7 (12%)	61	**2.28**	1.50
AEOP on Facebook, Twitter, Pinterest or other	33 (54%)	2 (3%)	16 (26%)	6 (10%)	4 (7%)	61	**2.11**	1.34
AEOP brochure	21 (34%)	1 (2%)	17 (28%)	13 (21%)	9 (15%)	61	**2.80**	1.48
It Starts Here! Magazine	46 (75%)	3 (5%)	6 (10%)	2 (3%)	4 (7%)	61	**1.61**	1.20
My JSHS mentor(s)	15 (25%)	4 (7%)	20 (33%)	8 (13%)	14 (23%)	61	**3.03**	1.46
Invited speakers or "career" events during JSHS	7 (12%)	1 (2%)	7 (12%)	12 (20%)	34 (56%)	61	**4.07**	1.34
Participation in JSHS	0 (0%)	0 (0%)	7 (12%)	5 (8%)	49 (80%)	61	**4.69**	0.67

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

How much did each of the following resources help you learn about STEM careers in the Army or Department of Defense (DoD)?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Academy of Applied Science (AAS) website	34 (56%)	3 (5%)	12 (20%)	6 (10%)	6 (10%)	61	**2.13**	1.43
Army Education Outreach Program (AEOP) website	33 (54%)	2 (3%)	8 (13%)	11 (18%)	7 (12%)	61	**2.30**	1.54
AEOP on Facebook, Twitter, Pinterest or other	37 (67%)	2 (3%)	16 (25%)	3 (5%)	3 (5%)	61	**1.90**	1.23
AEOP brochure	23 (38%)	1 (2%)	15 (25%)	12 (20%)	10 (16%)	61	**2.75**	1.53
It Starts Here! Magazine	44 (72%)	3 (5%)	6 (10%)	5 (8%)	3 (5%)	61	**1.69**	1.23
My JSHS mentor	15 (25%)	5 (8%)	13 (21%)	19 (31%)	9 (15%)	61	**3.03**	1.41
Invited speakers or "career" events during JSHS	6 (10%)	1 (2%)	5 (8%)	10 (16%)	39 (64%)	61	**4.23**	1.28
Participation in JSHS	0 (0%)	1 (2%)	5 (8%)	5 (8%)	50 (80%)	32	**4.70**	0.69

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

How SATISFIED were you with each of the following National JSHS program activities?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Student Oral Presentations	2 (3%)	0 (0%)	4 (7%)	12 (20%)	43 (71%)	61	**4.54**	0.89
Student Poster Presentations	4 (7%)	7 (12%)	11 (18%)	13 (21%)	26 (43%)	61	**3.82**	1.28
Judging Process	3 (5%)	18 (30%)	11 (18%)	11 (18%)	17 (28%)	60	**3.35**	1.31
Feedback from Judges	16 (26%)	15 (25%)	11 (18%)	7 (12%)	12 (20%)	61	**2.74**	1.47
Feedback from VIPs and Peers	9 (15%)	4 (7%)	10 (16%)	21 (34%)	17 (28%)	61	**3.54**	1.36
Invited Speaker Presentations	0 (0%)	2 (3%)	9 (15%)	13 (21%)	37 (67%	61	**4.39**	0.86
Panel or Roundtable Discussions	22 (36%)	3 (5%)	5 (8%)	11 (18%)	20 (33%)	61	**3.07**	1.74
Career Exhibits	6 (10%)	2 (3%)	10 (16%)	8 (13%)	35 (57%)	61	**4.05**	1.33
Tours or Field Trips	0 (0%)	1 (2%)	6 (10%)	17 (28%)	37 (61%)	61	**4.48**	0.74
Team Building Activities	19 (31%)	4 (7%)	6 (10%)	11 (18%)	21 (34%)	61	**3.18**	1.70
Social Events	3 (5%)	1 (2%)	9 (15%)	12 (20%)	35 (58%)	60	**4.25**	1.10

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Which of the following best describes your primary research mentor?		
	Freq.	**%**
I did not have a research mentor	4	6%
Teacher	22	36%
Coach	0	0%
Parent	1	2%
Club or activity leader (School club, Boy/Girls Scouts)	0	0%
STEM researcher (university, industry, or DoD/government employee)	32	53%
Other (specify)	2	3%
Total	**61**	**100%**

Note. Other = "Scientific professional, post-doctoral fellow"

How much input did you have in selecting your JSHS research project?		
	Freq.	**%**
I did not have a project	0	0%
I was assigned a project by my mentor	6	10%
I worked with my mentor to design a project	14	23%
I had a choice among various projects suggested by my mentor	5	8%
I worked with my mentor and members of a research team to design a project	11	18%
I designed the entire project on my own	25	41%
Total	**61**	**100%**

How often was your mentor available to you during JSHS?		
	Freq.	**%**
I did not have a mentor	6	10%
The mentor was never available	7	12%
The mentor was available less than half of the time	7	12%
The mentor was available about half of the time of my project	7	12%
The mentor was available more than half of the time	11	18%
The mentor was always available	22	36%
Total	**61**	**100%**

To what extent did you work as part of a group or team during JSHS?		
	Freq.	**%**
I worked alone (or alone with my research mentor)	40	66%
I worked with others in a shared laboratory or other space, but we worked on different projects	12	20%
I worked alone on my project, and I met with others regularly for general reporting or discussion	5	8%
I worked alone on a project that was closely connected with projects of others in my group	2	3%
I worked with a group who all worked on the same project	2	3%
Total	**61**	**100%**

How SATISFIED were you with each of the following?								
	0	1	2	3	4	n	Avg.	SD
My working relationship with my mentor	6 (10%)	1 (2%)	3 (5%)	6 (10%)	45 (74%)	61	**4.36**	1.28
The amount of time I spent doing meaningful research	0 (0%)	0 (0%)	1 (2%)	12 (20%)	48 (79%)	61	**4.77**	0.46
The amount of time I spent with my research mentor	7 (12%)	2 (3%)	3 (5%)	7 (11%)	42 (69%)	61	**4.23**	1.37
The research experience overall	0 (0%)	0 (0%)	2 (3%)	5 (8%)	54 (89%)	61	**4.85**	0.44

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Which of the following statements apply to your research experience? (choose all that apply)						
	Freq.	%			Freq.	%
I presented a talk or poster to other students or faculty	59	97%		I will present a talk or poster to other students or faculty	22	36%
I presented a talk or poster at a professional symposium or conference	50	82%		I will present a talk or poster at a professional symposium or conference	18	30%
I attended a symposium or conference	49	80%		I will attend a symposium or conference	25	41%
I wrote or co-wrote a paper that was/will be published in a research journal	15	25%		I will write or co-write a paper that was/will be published in a research journal	16	26%
I wrote or co-wrote a technical paper or patent	4	7%		I will write or co-write a technical paper or patent	4	7%
				I won an award or scholarship based on my research	36	59%
				Total	61	

The list below describes mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies that your mentor(s) used when working directly with you for JSHS:				
	Yes - my mentor used this strategy with me		No - my mentor did not use this strategy with me	
	Freq.	%	Freq.	%
Helped me become aware of the roles STEM play in my everyday life	42	75%	14	25%
Helped me understand how STEM can help me improve my community	41	73%	15	27%
Used a variety of strategies to help me learn	50	89%	6	11%
Gave me extra support when I needed it	54	96%	2	4%
Encouraged me to share ideas with others who have different backgrounds or viewpoints than I do	48	86%	8	14%
Allowed me to work on a team project or activity	36	64%	20	36%
Helped me practice a variety of STEM skills with supervision	52	93%	4	7%
Gave me feedback to help me improve in STEM	51	91%	5	9%
Talked to me about the education I need for a STEM career	46	82%	10	18%
Recommended Army Educational Outreach Programs that match my interests	10	18%	46	82%
Discussed STEM careers with DoD or other government agencies	15	27%	41	73%

Which category best describes the focus of your JSHS experience?		
	Freq.	%
Science	46	75%
Technology	4	7%
Engineering	7	11%
Mathematics	4	7%
Total	61	100%

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
In depth knowledge of a STEM topic(s)	2 (3%)	1 (2%)	14 (23%)	23 (28%)	21 (24%)	61	**3.98**	0.97
Knowledge of research conducted in a STEM topic or field	1 (2%)	1 (2%)	10 (16%)	25 (41%)	24 (39%)	61	**4.15**	0.87
Knowledge of research processes, ethics, and rules for conduct in STEM	2 (3%)	4 (7%)	17 (28%)	23 (38%)	15 (25%)	61	**3.74**	1.01
Knowledge of how scientists and engineers work on real problems in STEM	1 (2%)	2 (3%)	13 (21%)	22 (36%)	23 (38%)	61	**4.05**	0.94
Knowledge of what everyday research work is like in STEM	1 (2%)	3 (5%)	11 (18%)	24 (39%)	22 (36%)	61	**4.03**	0.95

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	1 (2%)	4 (9%)	12 (26%)	15 (33%)	14 (30%)	46	**3.80**	1.05
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	2 (4%)	4 (9%)	10 (22%)	15 (33%)	15 (33%)	46	**3.80**	1.13
Making a model of an object or system showing its parts and how they work	6 (13%)	7 (15%)	11 (24%)	12 (26%)	10 (22%)	46	**3.28**	1.33
Designing procedures for an experiment that are appropriate for the question to be answered	3 (7%)	3 (7%)	12 (26%)	15 (33%)	13 (28%)	46	**3.70**	1.15
Identifying the limitations of the methods and tools used for data collection	2 (5%)	6 (13%)	5 (11%)	17 (38%)	15 (33%)	46	**3.82**	1.17
Carrying out procedures for an investigation and recording data accurately	3 (7%)	2 (4%)	6 (13%)	17 (37%)	18 (39%)	46	**3.98**	1.14
Using computer models of objects or systems to test cause and effect relationships	9 (20%)	7 (15%)	9 (20%)	12 (26%)	9 (20%)	46	**3.11**	1.42
Organizing data in charts or graphs to find patterns and relationships	3 (7%)	3 (7%)	7 (15%)	16 (35%)	17 (37%)	46	**3.89**	1.18
Considering different interpretations of data when deciding how the data answer a question	1 (2%)	5 (11%)	9 (20%)	13 (28%)	18 (39%)	46	**3.91**	1.11
Supporting an explanation for an observation with data from experiments	1 (2%)	7 (15%)	6 (13%)	14 (30%)	18 (39%)	46	**3.89**	1.16
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	2 (4%)	7 (16%)	6 (13%)	14 (31%)	16 (36%)	45	**3.78**	1.22
Identifying the strengths and limitations of explanations in terms of how well they describe or predict	3 (7%)	6 (13%)	8 (18%)	12 (27%)	16 (36%)	45	**3.71**	1.27
Defending an argument that conveys how an explanation best describes an observation	2 (4%)	5 (11%)	10 (22%)	14 (31%)	14 (31%)	46	**3.73**	1.16
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	2 (4%)	4 (9%)	10 (22%)	14 (30%)	16 (35%)	46	**3.83**	1.14
Integrating information from technical or scientific texts and other media to support your explanation of an observation	1 (2%)	6 (13%)	7 (15%)	17 (37%)	15 (33%)	46	**3.85**	1.09
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	1 (2%)	3 (7%)	5 (11%)	18 (39%)	19 (41%)	46	**4.11**	0.99

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	1 (3%)	2 (7%)	9 (29%)	7 (23%)	12 (39%)	31	**3.87**	1.12
Using knowledge and creativity to propose a testable solution for a problem	1 (3%)	3 (10%)	6 (19%)	11 (36%)	10 (32%)	31	**3.84**	1.10
Making a model of an object or system to show its parts and how they work	2 (7%)	3 (10%)	9 (29%)	4 913%)	13 (42%)	31	**3.74**	1.29
Designing procedures for an experiment that are appropriate for the question to be answered	1 (3%)	3 (10%)	5 (16%)	9 (29%)	13 (42%)	31	**3.97**	1.14
Identifying the limitations of the methods and tools used for data collection	1 (3%)	3 (10%)	6 (19%)	8 (26%)	13 (42%)	31	**3.94**	1.15
Carrying out procedures for an experiment and recording data accurately	2 (7%)	2 (7%)	4 (13%)	9 (29%)	14 (45%)	31	**4.00**	1.21
Using computer models of an object or system to investigate cause and effect relationships	5 (16%)	5 (16%)	7 (23%)	5 (16%)	9 (29%)	31	**3.26**	1.46
Considering different interpretations of the data when deciding if a solution works as intended	2 (7%)	2 (7%)	7 (23%)	8 (26%)	12 (39%)	31	**3.84**	1.21
Organizing data in charts or graphs to find patterns and relationships	2 (7%)	3 (10%)	6 (19%)	8 (26%)	12 (39%)	31	**3.81**	1.25
Supporting a solution for a problem with data from experiments	3 910%)	2 (7%)	7 (23%)	7 (23%)	12 (38%)	31	**3.74**	1.32
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	1 (3%)	2 (7%)	7 (23%)	7 (23%)	14 (45%)	31	**4.00**	1.13
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	1 (3%)	2 (7%)	5 (16%)	11 (36%)	12 (39%)	31	**4.00**	1.06
Defend an argument that conveys how a solution best meets design criteria	1 (3%)	1 (3%)	9 (29%)	9 (29%)	11 (36%)	31	**3.90**	1.04
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	1 (3%)	2 (7%)	9 (19%)	7 (23%)	15 (48%)	31	**4.06**	1.12
Integrating information from technical or scientific texts and other media to support your solution to a problem	1 (3%)	2 (7%)	6 (19%)	9 (29%)	13 (42%)	31	**4.00**	1.10
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	2 (7%)	1 (3%)	7 (23%)	8 (26%)	13 (42%)	31	**3.94**	1.18

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Learning to work independently	6 (10%)	4 (7%)	10 (17%)	18 (31%)	21 (36%)	59	**3.75**	1.29
Setting goals and reflecting on performance	5 (9%)	4 (7%)	13 (22%)	16 (27%)	21 (36%)	59	**3.75**	1.25
Sticking with a task until it is finished	6 (10%)	6 (10%)	11 (19%)	13 (22%)	23 (39%)	59	**3.69**	1.36
Making changes when things do not go as planned	5 (9%)	2 (3%)	12 (20%)	14 (24%)	26 (44%)	59	**3.92**	1.25
Working well with people from all backgrounds	3 (5%)	8 (14%)	14 (24%)	11 (19%)	23 (39%)	59	**3.73**	1.26
Including others' perspectives when making decisions	4 (7%)	9 (15%)	15 (25%)	13 (22%)	18 (31%)	59	**3.54**	1.26
Communicating effectively with others	4 (7%)	5 (9%)	11 (19%)	12 (20%)	27 (46%)	59	**3.90**	1.27
Viewing failure as an opportunity to learn	3 (5%)	4 (7%)	10 (17%)	16 (27%)	26 (44%)	59	**3.98**	1.17

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Interest in a new STEM topic or field	2 (4%)	7 912%)	13 (22%)	12 (20%)	25 (42%)	59	**3.86**	1.20
Deciding on a path to pursue a STEM career	4 (7%)	6 (10%0	15 (25%)	14 (24%)	20 (34%)	59	**3.68**	1.24
Sense of accomplishing something in STEM	2 93%)	4 (7%)	9 (15%)	14 (24%)	30 (51%)	59	**4.12**	1.12
Feeling prepared for more challenging STEM activities	3 (5%)	2 (3%)	7 912%)	21 (36%)	26 (44%)	59	**4.10**	1.08
Confidence to try out new ideas or procedures on my own in a STEM project	4 (7%)	3 (5%)	9 (15%)	15 (25%)	28 (48%)	59	**4.02**	1.21
Patience for the slow pace of STEM research	5 (9%)	3 (5%)	11 919%)	13 (22%)	26 (45%)	58	**3.90**	1.28
Desire to build relationships with mentors who work in STEM	3 (5%)	3 (5%)	11 (19%)	11 (19%)	31 (53%)	59	**4.08**	1.18
Connecting a STEM topic or field to my personal values	4 (7%)	4 (7%)	10 (17%)	15 (25%)	26 (44%)	59	**3.93**	1.23

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

AS A RESULT OF YOUR JSHS experience, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?								
	1	2	3	4	5	n	Avg.	SD
Watch or read non-fiction STEM	1 (2%)	1 (2%)	23 (39%)	22 (37%)	12 (20%)	59	**3.73**	0.87
Tinker (play) with a mechanical or electrical device	0 (0%)	1 (2%)	26 (44%)	21 (36%)	11 (19%)	59	**3.71**	0.79
Work on solving mathematical or scientific puzzles	1 (2%)	0 (0%)	24 (41%)	19 (33%)	14 (24%)	58	**3.78**	0.88
Use a computer to design or program something	0 (0%)	2 (3%)	25 (42%)	20 (34%)	12 (20%)	59	**3.71**	0.83
Talk with friends or family about STEM	0 (0%)	1 (2%)	16 (27%)	23 (39%)	19 (32%)	59	**4.02**	0.82
Mentor or teach other students about STEM	0 (0%)	0 (0%)	17 (29%)	22 (37%)	20 (34%)	59	**4.05**	0.80
Help with a community service project related to STEM	0 (0%)	0 (0%)	21 (36%)	16 (27%)	22 (37%)	59	**4.02**	0.86
Participate in a STEM camp, club, or competition	1 (2%)	0 (0%)	16 (28%)	23 (40%)	18 (31%)	58	**3.98**	0.87
Take an elective (not required) STEM class	0 (0%)	0 (0%)	23 (39%)	13 (22%)	23 (39%)	59	**4.00**	0.89
Work on a STEM project or experiment in a university or professional setting	0 (0%)	0 (0%)	15 (25%)	16 (27%)	28 (48%)	59	**4.22**	0.83

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

How far did you want to go in school BEFORE participating in JSHS?		
	Freq.	%
Graduate from high school	0	0%
Go to a trade or vocational school	0	0%
Go to college for a little while	0	0%
Finish college (get a Bachelor's degree)	0	0%
Get more education after college	3	5%
Get a master's degree	11	18%
Get a Ph.D.	18	30%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	14	24%
Get a combined M.D. / Ph.D.	11	18%
Get another professional degree (law, business, etc.)	3	5%
Total	**60**	**100%**

How far did you want to go in school AFTER participating in JSHS?		
	Freq.	%
Graduate from high school	0	0%
Go to a trade or vocational school	0	0%
Go to college for a little while	0	0%
Finish college (get a Bachelor's degree)	1	2%
Get more education after college	2	3%
Get a master's degree	6	10%
Get a Ph.D.	20	33%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	9	15%
Get a combined M.D. / Ph.D.	20	33%
Get another professional degree (law, business, etc.)	2	4%
Total	**60**	**100%**

BEFORE you participated in JSHS, what kind of work did you want to do when you are 30? (select one)						
	Freq.	%			Freq.	%
Undecided	5	8%		Teaching, non-STEM	0	0%
Science (no specific subject)	3	5%		Medicine (e.g., doctor, dentist, veterinarian, etc.)	15	25%
Physical science (e.g., physics, chemistry, astronomy, materials science)	11	18%		Health (e.g., nursing, pharmacy, technician, etc.)	0	0%
Biological science	6	10%		Social science (e.g., psychologist, sociologist)	1	2%
Earth, atmospheric or oceanic science	0	0%		Business	1	2%
Environmental science	2	3%		Law	0	0%
Computer science	3	5%		Military, police, or security	0	0%
Technology	1	2%		Art (e.g., writing, dancing, painting, etc.)	0	0%
Engineering	9	15%		Skilled trade (carpenter, electrician, plumber, etc.)	0	0%
Mathematics or statistics	3	5%		Other	0	0%
Teaching, STEM	0	0%			0	0%
				Total	**60**	**100%**

AFTER you participated in JSHS, what kind of work do you want to do when you are 30? (select one)						
	Freq.	%			Freq.	%
Undecided	3	5%		Teaching, non-STEM	0	0%
Science (no specific subject)	2	4%		Medicine (e.g., doctor, dentist, veterinarian, etc.)	13	22%
Physical science (e.g., physics, chemistry, astronomy, materials science)	10	17%		Health (e.g., nursing, pharmacy, technician, etc.)	0	0%
Biological science	8	14%		Social science (e.g., psychologist, sociologist)	1	2%
Earth, atmospheric or oceanic science	0	0%		Business	1	2%
Mathematics or statistics	2	4%		Law	0	0%
Environmental science	4	7%		Military, police, or security	0	0%
Computer science	2	4%		Art (e.g., writing, dancing, painting, etc.)	0	0%
Technology	1	2%		Skilled trade (carpenter, electrician, plumber, etc.)	0	0%
Engineering	10	17%		Other	1	2%
Teaching, STEM	0	0%				
				Total	32	100%

When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your job?		
	Freq.	%
not at all	0	0%
up to 25% of the time	1	2%
up to 50% of the time	3	5%
up to 75% of the time	15	25%
up to 100% of the time	41	68%
Total	60	100%

How interested are you in participating in the following programs in the future?								
	0	1	2	3	4	n	Avg.	SD
Gains in the Education of Mathematics and Science (GEMS)	39 (66%)	2 (3%)	8 (14%)	4 (7%)	6 (10%)	59	**1.92**	1.42
UNITE	46 (79%)	1 (2%)	4 (7%)	3 (5%)	4 (7%)	58	**1.59**	1.24
Junior Science & Humanities Symposium (JSHS)	1 (2%)	1 (2%)	3 (5%)	5 (8%)	50 (83%)	60	**4.70**	0.79
Science & Engineering Apprenticeship Program (SEAP)	36 (61%)	1 (2%)	3 (5%)	6 (10%)	13 (22%)	59	**2.31**	1.73
Research & Engineering Apprenticeship Program (REAP)	37 (62%)	1 (2%)	5 (9%)	3 (5%)	13 (22%)	59	**2.22**	1.70
High School Apprenticeship Program (HSAP)	45 (76%)	2 (3%)	3 (5%)	3 (5%)	6 (10%)	59	**1.69**	1.37
College Qualified Leaders (CQL)	42 (71%)	1 92%)	4 (7%)	3 (5%)	9 (15%)	59	**1.92**	1.55
GEMS Near Peer Mentor Program	44 (75%)	2 93%0	4 (7%)	2 (3%)	7 (12%)	59	**1.75**	1.41
Undergraduate Research Apprenticeship Program (URAP)	33 (58%)	1 (2%)	6 (11%)	4 (7%)	13 (23%)	57	**2.35**	1.72
Science Mathematics, and Research for Transformation (SMART) College Scholarship	16 (27%	1 (2%)	7 (12%)	12 (20%)	23 (39%)	59	**3.42**	1.65
National Defense Science & Engineering Graduate (NDSEG) Fellowship	39 (66%)	1 (2%)	3 (5%)	3 (5%)	13 (22%)	59	**2.15**	1.71

Note. **Response scale: 0 = "I've never heard of this program",** 1 = **"Not at all,"** 2 = **"A little,"** 3 = **"Somewhat,"** 4 = **"Very much".**

How many jobs/careers in STEM did you learn about during JSHS?		
	Freq.	%
None	0	0%
1	0	0%
2	5	8%
3	6	10%
4	7	12%
5 or more	42	70%
Total	**60**	**100%**

How many Department of Defense (DoD) STEM jobs/careers did you learn about during JSHS?		
	Freq.	%
None	1	2%
1	1	2%
2	5	8%
3	5	8%
4	6	10%
5 or more	42	70%
Total	**60**	**100%**

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	0 (0%)	0 (0%)	1 (2%)	24 (40%)	35 (58%)	60	**4.57**	0.53
DoD researchers develop new, cutting edge technologies	0 (0%)	0 (0%)	1 (2%)	19 (32%)	40 (67%)	60	**4.65**	0.52
DoD researchers solve real-world problems	0 (0%)	1 (2%)	1 92%)	18 (30%)	40 (67%)	60	**4.62**	0.61
DoD research is valuable to society	0 (0%)	1 (2%)	2 (3%)	16 (27%)	41 (68%)	60	**4.62**	0.64

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

Which of the following statements describe you after participating in JSHS?							
	1	2	3	4	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	3 (5%)	7 (12%)	40 (67%)	10 (17%)	60	**2.95**	0.70
I am more interested in participating in STEM activities outside of school requirements	0 (0%)	12 (20%)	37 (62%)	11 (18%)	60	**2.98**	0.62
I am more aware of other AEOPs	9 (15%)	5 (8%)	27 (45%)	19 (32%)	60	**2.93**	1.01
I am more interested in participating in other AEOPs	18 (30%)	5 (8%)	21 (35%)	16 (27%)	60	**2.58**	1.18
I am more interested in taking STEM classes in school	0 (0%)	25 (42%)	26 (43%)	9 (15%)	60	**2.73**	0.71
I am more interested in earning a STEM degree	2 (3%)	20 (24%)	28 (48%)	9 (15%)	59	**2.75**	0.76
I am more interested in pursuing a STEM career	1 (2%)	19 (32%)	32 (53%)	8 (13%)	60	**2.78**	0.69
I am more aware of Army or DoD STEM research and careers	0 (0%)	3 (5%)	23 (38%)	34 (57%)	60	**3.52**	0.60
I have a greater appreciation of Army or DoD STEM research	2 (3%)	5 (8%)	21 (35%)	32 (53%)	60	**3.38**	0.78
I am more interested in pursuing a STEM career with the Army or DoD	13 (22%)	5 (8%)	23 (38%)	19 (32%)	60	**2.80**	1.12

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

Regional Youth Data Summary

So that we can determine how diverse students respond to participation in AEOP programs, please tell us about yourself and your school: What grade will you start in the fall? (Avg. = , SD =)		
	Freq.	**%**
4th	0	0%
5th	1	<1%
6th	0	0%
7th	0	0%
8th	2	1%
9th	11	3%
10th	34	9%
11th	69	19%
12th	132	37%
College freshman	92	26%
College sophomore	0	0%
College junior	0	0%
College senior	3	1%
Graduate program	3	1%
Other (specify)	7	2%
Choose not to report	4	1%
Total	**358**	**100%**

Note: Other included “mentor”, “professor”, and “teacher”.

What is your gender?		
	Freq.	**%**
Male	135	38%
Female	218	61%
Choose not to report	4	1%
Total	**357**	**100%**

What is your race or ethnicity?		
	Freq.	%
Hispanic or Latino	33	9%
Asian	76	21%
Black or African American	17	5%
Native American or Alaska Native	2	1%
Native Hawaiian or Other Pacific Islander	0	0%
White	195	55%
Other race or ethnicity (specify):	7	2%
Choose not to report	26	7%
Total	356	100%

Note. Other = "Asian (Thailand)", "Middle Eastern," "White and Indian," "Hindu", "Haitian", "Jewish", and "Mixed (Asian/White)."

Do you qualify for free or reduced lunches at school?		
	Freq.	%
Yes	57	16%
No	280	79%
Choose not to report	19	5%
Total	356	100%

Which best describes the location of your school?		
	Freq.	%
Frontier or reservation	0	0%
Rural (country)	53	15%
Suburban	207	58%
Urban (city)	95	27%
Total	355	100%

What kind of school do you attend?		
	Freq.	%
Public school	277	78%
Private school	65	18%
Home school	3	1%
Online school	1	<1%
Department of Defense school (DoDDS or DoDEA)	11	3%
Total	357	100%

In which REGIONAL JSHS event did you participate? (Select ONE)						
	Freq.	%			Freq.	%
Alabama	13	4%		New Jersey—Rutgers	16	5%
Alaska	17	5%		New York—Long Island	11	3%
Arizona	8	2%		New York—Metro	9	3%
California—Northern California & Western Nevada	0	0%		New York—Upstate	20	6%
California—Southern California	5	1%		North Carolina	6	2%
Connecticut	29	8%		North Central—Minnesota, North Dakota, South Dakota	0	0%
DoD Dependent Schools-Europe	8	2%		New England—Northern New England	1	<1%
DoD Dependent Schools-Pacific	3	1%		New England—Southern New England	0	0%
District of Columbia	11	3%		Ohio	27	8%
Florida	0	0%		Oregon	0	0%
Georgia	24	7%		Pennsylvania	7	2%
Hawaii	0	0%		Philadelphia	9	3%
Illinois	13	4%		Puerto Rico	20	6%
Indiana	19	5%		South Carolina	0	0%
Intermountain—Colorado, Montana, Idaho, Nevada, Utah	7	2%		Southwest	0	0%
Iowa	1	<1%		Tennessee	1	<1%
Kansas—Nebraska—Oklahoma	9	3%		Texas	5	1%
Kentucky	1	<1%		Virginia	12	3%
Maryland	6	2%		Washington	8	2%
Michigan	9	3%		West Virginia	2	1%
Mississippi	0	0%		Wisconsin – Western Wisconsin & Upper Michigan	0	0%
Missouri	0	0%		Wisconsin	0	0%
New Jersey—Monmouth	7	2%		Wyoming – Eastern Colorado	4	1%
				Total	348	100%

How did you learn about JSHS? (Check all that apply)						
	Freq.	%			Freq.	%
Army Educational Outreach Program (AEOP) website	0	0%		School or university newsletter, email, or website	16	20%
Friend	12	15%		Past participant of program	11	14%
Family member	4	5%		Someone who works with program	7	9%
Friend or co-worker of a family member	0	0%		Someone who works at the school or university I attend	24	30%
Someone who works with the Department of Defense (Army, Navy, Air Force)	1	1%		Choose not to report	2	3%
Other	3	4%				
				Total	50	100%

Why did you want to participate in JSHS?	n = 50
Teacher or professor encouragement	15 (10%)
An academic requirement or school grade	5 (3%)
Desire to learn something new or interesting	24 (16%)
The program mentor(s)	1 91%)
Building college application or resume	11 (7%)
Networking opportunities	4 (3%)
Interest in science, technology, engineering, or mathematics (STEM)	38 (26%)
Interest in STEM careers with the Army	0 (0%)
Having fun	9 (6%)
Earning stipends or awards for doing STEM	4 (3%)
Opportunity to do something with friends	1 (1%)
Opportunity to use advanced laboratory technology	0 (0%)
Desire to expand laboratory or research skills	15 (10%)
Learning in ways that are not possible in school	8 (5%)
Serving the community or country	5 (3%)
Recommendations of past participants	2 (1%)
Figuring out education or career goals	4 (3%)
Other (specify)	0 (0%)
Choose not to report	1 (1%)

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Learn about new science, technology, engineering, or mathematics (STEM) topics that are new to you	17 (5%)	14 (4%)	55 (17%)	117 (36%)	127 (38%)	330	**3.98**	1.09
Apply STEM learning to real life situations	25 (7%)	32 (10%)	103 (31%)	109 (33%)	60 (18%)	329	**3.45**	1.13
Learn about new discoveries in STEM	28 (9%)	40 (12%)	108 (33%)	101 (31%)	51 (15%)	328	**3.33**	1.14
Learn about different careers that uses STEM	32 (10%)	53 (16%)	121 (37%)	80 (25%)	40 (12%)	326	**3.13**	1.13
Interact with scientists or engineers	80 (24%)	79 (24%)	88 (27%)	47 (14%)	35 (11%)	329	**2.63**	1.28
Communicate with other students about STEM	35 (11%)	31 (10%)	61 (19%)	90 (27%)	112 (34%)	329	**3.65**	1.32

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

How often do you do each of the following in JSHS this year?								
	1	2	3	4	5	n	Avg.	SD
Learn about new science, technology, engineering, or mathematics (STEM) topics that are new to you	6 (2%)	19 (6%)	55 (17%)	75 (23%)	171 (52%)	326	**4.18**	1.03
Apply STEM learning to real life situations	17 (5%)	32 (10%)	63 (20%)	74 (22%)	141 (43%)	327	**3.89**	1.21
Learn about new discoveries in STEM	10 (3%)	23 (7%)	48 (15%)	82 (25%)	162 (50%)	325	**4.12**	1.09
Learn about different careers that use STEM	22 (7%)	42 (13%)	54 (17%)	85 (26%)	122 (38%)	325	**3.75**	1.27
Interact with scientists or engineers	14 (4%)	37 (11%)	48 (15%)	88 (27%)	139 (43%)	326	**3.92**	1.19
Communicate with other students about STEM	10 (3%)	39 (12%)	34 (11%)	74 (23%)	169 (52%)	326	**4.08**	1.17

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

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Build or make a computer model	144 (48%)	62 (21%)	50 (17%)	28 (9%)	17 (6%)	303	**2.04**	1.22
Use laboratory procedures and tools	7 (2%)	7 (2%)	125 (41%)	120 (39%)	45 (15%)	304	**3.62**	0.84
Participate in hands-on STEM activities	12 (4%)	12 (4%)	121 (40%)	111 (37%)	48 (16%)	304	**3.56**	0.94
Come up with creative explanations or solutions	13 (4%)	36 (12%)	104 (34%)	101 (33%)	50 (16%)	304	**3.46**	1.04
Draw conclusions from an investigation	6 (2%)	18 (6%)	107 (35%)	122 (40%)	51 (17%)	304	**3.64**	1.10
Work as part of a team	9 (3%)	15 (5%)	96 (32%)	126 (41%)	58 (19%)	304	**3.69**	0.90

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

How often do you do each of the following in JSHS this year?								
	1	2	3	4	5	n	Avg.	SD
Build or make a computer model	189 (62%)	35 (12%)	29 (10%)	25 (8%)	25 (8%)	303	**1.88**	1.35
Work as part of a team	101 (33%)	55 (18%)	43 (14%)	64 (21%)	43 (14%)	306	**2.65**	1.47
Use laboratory procedures and tools	110 (36%)	26 (9%)	48 (16%)	72 (24%)	48 (16%)	304	**2.74**	1.53
Participate in hands-on STEM activities	82 (27%)	32 (10%)	47 (15%)	74 (24%)	70 (23%)	305	**3.06**	1.53
Come up with creative explanations or solutions	67 (22%)	36 (12%)	48 (16%)	80 (26%)	73 (24%)	304	**3.18**	1.49
Draw conclusions from an investigation	58 (19%)	45 (15%)	55 (18%)	72 (24%)	75 (25%)	305	**3.20**	1.45

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

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Design an investigation	23 (8%)	55 (19%)	112 (37%)	85 (29%)	28 (9%)	303	**3.13**	1.05
Carry out an investigation	15 (5%)	25 (8%)	132 (43%)	92 (30%)	40 (13%)	304	**3.38**	0.98
Analyze data or information	8 (3%)	16 (5%)	87 (35%)	132 (40%)	62 (17%)	305	**3.73**	0.92
Identify questions or problems to investigate	11 (4%)	26 (9%)	89 (29%)	110 (36%)	68 (22%)	304	**3.65**	1.03

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

How often do you do each of the following in JSHS this year?								
	1	2	3	4	5	n	Avg.	SD
Design an investigation	97 (32%)	39 (13%)	50 (16%)	65 (21%)	54 (18%)	305	**2.80**	1.52
Carry out an investigation	95 (31%)	36 (12%)	49 (16%)	63 (21%)	62 (20%)	305	**2.87**	1.55
Identify questions or problems to investigate	58 (19%)	45 (15%)	55 (18%)	72 (24%)	75 (25%)	305	**3.20**	1.45
Analyze data or information	58 (19%)	37 (12%)	53 (17%)	77 (25%)	78 (26%)	303	**3.26**	1.46

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

How USEFUL were each of the following JSHS resources provided at JSHS.org?								
	0	1	2	3	4	n	Avg.	SD
National JSHS Groundrules for Student Presentations	82 (28%)	4 (1%)	29 (10%)	53 (18%)	126 (43%)	294	**3.47**	1.67
Paper Submissions and Competition Deadlines	63 (21%)	9 (3%)	23 (8%)	47 (16%)	153 (52%)	295	**3.74**	1.59
Sample Papers	110 (38%)	10 (3%)	31 (11%)	46 (16%)	96 (33%)	293	**3.02**	1.73
Oral Presentation Tips	106 (36%)	12 (4%)	30 (10%)	53 (18%)	92 (31%)	293	**3.05**	1.70
Selected Articles - Conducting Research	125 (43%)	18 (6%)	31 (11%)	40 (14%)	78 (27%)	292	**2.77**	1.70

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during JSHS:								
	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science (AAS) website	236 (79%)	11 (4%)	9 (3%)	11 (4%)	30 (10%)	297	**2.98**	1.18
Army Educational Outreach Program (AEOP) website	235 (79%)	9 (3%)	13 (4%)	12 (4%)	27 (9%)	296	**2.93**	1.12
AEOP on Facebook, Twitter, Pinterest or other social media	245 (83%)	14 (5%)	10 (3%)	10 (3%)	16 (5%)	295	**2.56**	1.21
AEOP brochure	221 (74%)	9 (3%)	24 (8%)	10 (3%)	33 (11%)	297	**2.88**	1.11
It Starts Here! Magazine	254 (87%)	10 (3%)	9 (3%)	7 (2%)	12 (4%)	292	**2.55**	1.2
My JSHS mentor(s)	131 (44%)	45 (15%)	39 (13%)	22 (7%)	61 (20%)	298	**2.59**	1.23
Invited speakers or "career" events during JSHS	112 (38%)	31 (10%)	54 (18%)	45 (15%)	55 (19%)	297	**2.67**	1.08
Participation in JSHS	59 (20%)	33 (11%)	63 (21%)	47 (16%)	95 (32%)	297	**2.86**	1.1

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during JSHS:								
	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science (AAS) website	232 (78%)	14 (5%)	12 (4%)	10 (3%)	28 (9%)	296	**2.81**	1.22
Army Educational Outreach Program (AEOP) website	236 (80%)	16 (5%)	8 (3%)	12 (4%)	23 (8%)	295	**2.71**	1.25
AEOP on Facebook, Twitter, Pinterest or other social media	245 (83%)	17 (6%)	9 (3%)	8 (3%)	17 (6%)	296	**2.49**	1.27
AEOP brochure	216 (73%)	13 (4%)	21 (7%)	11 (4%)	33 (11%)	294	**2.82**	1.16
It Starts Here! Magazine	252 (86%)	13 (4%)	9 (3%)	7 (2%)	13 (4%)	294	**2.48**	1.23
My JSHS mentor(s)	139 (47%)	46 (15%)	39 (13%)	18 (6%)	55 (19%)	297	**2.52**	1.24
Invited speakers or "career" events during JSHS	104 (35%)	32 (11%)	58 (20%)	49 (17%)	53 (18%)	296	**2.64**	1.06
Participation in JSHS	72 (24%)	38 (13%)	66 (22%)	44 (15%)	78 (26%)	298	**2.72**	1.11

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

The following activities were common to many Regional JSHS programs across the nation. How SATISFIED were you with each of the following REGIONAL JSHS program activities? If your Regional JSHS event did not have a given activity, select "Did Not Experience"								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Student Oral Presentations	0 (0%)	1 (5%)	1 (5%)	7 (35%)	11 (55%)	20	**3.40**	0.82
Student Poster Presentations	0 (0%)	1 (5%)	3 (15%)	6 (30%)	10 (50%)	20	**3.25**	0.91
Judging Process	2 (10%)	3 (15%)	3 (15%)	6 (30%)	6 (30%)	20	**2.83**	1.1
Feedback from Judges	3 (15%)	6 (30%)	2 (10%)	5 (25%)	4 (20%)	20	**2.41**	1.23
Feedback from VIPs and Peers	4 (20%)	0 (0%)	4 (20%)	5 (25%)	7 (35%)	20	**3.19**	0.83
Invited Speaker Presentations	0 (0%)	3 (15%)	4 (20%)	5 (25%)	8 (40%)	20	**2.90**	1.12
Panel or Roundtable Discussions	14 (70%)	2 (10%)	2 (10%)	1 (5%)	1 (5%)	20	**2.17**	1.17
Career Exhibits	15 (75%)	1 (5%)	0 (0%)	1 (5%)	3 (15%)	20	**3.20**	1.3
Tours or Field Trips	10 (50%)	0 (0%)	2 (10%)	2 (10%)	6 (30%)	20	**3.40**	0.84
Team Building Activities	15 (75%)	0 (0%)	1 (5%)	2 (10%)	2 (10%)	20	**3.20**	0.84
Social Events	5 (25%)	0 (0%)	1 (5%)	6 (30%)	8 (40%)	20	**3.47**	0.64

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Which of the following best describes your primary research mentor?		
	Freq.	**%**
I did not have a research mentor	9	4%
Teacher	106	46%
Coach	0	0%
Parent	14	6%
Club or activity leader (School club, Boy/Girls Scouts)	2	1%
STEM researcher (university, industry, or DoD/government employee)	87	38%
Other (specify)	12	5%
Total	**230**	**100%**

Note. Other = "professor", "university researcher", "optometrist", "college student", "family friend", "NYBG forest director", and "Honda employee".

Which of the following statements best reflects the input you had into your project initially?		
	Freq.	**%**
I did not have a project	2	1%
I was assigned a project by my mentor	14	6%
I worked with my mentor to design a project	75	33%
I had a choice among various projects suggested by my mentor	15	7%
I worked with my mentor and members of a research team to design a project	38	17%
I designed the entire project on my own	86	37%
Total	**230**	**100%**

Which of the following statements best reflects the availability of your mentor?		
	Freq.	**%**
The mentor was never available	23	11%
The mentor was available less than half of the time	19	9%
The mentor was available about half of the time of my project	20	9%
The mentor was available more than half of the time	32	15%
The mentor was always available	123	57%
Total	**217**	**100%**

Which of the following statements best reflects your working as part of a group or team?		
	Freq.	**%**
I worked alone (or alone with my research mentor)	151	67%
I worked with others in a shared laboratory or other space, but we worked on different projects	42	19%
I worked alone on my project, and I met with others regularly for general reporting or discussion	13	6%
I worked alone on a project that was closely connected with projects of others in my group	7	3%
I worked with a group who all worked on the same project	13	6%
Total	**226**	**100%**

How SATISFIED were you with each of the following?								
	0	1	2	3	4	n	Avg.	SD
My working relationship with my mentor	6 (3%)	4 (2%)	14 (6%)	25 (11%)	181 (79%)	230	**3.71**	0.66
The amount of time I spent doing meaningful research	1 (0%)	2 (1%)	17 (7%)	36 (16%)	174 (76%)	230	**3.67**	0.65
The amount of time I spent with my research mentor	6 (3%)	7 (3%)	17 (7%)	38 (17%)	162 (70%)	230	**3.58**	0.76
The research experience overall	0 (0%)	1 (0%)	10 (4%)	39 (17%)	179 (78%)	229	**3.73**	0.56

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Which of the following statements apply to your research experience? (choose all that apply)						
	Freq.	%			Freq.	%
I presented a talk or poster to other students or faculty	181	85%		I will present a talk or poster to other students or faculty	57	27%
I presented a talk or poster at a professional symposium or conference	134	63%		I will present a talk or poster at a professional symposium or conference	41	19%
I attended a symposium or conference	152	72%		I will attend a symposium or conference	49	23%
I wrote or co-wrote a paper that was/will be published in a research journal	25	12%		I will write or co-write a paper that was/will be published in a research journal	27	13%
I wrote or co-wrote a technical paper or patent	30	14%		I will write or co-write a technical paper or patent	12	6%
				I won an award or scholarship based on my research	77	36%
				Total	212	

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

	Yes - my mentor used this strategy with me		No - my mentor did not use this strategy with me	
	Freq.	%	Freq.	%
Helped me become aware of the roles STEM play in my everyday life	134	63%	78	37%
Helped me understand how STEM can help me improve my community	138	65%	74	35%
Used a variety of strategies to help me learn	175	83%	37	18%
Gave me with extra support when I needed it	196	93%	15	7%
Encouraged me to share ideas with others who have different backgrounds or viewpoints	154	73%	57	27%
Allowed me to work on a team project or activity	120	57%	91	42%
Helped me learn or practice a variety of STEM skills	181	85%	31	15%
Gave me feedback to help me improve in STEM	190	90%	22	10%
Talked to me about the education I need for a STEM career	135	64%	76	36%
Recommended Army Educational Outreach Programs that match my interests	50	24%	162	76%
Discussed STEM careers with the DoD or government	55	26%	157	74%

Which category best describes the focus of your JSHS experience?

	Freq.	%
Science	210	78%
Technology	11	4%
Engineering	43	16%
Mathematics	6	2%
Total	**270**	**100%**

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

	1	2	3	4	5	n	Avg.	SD
In depth knowledge of a STEM topic(s)	0 (0%)	15 (5%)	28 (10%)	79 (28%)	81 (29%)	283	**3.65**	1.15
Knowledge of research conducted in a STEM topic or field	0 (0%)	14 (5%)	14 (5%)	75 (27%)	89 (31%)	283	**3.81**	1.09
Knowledge of research processes, ethics, and rules for conduct in STEM	0 (0%)	13 (5%)	27 (10%)	70 (25%)	86 (30%)	283	**3.73**	1.13
Knowledge of how scientists and engineers work on real problems in STEM	0 (0%)	16 (6%)	24 (8%)	60 (21%)	91 (32%)	283	**3.77**	1.16
Knowledge of what everyday research work is like in STEM	0 (0%)	13 (5%)	28 (10%)	70 (25%)	74 (26%)	280	**3.75**	1.16

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	0 (0%)	12 (6%)	15 (8%)	54 (27%)	61 (31%)	199	**3.68**	1.14
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	0 (0%)	12 (6%)	13 (7%)	43 (22%)	63 (32%)	199	**3.81**	1.15
Making a model of an object or system showing its parts and how they work	0 (0%)	32 (16%)	26 (13%)	50 (25%)	41 (21%)	198	**3.25**	1.39
Designing procedures for an experiment that are appropriate for the question to be answered	0 (0%)	15 (8%)	8 (4%)	51 (26%)	59 (30%)	199	**3.77**	1.18
Identifying the limitations of the methods and tools used for data collection	0 (0%)	15 (8%)	12 (6%)	54 (27%)	55 (28%)	199	**3.7**	1.19
Carrying out procedures for an experiment and recording data accurately	0 (0%)	17 (9%)	7 (4%)	46 (23%)	53 (27%)	198	**3.82**	1.22
Using computer models of objects or systems to test cause and effect relationships	0 (0%)	61 (31%)	20 (10%)	37 (19%)	35 (18%)	198	**2.91**	1.56
Organizing data in charts or graphs to find patterns and relationships	0 (0%)	17 (9%)	13 (7%)	40 (20%)	55 (28%)	197	**3.77**	1.25
Considering different interpretations of data when deciding how the data answer a question	0 (0%)	16 (8%)	12 (6%)	48 (24%)	56 (28%)	198	**3.73**	1.22
Supporting an explanation for an observation with data from experiments	0 (0%)	14 (7%)	10 (5%)	40 (20%)	60 (30%)	199	**3.86**	1.18
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	14 (7%)	15 (8%)	35 (18%)	58 (29%)	198	**3.84**	1.22
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	0 (0%)	13 (7%)	11 (6%)	50 (25%)	62 (31%)	198	**3.75**	1.15
Defending an argument that conveys how an explanation best describes an observation	0 (0%)	14 (7%)	14 (7%)	53 (27%)	54 (27%)	198	**3.7**	1.19
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	13 (7%)	15 (8%)	50 (25%)	49 (25%)	198	**3.76**	1.21
Integrating information from technical or scientific texts and other media to support your explanation of an observation	0 (0%)	19 (10%)	18 (9%)	46 (23%)	55 (28%)	198	**3.6**	1.27
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	0 (0%)	13 (7%)	8 (4%)	43 (22%)	51 (26%)	198	**3.92**	1.18

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	0 (0%)	1 (1%)	4 (5%)	22 (29%)	24 (32%)	75	**3.88**	0.97
Using knowledge and creativity to propose a testable solution for a problem	0 (0%)	3 (4%)	3 (4%)	23 (31%)	21 (28%)	75	**3.83**	1.07
Making a model of an object or system to show its parts and how they work	0 (0%)	6 (8%)	7 (9%)	22 (29%)	15 (20%)	75	**3.61**	1.26
Designing procedures for an experiment that are appropriate for the question to be answered	0 (0%)	2 (3%)	7 (9%)	20 (27%)	23 (31%)	75	**3.77**	1.07
Identifying the limitations of the methods and tools used for data collection	0 (0%)	2 (3%)	6 (8%)	17 (23%)	25 (33%)	75	**3.87**	1.06
Carrying out procedures for an experiment and recording data accurately	0 (0%)	3 (4%)	7 (9%)	21 (28%)	20 (27%)	75	**3.73**	1.13
Using computer models of an object or system to investigate cause and effect relationships	0 (0%)	13 (18%)	12 (16%)	16 (22%)	15 (20%)	74	**3.18**	1.43
Considering different interpretations of the data when deciding if a solution works as intended	0 (0%)	2 (3%)	4 (5%)	17 (23%)	33 (44%)	75	**3.84**	0.96
Organizing data in charts or graphs to find patterns and relationships	0 (0%)	5 (7%)	5 (7%)	17 (23%)	28 (37%)	75	**3.71**	1.14
Supporting a solution for a problem with data from experiments	0 (0%)	3 (4%)	3 (4%)	21 (28%)	24 (32%)	75	**3.84**	1.05
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	1 (1%)	5 (7%)	17 (23%)	27 (36%)	75	**3.93**	0.98
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0 (0%)	1 (1%)	3 (4%)	21 (28%)	25 (34%)	74	**3.92**	0.95
Defend an argument that conveys how a solution best meets design criteria	0 (0%)	2 (3%)	8 (11%)	21 (28%)	21 (28%)	75	**3.73**	1.09
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	4 (5%)	5 (7%)	22 (29%)	23 (31%)	75	**3.69**	1.11
Integrating information from technical or scientific texts and other media to support your solution to a problem	0 (0%)	4 (5%)	6 (8%)	23 (31%)	20 (27%)	75	**3.67**	1.14
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	0 (0%)	1 (1%)	5 (7%)	15 (20%)	20 (27%)	75	**4.08**	1.02

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Learning to work independently	0 (0%)	22 (8%)	24 (9%)	43 (16%)	59 (23%)	262	**3.84**	1.30
Setting goals and reflecting on performance	0 (0%)	17 (7%)	19 (7%)	42 (16%)	77 (30%)	261	**3.90**	1.20
Sticking with a task until it is finished	0 (0%)	18 (7%)	14 (5%)	39 (15%)	63 (24%)	259	**4.02**	1.22
Making changes when things do not go as planned	0 (0%)	12 (5%)	19 (7%)	40 (15%)	66 (25%)	261	**4.04**	1.16
Working well with people from all backgrounds	0 (0%)	30 (11%)	27 (10%)	42 (16%)	60 (23%)	261	**3.68**	1.38
Including others' perspectives when making decisions	0 (0%)	27 (10%)	26 (10%)	49 (19%)	71 (27%)	261	**3.64**	1.32
Communicating effectively with others	0 (0%)	17 (7%)	20 (8%)	34 (13%)	71 (27%)	261	**3.98**	1.22
Viewing failure as an opportunity to learn	0 (0%)	14 (5%)	17 (7%)	42 (16%)	73 (28%)	261	**3.99**	1.16

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

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Interest in a new STEM topic	0 (0%)	28 (11%)	32 (13%)	50 (20%)	49 (19%)	255	**3.60**	1.38
Deciding on a path to pursue a STEM career	0 (0%)	19 (7%)	28 (11%)	43 (17%)	59 (23%)	257	**3.81**	1.29
Sense of accomplishing something in STEM	0 (0%)	17 (7%)	18 (7%)	51 (20%)	69 (27%)	255	**3.85**	1.21
Feeling prepared for more challenging STEM activities	0 (0%)	16 (6%)	14 (5%)	48 (19%)	74 (29%)	256	**3.92**	1.17
Confidence to try out new ideas or procedures on my own in a STEM project	0 (0%)	24 (9%)	25 (10%)	50 (20%)	73 (29%)	256	**3.66**	1.28
Patience for the slow pace of STEM research	0 (0%)	18 (7%)	20 (8%)	40 (16%)	57 (22%)	256	**3.95**	1.26
Desire to build relationships with mentors who work in STEM	0 (0%)	19 (7%)	22 (9%)	49 (19%)	61 (24%)	257	**3.83**	1.26
Connecting a STEM topic or field to my personal values	0 (0%)	28 (11%)	32 (13%)	50 (20%)	49 (19%)	255	**3.60**	1.38

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

AS A RESULT OF YOUR JSHS experience, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?								
	1	2	3	4	5	n	Avg.	SD
Watch or read non-fiction STEM	0 (0%)	6 (2%)	3 (1%)	115 (46%)	68 (27%)	251	**3.68**	0.93
Tinker (play) with a mechanical or electrical device	0 (0%)	3 (1%)	7 (3%)	110 (44%)	73 (29%)	251	**3.70**	0.90
Work on solving mathematical or scientific puzzles	0 (0%)	2 (1%)	3 (1%)	104 (41%)	78 (31%)	251	**3.79**	0.87
Use a computer to design or program something	0 (0%)	4 (2%)	10 (4%)	108 (43%)	69 (27%)	251	**3.68**	0.93
Talk with friends or family about STEM	0 (0%)	1 (0%)	5 (2%)	65 (26%)	90 (36%)	250	**4.04**	0.86
Mentor or teach other students about STEM	0 (0%)	3 (1%)	1 (0%)	73 (29%)	81 (32%)	251	**4.04**	0.89
Help with a community service project related to STEM	0 (0%)	2 (1%)	3 (1%)	69 (27%)	86 (34%)	251	**4.04**	0.87
Participate in a STEM camp, club, or competition	0 (0%)	5 (2%)	4 (2%)	63 (25%)	83 (33%)	251	**4.04**	0.94
Take an elective (not required) STEM class	0 (0%)	2 (1%)	5 (2%)	81 (32%)	72 (29%)	251	**3.98**	0.92
Work on a STEM project or experiment in a university or professional setting	0 (0%)	2 (1%)	3 (1%)	47 (19%)	82 (33%)	250	**4.23**	0.85

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

How far did you want to go in school BEFORE participating in JSHS?		
	Freq.	%
Graduate from high school	16	7%
Go to a trade or vocational school	0	0%
Go to college for a little while	2	1%
Finish college (get a Bachelor's degree)	33	14%
Get more education after college	22	9%
Get a master's degree	37	15%
Get a Ph.D.	53	22%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	40	17%
Get a combined M.D. / Ph.D.	27	11%
Get another professional degree (law, business, etc.)	12	5%
Total	**242**	**100%**

How far did you want to go in school AFTER participating in JSHS?		
	Freq.	**%**
Graduate from high school	1	5%
Go to a trade or vocational school	0	0%
Go to college for a little while	2	0%
Finish college (get a Bachelor's degree)	19	8%
Get more education after college	28	8%
Get a master's degree	34	22%
Get a Ph.D.	76	25%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	36	10%
Get a combined M.D. / Ph.D.	36	17%
Get another professional degree (law, business, etc.)	10	5%
Total	**242**	**100%**

When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?		
	Freq.	**%**
not at all	5	2%
up to 25% of the time	13	5%
up to 50% of the time	38	16%
up to 75% of the time	68	28%
up to 100% of the time	119	49%
Total	**243**	**100%**

BEFORE JSHS, what kind of work did you expect to be doing when you are 30 years old (select the ONE answer that best describes your career goals BEFORE JSHS)						
	Freq.	**%**			**Freq.**	**%**
Undecided	0	0%		**Teaching, non-STEM**	55	21%
Science (no specific subject)	33	13%		**Medicine (e.g., doctor, dentist, veterinarian, etc.)**	11	4%
Physical science (physics, chemistry, astronomy, materials science)	15	6%		**Health (e.g., nursing, pharmacy, technician, etc.)**	8	3%
Biological science	13	5%		**Social science (e.g., psychologist, sociologist)**	2	1%
Earth, atmospheric or oceanic science	19	7%		**Business**	5	2%
Environmental science	3	1%		**Law**	5	2%

Computer science	5	2%		**Farming**	7	3%
Technology	10	4%		**Military, police, or security**	2	1%
Engineering	2	1%		**Art (writing, dancing, painting, etc.)**	10	4%
Mathematics or statistics	34	14%		**Skilled trade (carpenter, electrician, plumber, etc.)**	1	0%
Teaching, STEM	3	1%		**Other**	13	5%
				Total	**256**	**100%**

Note. Other = Animal behavioral research (n=1), Biochemistry (n=1), Biomedical engineering (n=2), Cinematographer/Film/Journalism/Music (n=5), Episcopal Priest (n=1), Forensic science (n=1), Physical activity (n=1), Psychology (n=1)

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

	Freq.	%			Freq.	%
Undecided	0	0%		**Teaching, non-STEM**	53	21%
Science (no specific subject)	17	6%		**Medicine (e.g., doctor, dentist, veterinarian, etc.)**	12	5%
Physical science (physics, chemistry, astronomy, materials science)	10	4%		**Health (e.g., nursing, pharmacy, technician, etc.)**	9	4%
Biological science	13	5%		**Social science (e.g., psychologist, sociologist)**	3	1%
Earth, atmospheric or oceanic science	23	9%		**Business**	4	2%
Environmental science	4	1%		**Law**	5	2%
Computer science	7	3%		**Farming**	6	2%
Technology	10	4%		**Military, police, or security**	1	0%
Engineering	2	1%		**Art (writing, dancing, painting, etc.)**	7	3%
Mathematics or statistics	49	19%		**Skilled trade (carpenter, electrician, plumber, etc.)**	0	0%
Teaching, STEM	5	2%		**Other**	16	6%
				Total	**256**	**100%**

Note. Other = Animal behavioral research (n=1), Biochemistry (n=1), Biomedical engineering (n=2), Cinematographer/Film/Journalism/Music (n=5), Episcopal Priest (n=1), Forensic science (n=2), Physical activity (n=1), Psychology (n=3)

How interested are you in participating in the following programs in the future?							
	1	2	3	4	n	Avg.	SD
Gains in the Education of Mathematics and Science (GEMS)	148 (59%)	4 (2%)	26 (10%)	26 (10%)	249	**3.11**	0.93
UNITE	159 (65%)	4 (2%)	22 (9%)	25 (10%)	245	**3.06**	0.92
Junior Science & Humanities Symposium (JSHS)	5 (2%)	18 (7%)	30 (12%)	47 (19%)	250	**3.34**	0.96
Science & Engineering Apprenticeship Program (SEAP)	133 (54%)	5 (2%)	21 (8%)	27 (11%)	248	**3.27**	0.91
Research & Engineering Apprenticeship Program (REAP)	140 (57%)	6 (2%)	20 (8%)	23 (9%)	247	**3.24**	0.95
High School Apprenticeship Program (HSAP)	147 (60%)	4 (2%)	18 (7%)	20 (8%)	245	**3.31**	0.91
College Qualified Leaders (CQL)	153 (62%)	6 (2%)	20 (8%)	23 (9%)	246	**3.13**	0.97
GEMS Near Peer Mentor Program	156 (64%)	6 (2%)	19 (8%)	22 (9%)	245	**3.12**	0.97
Undergraduate Research Apprenticeship Program (URAP)	133 (54%)	3 (1%)	23 (9%)	23 (9%)	246	**3.31**	0.89
Science Mathematics, and Research for Transformation (SMART) College Scholarship	129 (52%)	5 (2%)	21 (8%)	25 (10%)	248	**3.31**	0.91

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

How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during JSHS?		
	Freq.	%
None	29	12%
1	25	11%
2	41	17%
3	50	21%
4	24	10%
5 or more	68	29%
Total	**237**	**100%**

How many Army or Department of Defense (DoD) STEM jobs/careers did you learn about during JSHS?		
	Freq.	%
None	110	46%
1	32	13%
2	34	14%
3	18	8%
4	18	8%
5 or more	26	11%
Total	**238**	**100%**

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	2 (1%)	0 (0%)	61 (25%)	92 (38%)	89 (36%)	244	**4.09**	0.83
DoD researchers develop new, cutting edge technologies	1 (0%)	2 (1%)	65 (27%)	81 (33%)	94 (39%)	243	**4.09**	0.85
DoD researchers solve real-world problems	0 (0%)	4 (2%)	56 (23%)	85 (35%)	100 (41%)	245	**4.15**	0.83
DoD research is valuable to society	1 (0%)	1 (0%)	58 (24%)	87 (36%)	97 (40%)	244	**4.14**	0.82

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

Which of the following statements describe you after participating in JSHS?							
	1	2	3	4	n	Avg.	SD
I am more interested in earning a STEM degree	20 (9%)	59 (27%)	95 (43%)	47 (21%)	221	**2.76**	0.78
I am more interested in pursuing a STEM career with the DoD	86 (39%)	27 (12%)	62 (28%)	47 (21%)	222	**2.32**	0.82
I am more interested in participating in other AEOPs	87 (39%)	25 (11%)	62 (28%)	48 (22%)	222	**2.32**	1.21
I am more interested in taking STEM classes in school	16 (7%)	71 (32%)	87 (39%)	48 (22%)	222	**2.75**	1.19
I am more confident in my STEM knowledge, skills, and abilities	13 (6%)	34 (15%)	124 (56%)	52 (23%)	223	**2.96**	0.87
I am more interested in pursuing a career in STEM	19 (9%)	48 (22%)	100 (46%)	52 (23%)	219	**2.84**	0.90
I am more aware of other AEOPs	81 (36%)	25 (11%)	62 (28%)	54 (24%)	222	**2.40**	0.89
I am more interested in participating in STEM activities outside of school requirements	13 (6%)	48 (22%)	104 (47%)	55 (25%)	220	**2.91**	1.18
I am more aware of DoD STEM research and careers	66 (30%)	25 (11%)	72 (33%)	57 (26%)	220	**2.55**	1.18
I have a greater appreciation of DoD STEM research	64 (29%)	23 (10%)	71 (32%)	63 (29%)	221	**2.60**	1.19

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

Appendix C

FY15 JSHS Mentor Questionnaire Data Summary

JSHS Mentor Data Summary

What is your gender?		
	Freq.	**%**
Male	108	41%
Female	129	49%
Choose not to report	2	1%
Total	**239**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	16	7%
Asian	18	8%
Black or African American	7	3%
Native American or Alaska Native	2	1%
Native Hawaiian or Other Pacific Islander	0	0%
White	174	73%
Other race or ethnicity:	5	2%
Choose not to report	16	7%
Total	**238**	**100%**

Which of the following BEST describes your current occupation? (select ONE)		
	Freq.	**%**
Teacher	117	50%
Other school staff	15	6%
University educator	33	14%
STEM professional in training (undergraduate/graduate student)	8	3%
STEM professional	32	14%
Other:	29	12%
Total	**234**	**100%**

Which of the following BEST describes your organization? (select ONE)		
	Freq.	**%**
No organization	9	4%
School or district (K-12)	114	47%
State educational agency	4	2%
Institution of higher education (vocational school, junior college, college, or university)	56	23%
Industry	10	4%
Department of Defense or other government agency	31	13%
Non-profit	6	2%
Other:	11	5%
Total	**241**	**100%**

What grade level(s) do you teach? (select ALL that apply)		
	Freq.	**%**
Upper elementary	2	2%
Middle school	11	9%
High school	118	94%
Total	**125**	**100%**

Which best describes the location of your school?		
	Freq.	**%**
Frontier or tribal school	0	0%
Rural (country)	18	15%
Suburban	65	56%
Urban (city)	34	29%
Total	**117**	**100%**

At what kind of school did you teach while participating in JSHS?		
	Freq.	**%**
Public school	80	77%
Private school	14	13%
Home school	1	1%
Online school	1	1%
Department of Defense school (DoDDS or DoDEA)	8	8%
Total	**104**	**100%**

Do you work at a "Title-I" school?		
	Freq.	**%**
Yes	24	23%
No	57	55%
I am not sure	22	21%
Total	**103**	**100%**

Which of the following subjects do you teach? (check all that apply)						
	Freq.	**%**			**Freq.**	**%**
Physical science (physics, chemistry, astronomy, materials science)	68	22%		**Engineering**	11	4%
Biological science	66	22%		**Mathematics or statistics**	12	4%
Earth, atmospheric, or oceanic science	25	8%		**Medicine, Health, or Behavioral Science**	8	3%
Environmental science	31	10%		**Social science (psychology, sociology, anthropology)**	4	1%
Computer science	3	1%		**Other, (specify):**	38	13%
Technology	4	1%		**No response**	33	11%
				Total		**100%**

Note. Other = "Research or Science Research" (n = 13), "Honors Research" (n = 2), "Research Methods" (n = 2), "Independent Research," "Mentor of out of school research class".

Which of the following best describes your primary area of research?						
	Freq.	**%**			**Freq.**	**%**
Physical science (physics, chemistry, astronomy, materials science)	9	12%		**Technology**	1	1%
Biological science	14	19%		**Engineering**	8	11%
Earth, atmospheric, or oceanic science	19	27%		**Mathematics or statistics**	4	5%
Agricultural science	1	1%		**Medicine, Health, or Behavioral Science**	6	8%

Environmental science	4	5%		**Social science (psychology, sociology, anthropology)**	2	3%
Computer science	1	1%		**Other, (specify):**	5	7%
				Total		**100%**

In which REGIONAL JSHS event did you/your student(s) participate? (Select ONE)

	Freq.	%			Freq.	%
Alabama	2	3%		**New Jersey—North New Jersey**	3	5%
Alaska	2	3%		**New York – Rutgers**	1	2%
Arizona	3	5%		**New York – Long Island**	1	2%
Arkansas	2	3%		**New York – Metro**	1	2%
California—Southern California	0	0%		**New York – Upstate**	2	3%
Connecticut	1	2%		**North Carolina**	0	0%
DoD Dependent Schools-Europe	4	7%		**North Central**	1	2%
DoD Dependent Schools-Pacific	3	5%		**New England – Northern**	2	3%
District of Columbia	1	2%		**New England – Southern**	1	2%
Florida	2	3%		**Ohio**	1	2%
Georgia	1	2%		**Pennsylvania**	1	2%
Hawaii	3	5%		**Philadelphia**	0	0%
Illinois	2	3%		**Puerto Rico**	1	2%
Illinois – Chicago	1	2%		**South Carolina**	2	3%
Indiana	1	2%		**Tennessee**	0	0%
Intermountain – CO, MT, ID, NV, UT	0	0%		**Texas**	2	3%
Iowa	1	2%		**Virginia**	2	3%
Kansas – Nebraska – Oklahoma	0	0%		**Washington**	2	3%
Kentucky	2	3%		**West Virginia**	1	2%
Louisiana	0	0%		**Wisconsin**	2	3%
Maryland	2	3%		**Wyoming – Eastern Colorado**	0	0%
Michigan	1	2%				
Missouri	1	2%				
				Total	**61**	**100%**

Which of the following BEST describes your role during JSHS (Choose all that apply)?		
	Freq.	%
Research Mentor	16	22
Competition advisor	13	18
Judge	17	23
Other, (specify):	35	47

Note. Other = "teacher" (n = 10), "chaperone" (n = 6), "co-director" (n = 2), & "student advisor".

How many JSHS students did you work with this year? (Avg. = 13.00 students, SD = 28.81)		
# of Students	Freq.	%
0	9	15%
1	7	12%
2	7	12%
3	1	2%
4	0	0%
5	10	17%
6 – 10	6	10%
11 – 15	3	5%
16 – 20	2	3%
21 or more	14	24%
Total	59	100%

How did you learn about JSHS? (Check all that apply)						
	Freq.	%			Freq.	%
Academy of Applied Science (AAS) website	14	19%		A colleague	62	84%
Army Educational Outreach Program (AEOP) website	10	14%		My supervisor or superior	35	47%
AEOP on Facebook, Twitter, Pinterest, or other social media	3	4%		A JSHS site host or director	70	95%
A STEM conference or STEM education conference	8	11%		Workplace communications	30	41%
An email or newsletter from school, university, or a professional organization	31	42%		Someone who works with the Department of Defense (Army, Navy, Air Force)	13	18%
Past JSHS participant	74	100%		Other, specify	27	36%
A student	15	20%				

Note. Other = "previous participation" (n = 3), "spouse," "Training by [university] of Science Research in the High School," "[state] Academy of Science website".

The following activities were common to many Regional JSHS programs across the nation. How SATISFIED were you with each of the following REGIONAL JSHS program activities? If your Regional JSHS event did not have a given activity, select "Did Not Experience"								
	0	1	2	3	4	n	Avg.	SD
Student Oral Presentation	13 (8%)	2 (1%)	6 (4%)	16 (9%)	133 (78%)	170	**4.49**	1.15
Student Poster Presentations	59 (35%)	2 (1%)	6 (4%)	25 (15%)	76 (45%)	168	**3.34**	1.81
Judging Process	18 (11%)	11 (6%)	14 (8%)	41 (24%)	87 (51%)	171	**3.98**	1.34
Feedback from Judges	46 (27%)	19 (11%)	15 (9%)	36 (21%)	55 (32%)	171	**3.20**	1.63
Invited Speaker Presentations	39 (23%)	2 (1%)	9 (5%)	33 (19%)	87 (51%)	170	**3.75**	1.62
Panel or Roundtable Discussions	119 (71%)	1 (1%)	3 (2%)	14 (8%)	30 (18%)	167	**2.01**	1.64
Career Exhibits	127 (76%)	1 (1%)	6 (4%)	12 (7%)	22 (13%)	168	**1.82**	1.50
Tours or Field Trips	80 (47%)	2 (1%)	8 (5%)	19 (11%)	60 (36%)	169	**2.86**	1.85
Team Building Activities	111 (66%)	1 (1%)	4 (2%)	13 (8%)	38 (23%)	167	**2.20**	1.74

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

The following activities were included in the National JSHS program. How SATISFIED were you with each of the NATIONAL JSHS program activities?								
	0	1	2	3	4	n	Avg.	SD
Student Oral Presentation	7 (9%)	1 (1%)	0 (0%)	9 (12%)	59 (78%)	76	**4.47**	1.21
Poster Presentations	12 (16%)	3 (4%)	4 (5%)	16 (21%)	41 (54%)	76	**3.93**	1.48
Judging Process	9 (12%)	4 (5%)	8 (11%)	20 (26%)	35 (46%)	76	**3.89**	1.36
Feedback from Judges	31 (41%)	6 (8%)	8 (11%)	12 (16%)	18 (24%)	75	**2.73**	1.68
Invited Speaker Presentations	17 (22%)	2 (3%)	3 (4%)	15 (20%)	39 (51%)	76	**3.75**	1.63
Panel or Roundtable Discussions	48 (64%)	1 (1%)	3 (4%)	8 (11%)	15 (20%)	75	**2.21**	1.70
Career Exhibits	27 (36%)	2 (3%)	5 (7%)	19 (25%)	23 (30%)	76	**3.12**	1.71
Tours or Field Trips	29 (38%)	2 (3%)	3 (4%)	15 (20%)	27 (36%)	76	**3.12**	1.79
Team Building Activities	57 (75%)	1 (1%)	1 (1%)	11 (14%)	6 (8%)	76	**1.79**	1.43

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

The list below describes mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in JSHS.				
	Yes – I used this strategy		No – I did not use this strategy	
	Freq.	%	Freq.	%
Become familiar with my student(s) background and interests at the beginning of the JSHS experience	177	83%	36	17%
Giving students real-life problems to investigate or solve	140	66%	71	34%
Selecting readings or activities that relate to students' backgrounds	130	62%	80	38%
Encouraging students to suggest new readings, activities, or projects	163	77%	48	23%
Helping students become aware of the role(s) that STEM plays in their everyday lives	159	75%	52	25%
Helping students understand how STEM can help them improve their own community	153	74%	55	26%
Asking students to relate real-life events or activities to topics covered in JSHS	142	68%	68	32%

The list below describes mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in JSHS.				
	Yes – I used this strategy		No – I did not use this strategy	
	Freq.	%	Freq.	%
Identify the different learning styles that my student (s) may have at the beginning of the JSHS experience	130	63%	76	37%
Interact with students and other personnel the same way regardless of their background	164	78%	45	22%
Use a variety of teaching and/or mentoring activities to meet the needs of all students	175	85%	32	15%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	117	57%	90	43%
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	131	63%	76	37%
Directing students to other individuals or programs for additional support as needed	165	79%	44	21%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	102	49%	106	51%

The list below describes mentoring strategies that are effective ways to support students' development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in JSHS.				
	Yes – I used this strategy		No – I did not use this strategy	
	Freq.	%	Freq.	%
Having my student(s) tell other people about their backgrounds and interests	154	73%	56	0.27
Having my student(s) explain difficult ideas to others	167	80%	41	0.20
Having my student(s) listen to the ideas of others with an open mind	172	82%	37	0.18
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	161	76%	50	0.24
Having my student(s) give and receive constructive feedback with others	180	85%	31	0.15

The list below describes mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in JSHS.				
	Yes – I used this strategy		No – I did not use this strategy	
	Freq.	%	Freq.	%
Teaching (or assigning readings) about specific STEM subject matter	124	61%	80	0.39
Having my student(s) search for and review technical research to support their work	174	84%	33	0.16
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	164	80%	41	0.20
Supervising my student(s) while they practice STEM research skills	167	81%	39	0.19
Providing my student(s) with constructive feedback to improve their STEM competencies	179	87%	27	0.13
Allowing students to work independently to improve their self-management abilities	181	87%	26	0.13

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

	Yes – I used this strategy		No – I did not use this strategy	
	Freq.	%	Freq.	%
Asking my student(s) about their educational and/or career goals	177	86%	28	0.14
Recommending extracurricular programs that align with students' goals	144	71%	60	0.29
Recommending Army Educational Outreach Programs that align with students' goals	65	32%	137	0.68
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	150	74%	52	0.26
Discussing STEM career opportunities within the DoD or other government agencies	82	40%	121	0.60
Discussing STEM career opportunities in private industry or academia	138	68%	66	0.32
Discussing the economic, political, ethical, and/or social context of a STEM career	119	59%	84	0.41
Recommending student and professional organizations in STEM to my student(s)	120	59%	83	0.41
Helping students build a professional network in a STEM field	124	61%	79	0.39
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	145	72%	56	0.28

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

	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science (AAS) website	156 (71%)	1 (0%)	13 (6%)	16 (7%)	35 (16%)	221	**1.97**	1.58
Army Educational Outreach Program (AEOP) website	164 (73%)	5 (2%)	18 (8%)	12 (5%)	25 (11%)	224	**1.79**	1.41
AEOP on Facebook, Twitter, Pinterest or other social media	193 (87%)	8 (4%)	7 (3%)	6 (3%)	9 (4%)	223	**1.34**	0.97
AEOP brochure	168 (75%)	7 (3%)	14 (6%)	16 (7%)	18 (8%)	223	**1.70**	1.32
It Starts Here! Magazine	197 (90%)	8 (4%)	1 (0%)	6 (3%)	6 (3%)	218	**1.24**	0.83
JSHS Program administrator or site coordinator	65 (29%)	5 (2%)	15 (7%)	37 (16%)	105 (46%)	227	**3.49**	1.72
Invited speakers or "career" events	103 (46%)	2 (1%)	17 (8%)	32 (14%)	71 (32%)	225	**2.85**	1.80
Participation in JSHS	31 (14%)	3 (1%)	12 (5%)	30 (13%)	152 (67%)	228	**4.18**	1.40

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Which of the following AEOPs did you EXPLICITLY DISCUSS with your student(s) during JSHS?				
	Yes - I discussed this program with my student(s)		No - I did not discuss this program with my student(s)	
	Freq.	%	Freq.	%
UNITE	35	16%	180	84%
Junior Science & Humanities Symposium (JSHS)	158	71%	63	29%
Science & Engineering Apprenticeship Program (SEAP)	24	11%	189	89%
Research & Engineering Apprenticeship Program (REAP)	19	9%	194	91%
High School Apprenticeship Program (HSAP)	14	7%	198	93%
College Qualified Leaders (CQL)	10	5%	201	95%
GEMS Near Peer Mentor Program	14	7%	198	93%
Undergraduate Research Apprenticeship Program (URAP)	19	9%	193	91%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	31	14%	183	86%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	10	5%	202	95%
I discussed AEOP with my student(s) but did not discuss any specific program.	34	16%	178	84%

How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during JSHS?								
	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science (AAS) website	165 (76%)	3 (1%)	7 (3%)	17 (8%)	26 (12%)	218	**1.79**	1.46
Army Educational Outreach Program (AEOP) website	166 (75%)	3 (1%)	15 (7%)	12 (5%)	24 (11%)	220	**1.75**	1.40
AEOP on Facebook, Twitter, Pinterest or other social media	187 (85%)	6 (3%)	9 (4%)	8 (4%)	9 (4%)	219	**1.38**	1.02
AEOP brochure	162 (74%)	8 (4%)	13 (6%)	15 (7%)	20 (9%)	218	**1.73**	1.36
It Starts Here! Magazine	193 (89%)	7 (3%)	3 (1%)	4 (2%)	9 (4%)	216	**1.28**	0.92
JSHS Program administrator or site coordinator	78 (35%)	9 (4%)	18 (8%)	43 (19%)	75 (34%)	223	**3.13**	1.72
Invited speakers or "career" events	105 (48%)	6 (3%)	14 (6%)	27 (12%)	67 (31%)	219	**2.75**	1.80
Participation in JSHS	47 (21%)	5 (2%)	16 (7%)	31 (14%)	125 (56%)	224	**3.81**	1.61

Note. Response scale: 0 = "Did Not Experience" (excluded from analysis), 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	4 (2%)	1 (0%)	19 (8%)	70 (31%)	133 (59%)	227	**4.44**	0.81
DoD researchers develop new, cutting edge technologies	4 (2%)	1 (0%)	20 (9%)	65 (29%)	137 (60%)	227	**4.45**	0.82
DoD researchers solve real-world problems	5 (2%)	1 (0%)	22 (10%)	61 (27%)	136 (60%)	225	**4.43**	0.86
DoD research is valuable to society	5 (2%)	1 (0%)	20 (9%)	61 (27%)	139 (62%)	226	**4.45**	0.85

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

How often did YOUR STUDENT(S) have opportunities do each of the following in JSHS?								
	1	2	3	4	5	n	Avg.	SD
Learn new science, technology, engineering, or mathematics (STEM) topics	11 (5%)	17 (8%)	23 (11%)	70 (33%)	89 (42%)	210	**4.00**	1.16
Apply STEM knowledge to real-life situations	14 (7%)	21 (10%)	27 (13%)	77 (37%)	70 (33%)	209	**3.80**	1.20
Learn about new discoveries in STEM	11 (5%)	17 (8%)	34 (16%)	70 (33%)	78 (37%)	210	**3.89**	1.15
Learn about different careers that use STEM	17 (8%)	23 (11%)	41 (20%)	67 (32%)	60 (29%)	208	**3.63**	1.24
Interact with scientists or engineers	16 (8%)	22 (11%)	45 (22%)	45 (22%)	80 (38%)	208	**3.73**	1.28
Communicate with other students about STEM	12 (6%)	13 (6%)	22 (11%)	62 (30%)	99 (48%)	208	**4.07**	1.16
Use laboratory or field techniques, procedures, and tools	33 (16%)	25 (12%)	31 (15%)	69 (34%)	47 (23%)	205	**3.35**	1.38
Participate in hands-on STEM activities	34 (17%)	23 (11%)	28 (14%)	72 (35%)	46 (23%)	203	**3.36**	1.39
Work as part of a team	40 (20%)	22 (11%)	35 (17%)	63 (31%)	44 (22%)	204	**3.24**	1.42
Identify questions or problems to investigate	28 (14%)	21 (10%)	40 (20%)	66 (32%)	50 (24%)	205	**3.43**	1.33
Design an investigation	42 (21%)	22 (11%)	45 (22%)	57 (28%)	37 (18%)	203	**3.12**	1.39
Carry out an investigation	43 (21%)	19 (9%)	32 (16%)	63 (31%)	47 (23%)	204	**3.25**	1.45
Analyze data or information	33 (16%)	16 (8%)	30 (15%)	74 (36%)	52 (25%)	205	**3.47**	1.37
Draw conclusions from an investigation	33 (16%)	16 (8%)	36 (18%)	71 (35%)	48 (24%)	204	**3.42**	1.36
Come up with creative explanations or solutions	27 (13%)	23 (11%)	39 (19%)	66 (32%)	50 (24%)	205	**3.43**	1.33
Build or make a computer model	96 (47%)	30 (15%)	38 (19%)	19 (9%)	21 (10%)	204	**2.21**	1.39

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

Which category best describes the focus of your student's JSHS project?		
	Freq.	**%**
Science	164	80%
Technology	11	5%
Engineering	25	12%
Mathematics	4	3%
Total	**204**	**100%**

AS A RESULT OF THE JSHS EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
In depth knowledge of a STEM topic(s)	6 (3%)	18 (8%)	45 (21%)	80 (38%)	63 (30%)	212	**3.83**	1.04
Knowledge of research conducted in a STEM topic or field	5 (2%)	10 (5%)	38 (18%)	81 (38%)	78 (37%)	212	**4.02**	0.98
Knowledge of research processes, ethics, and rules for conduct in STEM	10 (5%)	10 (5%)	51 (24%)	76 (36%)	65 (31%)	212	**3.83**	1.07
Knowledge of how professionals work on real problems in STEM/ Knowledge of how scientists and engineers work on problems in STEM	6 (3%)	13 (6%)	37 (18%)	81 (38%)	74 (35%)	211	**3.97**	1.02
Knowledge of what everyday research work is like in STEM	6 (3%)	14 (7%)	36 (17%)	73 (34%)	83 (39%)	212	**4.00**	1.04

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

AS A RESULT OF THE JSHS EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	2 (1%)	5 (3%)	37 (24%)	65 (42%)	44 (29%)	153	**3.94**	0.88
Using knowledge and creativity to propose a testable solution for a problem	3 (2%)	6 (4%)	27 (18%)	68 (44%)	49 (32%)	153	**4.01**	0.91
Making a model of an object or system to show its parts and how they work	15 (10%)	17 (11%)	52 (34%)	38 (25%)	31 (20%)	153	**3.35**	1.20
Designing procedures for an experiment that are appropriate for the question to be answered	4 (3%)	10 (7%)	31 (20%)	53 (35%)	55 (36%)	153	**3.95**	1.03
Identifying the limitations of the methods and tools used for data collection	4 (3%)	8 (5%)	34 (22%)	56 (37%)	50 (33%)	152	**3.92**	1.00
Carrying out procedures for an experiment and recording data accurately	6 (4%)	4 (3%)	30 (20%)	48 (32%)	64 (42%)	152	**4.05**	1.04
Using computer models of an object or system to investigate cause and effect relationships	29 (19%)	25 (17%)	44 (29%)	28 (19%)	24 (16%)	150	**2.95**	1.33
Organizing data in charts or graphs to find patterns and relationships	5 (3%)	8 (5%)	25 (17%)	55 (36%)	58 (38%)	151	**4.01**	1.03
Considering different interpretations of data when deciding how the data answer a question	6 (4%)	6 (4%)	38 (25%)	50 (33%)	51 (34%)	151	**3.89**	1.05
Supporting an explanation for an observation with data from experiments	5 (3%)	5 (3%)	30 (20%)	54 (36%)	57 (38%)	151	**4.01**	1.01
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	5 (3%)	4 (3%)	34 (22%)	52 (34%)	57 (38%)	152	**4.00**	1.00
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	5 (3%)	8 (5%)	27 (18%)	63 (42%)	48 (32%)	151	**3.93**	1.00
Defending an argument that conveys how an explanation best describes an observation	4 (3%)	7 (5%)	35 (23%)	55 (36%)	50 (33%)	151	**3.93**	0.99
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	5 (3%)	8 (5%)	32 (21%)	56 (37%)	50 (33%)	151	**3.91**	1.03
Integrating information from technical or scientific texts and other media to support your explanation of an observation	5 (3%)	9 (6%)	36 (24%)	54 (36%)	47 (31%)	151	**3.85**	1.04
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	4 (3%)	2 (1%)	23 (15%)	45 (30%)	78 (51%)	152	**4.26**	0.95

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

AS A RESULT OF THE JSHS EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	1 (3%)	2 (6%)	6 (18%)	12 (35%)	13 (38%)	34	**4.00**	1.04
Using knowledge and creativity to propose a testable solution for a problem	1 (3%)	2 (6%)	5 (15%)	10 (30%)	15 (45%)	33	**4.09**	1.07
Making a model of an object or system to show its parts and how they work	2 (6%)	2 (6%)	7 (21%)	11 (33%)	11 (33%)	33	**3.82**	1.16
Designing procedures for an experiment that are appropriate for the question to be answered	1 (3%)	1 (3%)	7 (22%)	11 (34%)	12 (38%)	32	**4.00**	1.02
Identifying the limitations of the methods and tools used for data collection	1 (3%)	1 (3%)	8 (25%)	9 (28%)	13 (41%)	32	**4.00**	1.05
Carrying out procedures for an experiment and recording data accurately	1 (3%)	1 (3%)	8 (25%)	8 (25%)	14 (44%)	32	**4.03**	1.06
Using computer models of an object or system to investigate cause and effect relationships	2 (6%)	3 (9%)	7 (22%)	11 (34%)	9 (28%)	32	**3.69**	1.18
Considering different interpretations of the data when deciding if a solution works as intended	1 (3%)	1 (3%)	7 (22%)	12 (38%)	11 (34%)	32	**3.97**	1.00
Organizing data in charts or graphs to find patterns and relationships	1 (3%)	2 (6%)	7 (22%)	11 (34%)	11 (34%)	32	**3.91**	1.06
Supporting a solution for a problem with data from experiments	1 (3%)	1 (3%)	6 (18%)	11 (33%)	14 (42%)	33	**4.09**	1.01
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	1 (3%)	1 (3%)	7 (21%)	11 (33%)	13 (39%)	33	**4.03**	1.02
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	1 (3%)	1 (3%)	7 (21%)	13 (39%)	11 (33%)	33	**3.97**	0.98
Defend an argument that conveys how a solution best meets design criteria	1 (3%)	1 (3%)	4 (13%)	11 (34%)	15 (47%)	32	**4.19**	1.00
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	1 (3%)	1 (3%)	9 (27%)	10 (30%)	12 (36%)	33	**3.94**	1.03
Integrating information from technical or scientific texts and other media to support your solution to a problem	1 (3%)	1 (3%)	9 (27%)	10 (30%)	12 (36%)	33	**3.94**	1.03
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	1 (3%)	1 (3%)	6 (19%)	10 (31%)	14 (44%)	32	**4.09**	1.03

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

AS A RESULT OF THE JSHS EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Learning to work independently	10 (5%)	5 (3%)	41 (21%)	71 (36%)	69 (35%)	196	**3.94**	1.06
Setting goals and reflecting on performance	8 (4%)	5 (3%)	42 (22%)	73 (37%)	67 (34%)	195	**3.95**	1.02
Sticking with a task until it is finished	9 (5%)	5 (3%)	32 (17%)	72 (37%)	75 (39%)	193	**4.03**	1.04
Making changes when things do not go as planned	8 (4%)	6 (3%)	39 (20%)	74 (38%)	69 (35%)	196	**3.97**	1.02
Including others' perspectives when making decisions	8 (4%)	6 (3%)	50 (26%)	74 (38%)	58 (30%)	196	**3.86**	1.01
Communicating effectively with others	5 (3%)	7 (4%)	27 (14%)	63 (32%)	94 (48%)	196	**4.19**	0.98
Confidence with new ideas or procedures in a STEM project	6 (3%)	6 (3%)	35 (18%)	58 (30%)	91 (46%)	196	**4.13**	1.01
Patience for the slow pace of research	5 (3%)	10 (5%)	56 (29%)	66 (34%)	58 (30%)	195	**3.83**	1.00
Desire to build relationships with professionals in a field	7 (4%)	15 (8%)	37 (19%)	64 (33%)	73 (37%)	196	**3.92**	1.09
Connecting a topic or field with their personal values	7 (4%)	11 (6%)	36 (19%)	73 (38%)	67 (35%)	194	**3.94**	1.04

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

Which of the following statements describe YOUR STUDENT(S) after participating in the JSHS program?							
	1	2	3	4	n	Avg.	SD
More confident in STEM knowledge, skills, and abilities	9 (5%)	23 (12%)	113 (60%)	43 (23%)	188	**3.01**	0.74
More interested in participating in STEM activities outside of school requirements	11 (6%)	24 (13%)	107 (57%)	47 (25%)	189	**3.01**	0.78
More aware of other AEOPs	75 (41%)	8 (4%)	64 (35%)	37 (20%)	184	**2.34**	1.20
More interested in participating in other AEOPs	81 (44%)	10 (5%)	64 (35%)	28 (15%)	183	**2.21**	1.17
More interested in taking STEM classes in school	17 (9%)	33 (18%)	99 (54%)	36 (19%)	185	**2.83**	0.85
More interested in earning a STEM degree	14 (8%)	34 (18%)	100 (54%)	38 (20%)	186	**2.87**	0.82
More interested in pursuing a career in STEM	14 (7%)	33 (18%)	101 (54%)	39 (21%)	187	**2.88**	0.82
More aware of DoD STEM research and careers	47 (25%)	13 (7%)	77 (41%)	49 (26%)	187	**2.69**	1.12
Greater appreciation of DoD STEM research	48 (26%)	14 (8%)	76 (41%)	47 (25%)	185	**2.66**	1.12
More interested in pursuing a STEM career with the DoD	67 (36%)	17 (9%)	63 (34%)	38 (21%)	185	**2.39**	1.17

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

Appendix D

FY15 JSHS Student Focus Group Protocol

2015 Army Education Outreach Program Evaluation Study
Student Focus Group Protocol, JSHS

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

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

Key Questions

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

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

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

Appendix E

FY15 JSHS Mentor Focus Group Protocol

2015 Army Education Outreach Program Evaluation Study
Adult/Mentor Focus Group Protocol, JSHS

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

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

Key Questions:

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

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

2. **We need to understand more about how JSHS is helping students know more about STEM career opportunities in the Department of Defense, especially civilian positions.**
    - Have you seen any efforts by JSHS to educate participants about the Army, DoD, or careers in the DoD?
    - What strategies seem to be the most effective for JSHS students?
    - Do you have any suggestions for helping JSHS teach students about careers in the DoD?
3. The AEOP sponsors a wide range of national STEM outreach programs that these students qualify for. **The AEOP needs to know if JSHS is teaching students the other STEM outreach programs that it sponsors.**
    - First, are you aware of the other programs offered by the AEOP? (e.g., REAP, SEAP, CQL, SMART, etc)
    - Have you seen any efforts at JSHS to educate adults or students about the other AEOP programs?
    - What seems to work the best? The worst?
    - Any suggestions for helping the AEOP educate these students about the other programs?
4. **The AEOP is trying to make sure that its programs become more effective at reaching adult and youth participants from underserved and underrepresented groups (racial/ethnic groups, low SES, etc.).**
    - Have you seen any efforts by JSHS to help engage underserved or underrepresented groups of adults and youth?
    - What strategies seem to work the best? The worst?
    - Any suggestions for helping JSHS reach new populations of adult and youth participants?
5. **What suggestions do you have for improving JSHS?**
6. **Last Chance - Have we missed anything? Tell us anything you want us to know that we didn't ask about.**

Appendix F

FY15 JSHS Student Questionnaire

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

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

Please provide your personal information below:

First Name: _____

Last Name: _____

What is your email address? (optional)

Email: _____

What was your JSHS regional site? (Select ONE) **Only presented to REGIONAL JSHS participants**

- ❍ Alabama
- ❍ Alaska
- ❍ Arizona
- ❍ Arkansas
- ❍ California—Northern California & Western Nevada
- ❍ California—Southern California
- ❍ Chicago
- ❍ Connecticut
- ❍ DoD Dependent Schools-Europe
- ❍ DoD Dependent Schools-Pacific
- ❍ District of Columbia – Washington DC
- ❍ Florida
- ❍ Georgia
- ❍ Hawaii
- ❍ Illinois
- ❍ Indiana
- ❍ Intermountain—Colorado, Montana, Idaho, Nevada, Utah
- ❍ Iowa
- ❍ Kansas—Nebraska—Oklahoma
- ❍ Kentucky
- ❍ Louisiana
- ❍ Maryland
- ❍ Michigan
- ❍ Mississippi
- ❍ Missouri
- ❍ New Jersey--Monmouth
- ❍ New Jersey—Rutgers
- ❍ New York—Long Island
- ❍ New York—Metro
- ❍ New York—Upstate
- ❍ North Carolina
- ❍ North Central—Minnesota, North Dakota, South Dakota
- ❍ New England—Northern New England
- ❍ New England—Southern New England
- ❍ Ohio
- ❍ Oregon
- ❍ Pennsylvania
- ❍ Philadelphia
- ❍ Puerto Rico
- ❍ South Carolina
- ❍ Southwest
- ❍ Tennessee
- ❍ Texas
- ❍ Virginia
- ❍ Washington
- ❍ West Virginia

Which of the following social media outlets do you use on a regular basis? (Choose ALL that apply)? **Only Presented to NATIONAL JSHS participants**

- ❍ Facebook
- ❍ Twitter
- ❍ Instagram
- ❍ LinkedIn
- ❍ Snapchat
- ❍ Vine
- ❍ Flickr
- ❍ Tumblr
- ❍ Other: _____

Which of the following do you read on a regular basis? (Choose ALL that apply) **Only presented to NATIONAL JSHS participants**

- ❍ New York Times
- ❍ Huffington Post
- ❍ Scientific American
- ❍ Wall Street Journal
- ❍ USA Today
- ❍ Discover
- ❍ National Geographic
- ❍ Science
    - ❍ Other: _____

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

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

How often did you do each of the following in JSHS this year?

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

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

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

How often did you do each of the following in JSHS this year?

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

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

	Did not experience	Not at all	A little	Somewhat	Very much
Academy of Applied Science (AAS) website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP on Faceook, Twitter, Pinterest, or other social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
It Starts Here! Magazine	❍	❍	❍	❍	❍
My JSHS mentor(s)	❍	❍	❍	❍	❍
Invited speakers or “career” events during JSHS	❍	❍	❍	❍	❍
Participation in JSHS	❍	❍	❍	❍	❍

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

	Not at all	A little	Somewhat	Very much
Academy of Applied Science (AAS) website	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍
AEOP on Faceook, Twitter, Pinterest, or other social media	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍
It Starts Here! Magazine	❍	❍	❍	❍
My JSHS mentor(s)	❍	❍	❍	❍
Invited speakers or "career" events during JSHS	❍	❍	❍	❍
Participation in JSHS	❍	❍	❍	❍

How USEFUL were the following resources from JSHS.org

	I did not use this resource	Not at all	A little	Somewhat	Very much
National JSHS Groundrules for Student Presentations	❍	❍	❍	❍	❍
Paper Submissions and Competition Deadlines	❍	❍	❍	❍	❍
Sample Papers	❍	❍	❍	❍	❍
Oral Presentation Tips	❍	❍	❍	❍	❍
Selected Articles – Conducting Research	❍	❍	❍	❍	❍

How satisfied were you with each of the following JSHS features?

	Did Not Experience	Not at all	A little	Somewhat	Very much
Applying or registering for the program	❍	❍	❍	❍	❍
Communicating with your JSHS host site organizers	❍	❍	❍	❍	❍
The variety of STEM topics available to you in JSHS	❍	❍	❍	❍	❍
Teaching or mentoring provided during JSHS activities	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍
Research presentation process	❍	❍	❍	❍	❍

The following were common activities at many Regional JSHS symposia across the nation. How satisfied were you with each of the following REGIONAL JSHS program activities? **Only presented to REGIONAL JSHS participants**

	Did not experience	Not at all	A little	Somewhat	Very much
Student Oral presentation	❍	❍	❍	❍	❍
Student Poster Presentation	❍	❍	❍	❍	❍
Judging Process	❍	❍	❍	❍	❍
Feedback from Judges	❍	❍	❍	❍	❍
Feedback from VIPs and Peers	❍	❍	❍	❍	❍
Invited Speaker Presentations	❍	❍	❍	❍	❍
Panel or Roundtable Discussions	❍	❍	❍	❍	❍
Career Exhibits	❍	❍	❍	❍	❍
Tours or Field Trips	❍	❍	❍	❍	❍
Team Building Activities	❍	❍	❍	❍	❍
Social Events	❍	❍	❍	❍	❍

How satisfied were you with each of the following NATIONAL JSHS program activities? **Only presented to NATIONAL JSHS participants**

	Did not experience	Not at all	A little	Somewhat	Very much
Student Oral presentation	❍	❍	❍	❍	❍
Student Poster Presentation	❍	❍	❍	❍	❍
Judging Process	❍	❍	❍	❍	❍
Feedback from Judges	❍	❍	❍	❍	❍
Feedback from VIPs and Peers	❍	❍	❍	❍	❍
Invited Speaker Presentations	❍	❍	❍	❍	❍
Panel or Roundtable Discussions	❍	❍	❍	❍	❍
Career Exhibits	❍	❍	❍	❍	❍
Tours or Field Trips	❍	❍	❍	❍	❍
Team Building Activities	❍	❍	❍	❍	❍
Social Events	❍	❍	❍	❍	❍

What was your role at Regional JSHS? (Select ONE) **Only presented to REGIONAL JSHS participants**

❍ I was attending Regional JSHS l- I did not present my research
❍ I was a non-competitive poster presenter
❍ I was a competitive poster presenter
❍ I presented my research in an oral symposium

What was your role at National JSHS? (Select ONE) **Only presented to NATIONAL JSHS participants**

❍ I was attending National JSHS l- I did not present my research
❍ I was a non-competitive poster presenter
❍ I was a competitive poster presenter
❍ I presented my research in an oral symposium

Which of the following best describes your primary research mentor?

❍ I did not have a research mentor
❍ Teacher
❍ Coach
❍ Parent
❍ Club or activity leader (School club, Boy/Girls Scouts, etc.)
❍ STEM researcher (private industry, university, or DoD/government employee, etc.)
❍ Other (specify) _____

The list below describes mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies that your mentor(s) used when working directly with you in JSHS: **Not presented to non-presenting regional JSHS participants or those who did not have a research mentor**

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

How much input did you have in selecting your JSHS research project? **Not presented to non-presenting regional JSHS participants**

- ❍ I did not have a project
- ❍ I was assigned a project by my mentor
- ❍ I worked with my mentor to design a project
- ❍ I had a choice among various projects suggested by my mentor
- ❍ I worked with my mentor and members of a research team to design a project
- ❍ I designed the entire project on my own

How often was your mentor available to you during JSHS **Presented only to NATIONAL JSHS participants **

- ❍ I did not have a mentor
- ❍ The mentor was never available
- ❍ The mentor was available less than half of the time
- ❍ The mentor was available about half of the time of my project
- ❍ The mentor was available more than half of the time
- ❍ The mentor was always available

To what extent did you work as a part of a group or team? **Not presented to non-presenting regional JSHS participants**

- ❍ I worked alone (or alone with my research mentor)
- ❍ I worked with others in a shared laboratory or other space, but we work on different projects
- ❍ I worked alone on my project and I met with others regularly for general reporting or discussion
- ❍ I worked alone on a project that was closely connected with projects of others in my group
- ❍ I work with a group who all worked on the same project

How satisfied were you with each of the following: **Not presented to non-presenting regional JSHS participants**

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

Which of the following statements apply to your research experience? (choose ALL that apply) **Not presented to non-presenting regional JSHS participants**

- ❍ I presented a talk or poster to other students or faculty
- ❍ I presented a talk or poster at a professional symposium or conference
- ❍ I attended a symposium or conference
- ❍ I wrote or co-wrote a paper that was/will be published in a research journal
- ❍ I wrote or co-wrote a technical paper or patent
- ❍ I will present a talk or poster to other students or faculty
- ❍ I will present a talk or poster at a professional symposium or conference
- ❍ I will attend a symposium or conference
- ❍ I will write or co-write a paper that was/will be published in a research journal
- ❍ I will write or co-write a technical paper or patent
- ❍ I won an award or scholarship based on my research

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

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

Which category best describes the focus of your JSHS experience?

❍ Science
❍ Technology
❍ Engineering
❍ Mathematics

AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "science" as the focus of their JSHS experience**

	No gains	A little gain	Some gain	Large gain	Extreme gain
Asking a question that can be answered with one or more scientific experiments	❍	❍	❍	❍	❍
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	❍	❍	❍	❍	❍
Making a model of an object or system showing its parts and how they work	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Designing procedures for an experiment that are appropriate for the question to be answered	❍	❍	❍	❍	❍
Identifying the limitations of the methods and tools used for data collection	❍	❍	❍	❍	❍
Carrying out procedures for an experiment and recording data accurately	❍	❍	❍	❍	❍
Organizing data in charts or graphs to find patterns and relationships	❍	❍	❍	❍	❍
Considering different interpretations of data when deciding how the data answer a question	❍	❍	❍	❍	❍
Supporting an explanation with relevant scientific, mathematical and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	❍	❍	❍	❍	❍
Defending an argument that conveys how an explanation best describes an observation	❍	❍	❍	❍	❍

Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from technical or scientific texts and other media to support your explanation of an observation	❍	❍	❍	❍	❍
Communicating about your experiments and explanations in different formats (through talking, writing, graphics, or mathematics)	❍	❍	❍	❍	❍

Q38. AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "technology," "engineering," or "mathematics" as the focus of their JSHS experience **

	No gain	A little gain	Some gain	Large gain	Extreme gain
Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Using knowledge and creativity to propose a testable solution for a problem	❍	❍	❍	❍	❍
Making a model of an object or system to show its parts and how they work	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the methods and tools used for data collection	❍	❍	❍	❍	❍
Carrying out procedures for an experiment and recording data accurately	❍	❍	❍	❍	❍
Using computer-based models of an object or system to investigate cause and effect relationships	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution works as intended	❍	❍	❍	❍	❍
Organizing data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍
Defend an argument that conveys how a solution best meets design criteria	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from technical or scientific texts and other media to to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about your design processes and/or solutions in different formats (through talking, writing, graphics, or math equations)	❍	❍	❍	❍	❍

Q39. AS A RESULT OF YOUR JSHS EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍
Sticking with a task until it is finished	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Working well with people from all backgrounds	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Viewing failure as an opportunity to learn	❍	❍	❍	❍	❍

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

	No gain	A little gain	Some gain	Large gain	Extreme gain
Interest in a new STEM topic or field	❍	❍	❍	❍	❍
Deciding on a path to purse a STEM career \	❍	❍	❍	❍	❍
Sense of accomplishing something in STEM	❍	❍	❍	❍	❍
Feeling prepared for more challenging STEM activities	❍	❍	❍	❍	❍
Confidence to try out new ideas or procedures on my own in a STEM project	❍	❍	❍	❍	❍
Patience for the slow pace of STEM research	❍	❍	❍	❍	❍
Desire to build relationships with mentors who work in STEM	❍	❍	❍	❍	❍
Connecting a STEM topic or field to my personal values	❍	❍	❍	❍	❍
Feeling like part of a STEM community	❍	❍	❍	❍	❍

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

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

Before you participated in JSHS, how far did you want to go in school?

❍ Graduate from high school
❍ Go to a trade or vocational school
❍ Go to college for a little while
❍ Finish college (get a Bachelor's degree)
❍ Get more education after college
❍ Get a master's degree
❍ Get a Ph.D.
❍ Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
❍ Get a combined M.D. / Ph.D.
❍ Get another professional degree (law, business, etc.)

After you have participated in JSHS, how far do you want to go in school?

- ❍ Graduate from high school
- ❍ Go to a trade or vocational school
- ❍ Go to college for a little while
- ❍ Finish college (get a Bachelor's degree)
- ❍ Get more education after college
- ❍ Get a master's degree
- ❍ Get a Ph.D.
- ❍ Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
- ❍ Get a combined M.D. / Ph.D.
- ❍ Get another professional degree (law, business, etc.)

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

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

Before you participated in JSHS, what kind of work did you expect to be doing when you are 30 years old? (select one)

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

After you participated in JSHS, what kind of work did you expect to be doing when you are 30 years old? (select one)

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

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

	Not at all	A little	Somewhat	Very much
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍
UNITE	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍

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

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

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

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

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

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

Which of the following statements describe you after participating in JSHS?

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

What are the three most important ways that you have benefited from JSHS?

Benefit #1:

Benefit #2:

Benefit #3:

What are the three ways that JSHS should be improved for future participants?

Improvement #1:

Improvement #2:

Improvement #3:

Tell us about your overall satisfaction with your JSHS experience.

Appendix G

FY15 JSHS Mentor Questionnaire

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

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

Please provide your personal information below:

First Name: _____

Last Name: _____

Please provide your email address: (optional)

Email: _____

Which of the following social media outlets do you use on a regular basis? (Choose ALL that apply)? Facebook

- ❍ Twitter
- ❍ Instagram
- ❍ LinkedIn
- ❍ Snapchat
- ❍ Vine
- ❍ Flickr
- ❍ Tumblr
- ❍ Other: _____

Which of the following do you read on a regular basis? (Choose ALL that apply) New York Times

- ❍ Huffington Post
- ❍ Scientific American
- ❍ Wall Street Journal
- ❍ USA Today
- ❍ Discover
- ❍ National Geographic
- ❍ Science
- ❍ Other: _____

Which of the following BEST describes the organization you work for? (select ONE)

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

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

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

What grade level(s) do you teach? (select ALL that apply) **If selected teacher or other school staff as occupation**

- ❍ Upper elementary
- ❍ Middle school
- ❍ High school

Which of the following subjects do you teach? **If selected teacher or other school staff as occupation**

- ❍ Upper elementary
- ❍ Physical science (e.g., physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric, or oceanic science
- ❍ Environmental science
- ❍ Computer science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Medicine, Health, or Behavioral Science
- ❍ Social science (psychology, sociology, anthropology)
- ❍ Other (specify)_____

Which of the following best describes your primary area of research? **If selected Scientist, Engineer, or Mathematician in training or Scientist, Engineer, or Mathematics professional**

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

Which of the following BEST describes your role during JSHS?

- ❍ Research Mentor
- ❍ Competition advisor
- ❍ Judge
- ❍ Invited Speaker
- ❍ Other (specify) _____

How many JSHS students did you work with this year? _____

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

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

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

Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

The following activities were common to many Regional JSHS symposia across the nation. How SATISFIED were you with each of the following Regional JSHS program activities? **Included for only REGIONAL JSHS mentors**

Student Oral Presentations	❍	❍	❍	❍	❍
Student Poster Presentations	❍	❍	❍	❍	❍
Judging Process	❍	❍	❍	❍	❍
Feedback from Judges	❍	❍	❍	❍	❍
Invited Speaker Presentations	❍	❍	❍	❍	❍
Panel or Roundtable Discussions	❍	❍	❍	❍	❍
Career Exhibits	❍	❍	❍	❍	❍
Tours or Field Trips	❍	❍	❍	❍	❍
Team Building Activities	❍	❍	❍	❍	❍

How satisfied were you with the following JSHS features?

Application or registration process	❍	❍	❍	❍	❍
Communicating with the Academy of Applied Science (AAS)	❍	❍	❍	❍	❍
Communicating with your JSHS site's organizers	❍	❍	❍	❍	❍
Support for instruction or mentorship during program activities	❍	❍	❍	❍	❍
The physical location(s) of JSHS activities	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍

How SATISFIED were you with each of the following National JSHS program activities? **Included for only NATIONAL JSHS mentors**

Student Oral Presentations	❍	❍	❍	❍	❍
Student Poster Presentations	❍	❍	❍	❍	❍
Judging Process	❍	❍	❍	❍	❍
Feedback from Judges	❍	❍	❍	❍	❍
Invited Speaker Presentations	❍	❍	❍	❍	❍
Panel or Roundtable Discussions	❍	❍	❍	❍	❍
Career Exhibits	❍	❍	❍	❍	❍
Tours or Field Trips	❍	❍	❍	❍	❍
Team Building Activities	❍	❍	❍	❍	❍

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

Becoming familiar with my students' backgrounds and interests at the beginning of the JSHS experience	❍	❍
Giving students real-life problems to investigate or solve	❍	❍
Selecting readings or activities that relate to students' backgrounds	❍	❍
Encouraging students to suggest new readings, activities, or projects	❍	❍
Helping students become aware of the role(s) that STEM plays in their everyday lives	❍	❍
Helping students understand how STEM can help them improve their communities	❍	❍
Asking students to relate real-life events or activities in topics covered in JSHS	❍	❍

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

Identify the different learning styles that my student(s) may have at the beginning of the JSHS experience	❍	❍
Interact with all students and other personnel the same way regardless of their background	❍	❍

Using a variety of teaching and/or mentoring activities to meet the needs of all students	❍	❍
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	❍	❍
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	❍	❍
Directing students to other individuals or programs for additional support as needed	❍	❍
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	❍	❍

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

Having students tell other people about their backgrounds and interests	❍	❍
Having my student(s) explain difficult ideas to others	❍	❍
Having my student(s) listen to the ideas of other with an open mind	❍	❍
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	❍	❍
Having my student(s) give and receive constructive feedback with others	❍	❍

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

Teaching (or assigning readings) about specific STEM subject matter	❍	❍
Having student(s) search for and review technical research to support their work	❍	❍
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	❍	❍
Supervising my student(s) while they practice STEM research skills	❍	❍
Providing my student(s) with constructive feedback to improve their STEM competencies	❍	❍
Allowing students to work independently to improve their self-management abilities	❍	❍

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

Asking my students about their educational and career goals	❍	❍
Recommending extracurricular programs that align with students' educational goals	❍	❍
Recommending Army Educational Outreach Programs that align with students' goals	❍	❍
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	❍	❍
Discussing STEM career opportunities within the DoD or other government agencies	❍	❍
Discussing STEM career opportunities in private industry or academia	❍	❍
Discussing the economic, political, ethical, and/or social context of a STEM career	❍	❍
Recommending student and professional organizations in STEM to my student(s)	❍	❍
Helping students build a professional network in a STEM field	❍	❍
Helping my students with their resume, application, personal statement, or interview preparations	❍	❍

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

Academy of Applied Science (AAS) website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP on Faceook, Twitter, Pinterest, or other social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
It Starts Here! Magazine	❍	❍	❍	❍	❍
My JSHS mentor(s)	❍	❍	❍	❍	❍
Invited speakers or "career" events during JSHS	❍	❍	❍	❍	❍
Participation in JSHS	❍	❍	❍	❍	❍

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

UNITE	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍
College Qualified Leaders (CQL)	❍	❍
GEMS Near Peers	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍
I discussed AEOP with my student(s) but did not discuss any specific program	❍	❍

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

Academy of Applied Science (AAS) website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP on Faceook, Twitter, Pinterest, or other social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
It Starts Here! Magazine	❍	❍	❍	❍	❍
My JSHS mentor(s)	❍	❍	❍	❍	❍
Invited speakers or “career” events during JSHS	❍	❍	❍	❍	❍
Participation in JSHS	❍	❍	❍	❍	❍

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

DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

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

Learn new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍	❍
Learn about new discoveries in STEM	❍	❍	❍	❍	❍	❍
Learn about different careers that use STEM	❍	❍	❍	❍	❍	❍
Interact with STEM scientists or engineers	❍	❍	❍	❍	❍	❍
Use laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍	❍
Identify questions or problems to investigate	❍	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍	❍
Pose questions or problems to investigate	❍	❍	❍	❍	❍	❍
Analyze data or information	❍	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍	❍
Build or make a computer model	❍	❍	❍	❍	❍	❍

Which category best describes the focus of your student(s)' JSHS activities?

❍ Science
❍ Technology
❍ Engineering
❍ Mathematics

AS A RESULT OF THE JSHS EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to those who chose "science" as students' focus**

Asking a question that can be answered with one or more scientific experiments	❍	❍	❍	❍	❍
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	❍	❍	❍	❍	❍
Making a model of an object or system showing its parts and how they work	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Designing procedures for an experiment that are appropriate for the question to be answered	❍	❍	❍	❍	❍
Identifying the limitations of the methods and tools used for data collection	❍	❍	❍	❍	❍
Carrying out procedures for an experiment and recording data accurately	❍	❍	❍	❍	❍
Organizing data in charts or graphs to find patterns and relationships	❍	❍	❍	❍	❍
Considering different interpretations of data when deciding how the data answer a question	❍	❍	❍	❍	❍
Supporting an explanation with relevant scientific, mathematical and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	❍	❍	❍	❍	❍
Defending an argument that conveys how an explanation best describes an observation	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from technical or scientific texts and other media to support your explanation of an observation	❍	❍	❍	❍	❍
Communicating about your experiments and explanations in different formats (through talking, writing, graphics, or mathematics)	❍	❍	❍	❍	❍

AS A RESULT OF THE JSHS EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to those who chose "technology", "engineering", or "mathematics" as students' focus**

Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Using knowledge and creativity to propose a testable solution for a problem	❍	❍	❍	❍	❍
Making a model of an object or system to show its parts and how they work	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the methods and tools used for data collection	❍	❍	❍	❍	❍
Carrying out procedures for an experiment and recording data accurately	❍	❍	❍	❍	❍
Using computer-based models of an object or system to investigate cause and effect relationships	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution works as intended	❍	❍	❍	❍	❍
Organizing data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍
Defend an argument that conveys how a solution best meets design criteria	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from technical or scientific texts and other media to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about design processes and/or solutions in different formats (through talking, writing, graphics, or math equations)	❍	❍	❍	❍	❍

AS A RESULT OF THEIR JSHS EXPERIENCE, how much did students GAIN in the following areas?

In depth knowledge of a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

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

Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍
Sticking with a task until it is finished	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Confidence with new ideas or procedures in a STEM project	❍	❍	❍	❍	❍
Patience for the slow pace of research	❍	❍	❍	❍	❍
Desire to build relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field to their personal values	❍	❍	❍	❍	❍

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

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

What are the three most important strengths of JSHS?

Strength #1

Strength #2

Strength #3

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

Improvement #1

Improvement #2

Improvement #3

Tell us about your overall satisfaction with your JSHS experience.

Appendix H

AAS Response to FY15 Evaluation Report

Army Educational Outreach Program
Junior Science & Humanities Symposia Program
2015 Annual Program Evaluation Report

Response to Findings, 22 March 2016

The Academy of Applied Science has received the FY 2015 Program Evaluation and is in agreement with many of its conclusions.

We are requesting the following additions or edits to the report.

1. The FY '15 JSHS Program Evaluation reports that students who participate in JSHS indicated an 84% interest in participating in the program in the future.
2. The FY '15 evaluation report stated that 26% of JSHS students indicated plans to write or co-write a paper that will be published in an a research journal. This is an astounding figure that should not go unrecognized. This is a figure commensurate with prestigious research institutions. That such a publication rate can be achieved by high school students is not only unprecedented, but also attests the enduring success of JSHS in reaching future STEM leaders.

Other areas of improvement include:

3. **Response rate- evaluations**. The Academy agrees that in order to improve the value of and accuracy of the surveys, we need to increase the response rate. The Academy worked with the review team in FY '15 to inform JSHS Regional Symposia of the survey expectations and contacted each regional symposium immediately prior to the event to assist with survey implementation.

   The Academy did learn in FY '15 that email distribution of the survey was not sufficient. Additional training and compliance with a centralized registration system is planned.
4. **Expanding participation of populations historically underrepresented in STEM careers.** Evaluation results indicate success as measured by the number of Title I high schools which participate or the number of participating students from urban populations. Unfortunately, there are systemic issues in the public schools which limit access to STEM opportunities for many students from these populations. The Academy and JSHS Regional Symposia will continue to partner with the AEOP Strategic Outreach Initiative to build participation pathways for underrepresented students.

5. **The judging process is open for frequent criticism because not all students can win**. It is important for the Academy and the JSHS Regional Symposia to ensure that all participating students feel successful as a result of their participation in STEM. Competition pressures increase when students progress to the National competition and it is more difficult to refine judging so that every child, and his/her parent, is satisfied with the results.

   The Academy continuously reviews the judging process, the composition of the judging team, and the student application process. The National JSHS judging standards are followed by all regional symposia and include judging rubrics and judges training and orientation. The Judging materials are widely published and distributed to parents, students, regional symposia, and judges.

The Academy of Applied Science looks forward to working with the AEOP team to continue to strengthen the reach of the JSHS Program and to expose our youth to future opportunities in DoD STEM.