Army Educational Outreach Program

Junior Solar Sprint

2015 Annual Program Evaluation Report

JSS_03_05112016

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Executive Summary

Junior Solar Sprint (JSS), managed by the Technology Student Association (TSA), is an Army Educational Outreach Program (AEOP) science, technology, engineering, and mathematics (STEM) education program where 5th-8th grade students apply scientific understanding, creativity, experimentation, and teamwork to design, build, and race solar electric vehicles. JSS activities occur nationwide, in classrooms and schools, through extracurricular clubs and student associations, and as community-based events that are independently hosted and sponsored. The AEOP's JSS programming is designed to support the instruction of STEM in categories such as alternative fuels, engineering design, and aerodynamics. Through JSS, students develop teamwork and problem-solving abilities, investigate environmental issues, gain hands-on engineering skills, and use principles of science and math to create the fastest, most interesting, and best crafted vehicle possible. Students have the opportunity to participate in JSS through TSA chapters and Army-hosted locations across the country.

This report documents the evaluation of the FY15 JSS 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 JSS included questionnaires for students and mentors, 2 focus groups with students, 1 focus group with mentors, rapid interviews with 8 students and 9 mentors, and an annual program report compiled by TSA.

In 2015, students participated in JSS through 17 TSA-affiliated state competitions, three regional Army laboratory-hosted locations, and one national competition in Grapevine, TX.

2015 JSS Fast Facts	
Description	STEM Competition - Solar car competition regional events at 3 Army laboratories, 17 TSA state events, and one national event hosted in conjunction with the TSA national conference.
Participant Population	5th–8th grade students
No. of Applicants	636
No. of Students	636
Placement Rate	N/A (all students who registered were participants)
No. of Adults (Mentors and Volunteers – incl. Teachers and Army S&Es)	168
No. of Army S&Es	26
No. of Army Research Centers and Laboratories	3
No. of K-12 Schools	266
No. of K-12 Schools – Title I	94

No. of Other Collaborating Organizations	0
Total Cost	$123,371.86
Scholarships/Awards Cost	$15,072.52
Stipend Cost	$500.00*

*Stipend was provided to the guest speaker at the national conference.

Summary of Findings

The FY15 evaluation of JSS 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 the following table.

2015 JSS Evaluation Findings	
Participant Profiles	
JSS experienced a decline in applications and youth/adult participants in FY15. JSS served relatively small percentages of students from historically underrepresented and underserved populations; there is room for growth in this area as well as a need for consistent collection of enrollment demographic data.	The overall number of applications for and participants in JSS for FY15 decreased 29% from FY14. The number of adults who supported the JSS program declined 51% from FY14. Interestingly, the number of participating K12 schools grew 74% (266) in FY15 compared to FY14. Additionally, 68% of participating schools were Title I.
	Only 27% of JSS student participants in FY 15 were female —a population that is historically underrepresented and underserved in STEM fields, which is particularly so in the physical sciences. JSS had limited success in engaging students from historically underrepresented and underserved races/ethnicities. Enrollment data indicate that in FY15 only 7% of participants identified themselves as Black or African American and 9% as Hispanic or Latino. This may be due to the fact that only TSA chapter members and their students are permitted to participate in JSS and the overall TSA population may be limited in diversity.
	There is evidence that JSS's success in reaching low-income students was limited. Only 20% of enrolled participants identified themselves as qualifying for free or reduced-price lunch (FRL), a commonly used indicator of family income. It is noteworthy, however, that 16% of participants chose not to report their FRL status.

	No enrollment demographic data is available for FY14, therefore it is not possible to compare FY15 student demographic data with the prior year's data to track emerging trends in enrollment (data is available for FY14 questionnaire respondents, however since only 9% of students and 5% of mentors responded it cannot be assumed that these respondents are representative of participant demographics for the year). There is a need for consistent tracking of JSS participant demographics.
JSS participants have little experience with other AEOPs and only limited interest in participating in other AEOPs in the future.	Only a very small number of students reported having participated in other AEOPs in the past. In addition, the majority of students have not heard of AEOPs that they currently qualify for or that they may qualify for in high school. This is an area for potential growth for JSS. It is unclear how much TSA promotes non-TSA events/competitions to their membership.
Actionable Program Evaluation	
There is evidence that the national infrastructure for JSS benefits participants and enhances marketing efforts.	Nearly half (49%) of students questionnaire respondents reported learning about JSS from the TSA while over half (64%) of mentors reported learning about JSS from the TSA; this was by far the most common method of learning about JSS for both groups and indicates that TSA's infrastructure and outreach efforts are key to the continued success of JSS.
	Students and mentors reported high levels of satisfaction with TSA online resources, and the TSA website was cited by students as a major source of information about other AEOPs.
JSS students reported a variety of motivators for participating in the program.	Students were most frequently motivated to participate in JSS by an interest in STEM (19%), a desire to learn something new or interesting (16%), to have fun (16%), and because of teacher encouragement (14%).
JSS students reported engaging in meaningful STEM learning through team-based and hands-on activities.	Most students (53-64%) report communicating with other students about STEM and learning about new STEM topics on most days or every day of their JSS experience.
	Teamwork, participating in hands-on STEM activities, and coming up with creative explanations/solutions were key to students' work in JSS. Student respondents reported engaging in these practices most days or every day (74%, 72% and 59% respectively). Students engaged in a variety of other STEM practices on a frequent basis, including analyzing data or information (59%) and drawing conclusions from an investigation (55%).
	Mentors reported using a variety of strategies to help make learning activities to students relevant, support the needs of diverse learners, develop students' collaboration and interpersonal skills, and engage students in authentic STEM activities.

JSS involved more Army/DoD S&E's in the program in FY15. However, JSS has an opportunity to improve student and mentor awareness of other AEOPs and DoD STEM careers.	The number of Army/DoD S&E's grew to 26 in FY15 for JSS. Although 62% of students reported that participating in JSS impacted their awareness of other AEOPs, most students reported never hearing about any of the other AEOP initiatives. Only small proportions of mentors (10% or less) reported discussing specific programs with students although over half of mentors (52%) indicated that they discussed AEOP in general with their students.
	The majority of mentors (68%) found the TSA website to be a useful resource to expose students to DoD STEM careers. Student attitudes toward DoD researchers and research were positive, although 58% of students indicated learning about no DoD STEM careers during JSS. In comparison, 66% of students reported learning about at least one career in STEM more generally.
Students and mentors value the JSS experience.	Most students indicated being satisfied with their JSS experience. Learning about various topics, learning about STEM in general, and opportunities for teamwork were particular areas of satisfaction noted by students.
	Like students, nearly all responding mentors reported having a positive experience with JSS. Teamwork and the opportunity for hands-on learning were two of the most commonly mentioned benefits for students named by mentors.
Outcomes Evaluation	
JSS students reported gains in STEM knowledge and competencies.	Most students reported at least some gains in their STEM knowledge, including knowledge of how scientists and engineers work on real problems in STEM, an in-depth knowledge of a STEM topic, and knowledge of the research processes, ethics, and rules for conduct in STEM.
	Students also reported gains in their STEM competencies, including making a model of an object or system showing its parts and how they work, carrying out procedures for an experiment and recording data accurately, and communicating information about their design experiments and solutions in different ways.
JSS participants reported gains in 21st Century Skills.	Nearly all students reported gains in their 21st century skill. For instance, all students reported gains in making changes when things do not go as planned. A majority of students reported large or extreme gains in all categories of 21st Century Skills, including working well with students from all backgrounds, including others' perspectives when making decisions, and communicating effectively with others.
JSS participants reported gains in their identity in STEM and in their interest in engaging in STEM in the future.	The majority of students reported gains in areas related to their STEM identity, defined as confidence in one's ability to succeed in STEM. Over half reported large or extreme gains in areas such as interest in a new STEM topic (59%), feeling prepared for more challenging STEM activities (59%), and thinking creatively about a STEM project or activity (57%).
	Students also reported gains in the likelihood that they would engage in STEM activities outside of school. For instance, 72% indicated that as a result of JSS they were more likely to tinker with a mechanical or electrical device, 69% that they were more likely to take an elective STEM class, and 58% that they were more likely to participate in a STEM camp, club, or competitions.

Students had higher education aspirations after participating in JSS, although their career aspirations showed little change.	After participating in JSS, there was an increase in the number of students aspiring to continuing their education after college (57% as compared with 45% reporting this as their aspiration before JSS participation).
	Students reported similar career aspirations before and after participating in JSS, although more students aspired to a career as an engineer or architect after participation in JSS (31% before versus 40% after). Overall, there was not a statistically significant difference in career aspirations from before JSS to after.
Although JSS students are largely unaware of AEOP initiatives, students showed some interest in future AEOP opportunities.	In spite of results that showed a majority of students were unaware of most other AEOP initiatives, 62% of students indicated that JSS impacted their awareness of other AEOPs. Students had at least a little interest in participating in all other AEOPs for which they are currently eligible or will be eligible in high school, including GEMS (49%), eCYBERMISSION (39%), and SEAP (31%).

Recommendations

Evaluation findings indicate that FY15 some success overall for the JSS program. Notable successes for the year include high levels of mentor and student satisfaction with the program, evidence of an expanding national infrastructure to support JSS activities, and satisfaction with TSA resources. Both students and mentors reported gains in students' STEM knowledge and competencies and gains in students' 21st Century Skills as a result of the JSS experience.

While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. Specifically, the JSS program experienced significant decline in number of participants and overall lack of diversity in participant demographics. The membership model associated with TSA chapters being the sole source of recruitment may be limiting the ability of JSS to grow and reach the desired target populations. 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. The AEOP goal of broadening the talent pool in STEM fields continues to be a challenge for JSS. The recommendations made in the 2013 and 2014 JSS evaluation reports for the program to consider doing more to engage and interest students from schools serving historically underrepresented and underserved groups is therefore repeated. However, it is unclear if TSA has the capacity to do this within their current chapter membership. Additionally, the program may wish to consider ways to revise its outreach and marketing strategies to reach and appeal to female students and other groups underrepresented in STEM careers. It is recommended that TSA coordinate regional promotional activities associated with Army JSS Host Sites with POCs at Army research centers and labs.

It should be noted that the lack of demographic data for 2014 JSS enrollment prevented identifying any growth that occurred in this area over the past year. The universal use of CVENT for participant enrollment going forward should permit for enhanced data collection and the ability to more effectively track enrollment trends. The evaluation team would also like for TSA to provide overall demographics for their TSA chapter membership nationally to have a better understanding of how reflective the JSS participation is of the overall potential recruitment base within the TSA chapters.

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

1. Responding mentors reported an overall high level of satisfaction with resources, including TSA website resources, TSA instructional materials, and materials. Although the program met and exceeded its goal of distributing 240 car kits (a total of 300 PITSCO car kits were distributed in FY15), there was no funding for JSS-in-a-box kits or for instructional videos and webinars. It is noteworthy that over 50% of students reported dissatisfaction with (10%) or lack of experience with (44%) JSS video tutorials. When asked about resource improvements, 18% of students specifically suggested providing videos or examples, indicating that these resources would be welcome instructional supports. In light of this, the program should continue to pursue opportunities to create video content to support teachers and students.

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

1. The JSS program objective of creating a national infrastructure to support local, regional, and national events and increase participation in JSS was supported by a number of program activities. Student comments about frustration with the event registration process (in particular the requirement to register in two separate places for events) should be taken into consideration as the program continues to build this infrastructure. The evaluation team would like to explore the ability of AEOP to import the current JSS registrations from the TSA system into CVENT. JSS should follow up with the AEOP CAM office to explore this as soon as possible.

2. In order to create a robust pipeline of AEOP programs in which students' progress from other AEOPs into JSS and beyond, the program may want to consider innovative ways to work with other AEOPs to create a more seamless continuum of programs. 2015 saw a slight increase in the number of mentors who recommended AEOPs to students that align with students' educational goals (43% versus 33% in 2014), however few mentors discussed specific AEOPs with students. The recommendation made in 2013 and 2014 to devise strategies to increase students' exposure to other AEOP opportunities will therefore be repeated. In particular, the program may want to work with each site to ensure that all students have access to structured opportunities that both describe the other AEOPs and provide information to students on how they can apply to them. Since teachers provide much of the program information students receive during JSS, efforts should be made to ensure that

teachers are informed about the range of AEOPs. Other means of educating students about AEOPs should be combined with teacher information, especially given the very real consideration of teacher time constraints in working with students. Given the limited use of the AEOP website, print materials, and social media, the program should consider how these materials could be more effectively utilized to provide students with information and facilitate their enrollment in other AEOPs.

3. The JSS program's participation in evaluation activities continues to be a source of concern. Although the response rates were slightly higher for FY15 than for FY14 (14% versus 9% for students and 8% versus 5% for mentors), the low response rates for both the student and mentor questionnaires raise questions about the representativeness of the results. The program may want to consider emphasizing the importance of these evaluations with individual program sites and communicating expectations for evaluation activities to be conducted on-site directly following the actual race. In addition, the evaluation instruments may need to be streamlined and revised with age-appropriate language to reduce the time commitment of respondents.

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 FY15 evaluation Junior Solar Sprint (JSS). JSS is administered on behalf of the Army by the Technology Student Association (TSA). 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

JSS is a STEM education activity where 5th- 8th grade students apply scientific understanding, creativity, experimentation, and teamwork to design, build, and race a model solar car. JSS activities occur nationwide, in classrooms and schools, through extracurricular clubs and student associations, and as community-based events that are independently hosted and sponsored. The AEOP's investment in JSS-based programming is managed by TSA. The AEOP's JSS programming is designed to support the instruction of STEM in categories such as alternative fuels, engineering design, and

aerodynamics. Through JSS, students develop teamwork and problem-solving abilities, investigate environmental issues, gain hands-on engineering skills, and use principles of science and math to create the fastest, most interesting, and best crafted vehicle possible.

In 2015, students participated in JSS through 17 TSA-affiliated state competitions, three regional Army laboratory-hosted locations, and one national competition in Grapevine, TX. In 2015, the AEOP's contributions to JSS programming were guided by the following priorities:

1. Create a national infrastructure to manage local, regional, and national JSS events and increase participation;
2. Enhance training opportunities and resources for teachers/mentors;
3. Coordinate tracking and evaluation opportunities for student and teacher participation in JSS; and
4. Leverage AEOP through cross-program marketing efforts.

Table 1 summarizes 2015 student participation by site.

Table 1. 2015 JSS Regional/State Site Participation Numbers [t]	
2015 JSS Site	**No. of Enrolled Students**
National TSA Conference (Grapevine, TX) - June 27th through July 1st, 2014	230
Colorado TSA state competition – Denver	5
Delaware TSA state competition – Harrington	7
Florida TSA state competition – Orlando	34
Georgia TSA state competition – Athens	46
Iowa TSA state competition – Altoona	9
Missouri TSA state competition – Rolla	3
New Hampshire TSA state competition – Lincoln	6
New Jersey TSA state competition – Ewing	17
New York TSA state competition – Oswego	2
North Carolina TSA state competition – Greensboro	10
Oklahoma TSA state competition – Midwest City	39
Pennsylvania TSA state competition – Champion	59
South Carolina TSA state competition – Columbia	1
Texas TSA state competition – Waco	24
U.S. Army – Aberdeen Proving Ground (APG) – Aberdeen, MD	31
U.S. Army Armament Research, Development and Engineering Center (ARDEC) – Picatinny Arsenal, NJ	90
U.S. Army Aviation & Missile Research, Development & Engineering Center (AMRDEC) - Redstone, AL	55
Utah TSA state competition – Kaysville	6
Virginia TSA state competition – Hampton	30
Washington	77
Total	**551**

[t] Although 636 students are reported to have enrolled in JSS, site participation data is available for only 551.

Table 2. 2015 JSS Student Participant Profile ‡		
Demographic Category		
Respondent Gender (n = 624)		
Female	171	27%
Male	443	71%
Not Reported	10	2%
Respondent Race/Ethnicity (n = 624)		
Asian	63	10%
Black or African American	45	7%
Hispanic or Latino	54	9%
Native American or Alaska Native	13	2%
White	349	56%
Other race or ethnicity	20	3%
Choose not to report	80	13%
Respondent Grade Level‡ (n = 624)		
5th	18	3%
6th	137	22%
7th	167	27%
8th	301	48%
Not Reported	1	<1%
Respondent Eligible for FRL (n = 624)		
Yes	123	20%
No	404	65%
Not Reported	97	16%

‡ Although 636 students were reported to have enrolled in JSS, demographic data is available for only 624.

It should be noted that in an enrollment of 891 was reported in the FY14 JSS Evaluation Report. The 2015 enrollment of 636 represents a 29% decrease from this number. Further, no overall participant demographics were available for 2014. A total of 281 adults participated in FY15 JSS program activities, a decrease from FY14 as well (341). In FY15 this included teachers, chaperones, and 37 Army Scientists and Engineers (S&Es). These adults supported students as they prepared for or participated in a JSS event and played important roles as mentors to JSS students (see Table 3).

Table 3. 2015 Adult JSS Participation	
Participant Group	**Teachers/Adults**
Total Regional/State-level Adult Participants	103
Adults at TSA state-level competitions	84
Adults at Army regional competitions	19
Total National-level Adult Participants	67
TSA Adults at National-level Competition	75
Army regional Adults at National-level Competition	1
Grand Total of Adult Participants (includes Army S&Es)	**281**

The total cost of the 2015 JSS program was $123,372. The average cost per student participant was $194 (including the $1,102.14). Table 4 summarizes these and other 2015 JSS program costs.

Table 4. 2015 JSS Program Costs	
2015 JSS - Cost Per Student Participant	
Total Participants	636
Total Cost	$123,372
Cost Per Student Participant	**$194**
2015 JSS - Cost Breakdown	
Administrative Cost to TSA	$107,799
Total Scholarships/Awards Cost	$15,073
Total Stipend Cost	$500
Total Cost	**$123,372**

Evidence-Based Program Change

The AEOP tasks its programs with achieving three broad priorities: (1) STEM Literate Citizenry – Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base; (2) STEM Savvy Educators – Support and empower educators with unique Army research and technology resources; and (3) Sustainable Infrastructure – Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army. Based on recommendations from the FY13 and FY14 summative evaluation reports, the AEOP identified three key objectives for the portfolio in FY15:

1. Increase outreach to populations that are historically underserved and under-represented in STEM;
2. Increase participants' awareness of Army/DoD STEM careers; and
3. Increase participants' awareness of other AEOP opportunities.

In support of these priorities and objectives, the TSA established the following objectives for the JSS program in 2015:

1. Create a national infrastructure to manage local, regional, and national JSS events and increase participation;
2. Enhance training opportunities and resources for teachers/mentors;
3. Coordinate tracking and evaluation opportunities for student and teacher participation in JSS; and
4. Leverage AEOP through cross-program marketing efforts.

TSA took the following actions in FY15 in light of these objectives, the FY14 JSS evaluation study, and site visits conducted by TSA, the Army, and Virginia Tech:

I. Create a national infrastructure to manage local, regional, and national JSS events and increase participation *(supports AEOP Priority 1).*

a) TSA chapters and Army labs were given solar kits and marketing resources to execute their respective JSS competitions
b) JSS was promoted through mailings (print and email) to TSA middle school advisors (teachers) and on the TSA website
c) States holding JSS at their TSA state conference were given AEOP promotional materials to distribute to their student and adult participants
d) Three teams from Army labs competed in the national JSS competition in Dallas, Texas.

II. Strengthen Army connection to JSS regional and national events *(supports AEOP Priority 2).*

a) National TSA coordinated with Army POCs and Florida TSA and Texas TSA, respectively, in order to connect Army volunteers with state-level JSS competitions
b) National TSA also coordinated with AEOP representatives to engage them at the national TSA conference as volunteer judges and timers for the national JSS competition. In addition to serving in this capacity, AEOP representatives also networked with students, teachers, parents, and other conference attendees during the TSA Meet and Greet and an AEOP special interest session.

III. Enhance training opportunities and resources for teachers/mentors *(supports AEOP Priorities 1, 2, and 3).*

a) Continued distribution of free solar car kits with PITSCO to middle school TSA chapters who completed the request for a free kit.
b) Every state holding a JSS competition at their state TSA conference and each Army lab location hosting a JSS race received AEOP brochures and RITR notebooks for their participants.

IV. Coordinate tracking and evaluation opportunities for student and teacher participants in JSS *(supports AEOP Priority 3).*

a) Students were asked to complete evaluation during check-in at the national competition via tablets.
b) A link was sent following the national competition to the email addresses collected on Cvent for students who did not complete an onsite evaluation via tablet at the national competition.

c) A link was sent to teachers and adult volunteers and mentors following participation in national JSS competition.

FY15 Evaluation At-A-Glance

Purdue University, in collaboration with TSA and using data collected by Virginia Tech, conducted a comprehensive evaluation study of the AEOP's JSS program. The logic model below presents a summary of the expected outputs and outcomes for the JSS program in relation to the AEOP and JSS-specific priorities. This logic model provided guidance for the overall JSS evaluation strategy.

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• Army sponsorship • TSA providing —capacity to establish national network of JSS participants —online JSS educational and event resources —national JSS competition • JSS participants, inclusive of local event hosts, educators, and students seeking resources and event information • Awards for student winner(s) of national JSS competition • Centralized branding and comprehensive marketing of AEOP • Centralized evaluation	• Event hosts, educators, and students access and use JSS educational and event resources • Students build, test, and register solar car in state, Army, and national JSS competitions • TSA-selected judges evaluate solar cars at JSS competitions and select winner(s) • Program activities that expose students to AEOP programs and/or STEM careers in the Army or DoD	• Number of event hosts, educators, and students using online JSS educational and event resources • Number and diversity of students participating in national JSS competition • Number of and Title 1 status of schools served through event host, educator, or student engagement • Event hosts, educators, students, others, and TSA contributing to evaluation	• Increased student 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 Army/DoD STEM research and careers • Implementation of evidence-based recommendations to improve TSA's JSS offerings	• Increased participant engagement in other AEOP opportunities and Army/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 Army/DoD STEM careers • Continuous improvement and sustainability of JSS

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

The assessment strategy for JSS included student and mentor questionnaires, 2 focus groups with students, 1 focus group with mentors, rapid interviews with eight students, rapid interviews with nine mentors, and an Annual Program Report (APR) prepared by TSA using data from all JSS sites. Tables 5-11 outline the information collected in student and instructor questionnaires, focus groups and rapid interviews, as well as information from the APR that is relevant to this evaluation report.

Key Evaluation Questions

- What aspects of JSS programs motivate participation?
- What aspects of JSS program structure and processes are working well?
- What aspects of JSS programs could be improved?
- Did participation in JSS programs:
  - Increase students' STEM competencies?
  - Increase students' positive attitudes toward STEM?
  - Increase students' interest in future STEM learning?
  - Increase students' awareness of and interest in other AEOP opportunities?
  - Increase students' awareness of and interest in Armv/DoD STEM careers?

Table 5. 2015 Student Questionnaires

Category	Description
Profile	**Demographics:** Participant gender, 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
	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
	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 6. 2015 Mentor Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, race/ethnicity, occupation, past participation
Satisfaction & Suggestions	Awareness of JSS, motivating factors for participation, satisfaction with and suggestions for improving JSS programs, benefits to participants
AEOP Priority 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 Priorities 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 7. 2015 Student Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in JSS, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of JSS, motivating factors for participation, interest in participating in other STEM programs, satisfaction with and suggestions for improving JSS programs, benefits to participants
AEOP Priorities 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 knew JSS was sponsored by the Army, extent to which students were exposed to STEM and Army/DoD STEM jobs

Table 8. 2015 Mentor Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, occupation, organization, role in JSS, past participation in JSS, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of JSS, benefits to participants, suggestions for improving JSS programs
AEOP Priorities 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 JSS

Table 9. 2015 Student Rapid Interviews	
Category	**Description**
Profile	Role in JSS, gender, race/ethnicity
Satisfaction & Suggestions	Extent to which student would recommend JSS, suggestions for improvement

Table 10. 2015 Mentor Rapid Interviews	
Category	**Description**
Profile	Role in JSS, gender, race/ethnicity
Satisfaction & Suggestions	Extent to which mentor would recommend JSS, suggestions for improvement

Table 11. 2015 Annual Program Report	
Category	**Description**
Program	Description of program, activities, academic level (grades 5 through 8), STEM tie-in, and benefits of participation
AEOP Priorities 1 and 2 Program Efforts	**Partnering with Teachers and Schools –** Mechanisms for marketing to and recruitment of students
	Army STEM: AEOP Opportunities – Marketing other AEOP programs
	Mentor Capacity: Local Educators – Steps to enhance training opportunities and resources

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. Questionnaires data summaries are provided in Appendix B (student) and Appendix C (mentor). The student and mentor interview protocols are provided in Appendix D (student) and Appendix E (mentor); and student and mentor questionnaire instruments are located in Appendix F (student) and Appendix G (mentor).

Table 12 provides an analysis of student and mentor participation in the JSS 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. Both student and mentor response rates are higher than in 2014 when they were 9% and 5% respectively. Although there is much room for improvement in questionnaire response rates, the increase indicates an upward trend in questionnaire responses.

Table 12. 2015 JSS Questionnaire Participation

Participant Group	Respondents (Sample)	Total Participants (Population)	Participation Rate	Margin of Error @ 95% Confidence[1]
Students	92	636	14%	±9.46%
Mentors	22	281	8%	±20.09%

Five students participated in the two focus student focus groups (2 females, 3 males). One of these students was a sixth grader, three were in seventh grade, and one was in eight grade. A series of student rapid interviews was also conducted that included eight students (4 females, 4 males). One mentor focus group with two mentors (1 male, 1 female) was conducted. Participants in these focus groups were a teacher and a professional in the field of science, engineering, or mathematics. A series of rapid interviews were also conducted with mentors (3 males, 6 females). Focus groups and rapid interviews were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of student questionnaire data. They add to the overall narrative of JSS' efforts and impact, and highlight areas for future exploration in programming and evaluation.

Respondent Profiles

Student Demographics

Demographic information collected from JSS questionnaire respondents is summarized in Table 13. Of those who reported their gender, more females (51%) than males (30%) completed the questionnaire, although 19% of respondents failed to report their gender. More responding students identified with the race/ethnicity category of White (48%) than with any other single race/ethnicity category, and only 6% of respondents identified with the Black/African American category and 4% with Hispanic/Latino. It is important to note, however, that 24% of respondents chose not to respond to this item. Nearly half (44%) of respondents were 9th graders, while 22% were in the 8th grade, 15% were in the 7th grade, and only 1% was a 6th grader. Again, there was a relatively large (18%) non-response rate to

[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.

this item. Sixty-three percent of respondents reported not qualifying for free or reduce-priced lunch (FRL) although 24% of respondents chose not to respond to this item.

These data suggest that providing outreach to students from historically underrepresented and underserved race/ethnicity and low-income groups is an area with potential for improvement. The relatively large non-response rate to demographic items could mean that these data are not representative of questionnaire respondents, however. It is also noteworthy that while 51% of questionnaire respondents who reported their gender were female, only 27% of all JSS participants were female.

Table 13. 2015 JSS Student Respondent Profile

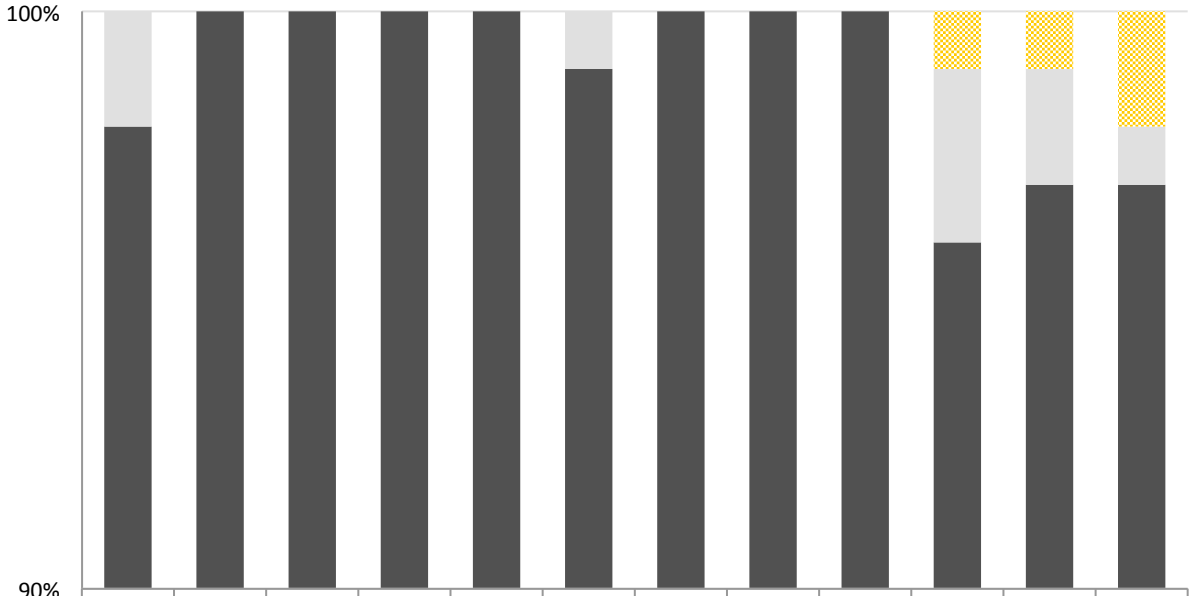
Demographic Category	Questionnaire Respondents	
Respondent Gender (n = 90)		
Female	46	51%
Male	27	30%
Not Reported	73	19%
Respondent Race/Ethnicity (n = 90)		
Asian	7	8%
Black or African American	5	6%
Hispanic or Latino	4	4%
Native American or Alaska Native	3	3%
Native Hawaiian or Other Pacific Islander	0	0%
White	43	48%
Other race or ethnicity	6	7%
Choose not to report	22	24%
Respondent Grade Level‡ (n = 90)		
6th	1	1%
7th	13	15%
8th	20	22%
9th‡	40	44%
Not Reported	16	18%
Respondent Eligible for FRL (n = 90)		
Yes	12	13%
No	57	63%
Not Reported	21	24%

‡ Students who indicated being in the 9th grade started their participation in JSS during their 8th grade year.

Table 14. 2015 JSS Student Respondent School Information		
Demographic Category	**Questionnaire Respondents**	
Respondent School Location (n = 90)		
Suburban	18	20%
Urban (city)	13	14%
Rural (country)	43	48%
Frontier or tribal school	0	0%
Not Reported	16	18%

In addition, students were asked how many times they participated in each of the AEOP programs. Chart 1 demonstrates that almost no students had participated in AEOP programs in the past. The three most commonly reported programs for past participation were GEMS Near Peer Mentors, CQL, and URAP, programs that middle school students are not eligible to participate in, indicating that respondents may not have understood this question.

Chart 1: Student Participation in AEOP Programs (n = 99)



	Camp Invention	eCyber mission	JSS	West Point Brigade Design Contest (WPBDC)	GEMS	UNITE	SEAP	REAP	HSAP	GEMS Near Peer Mentors	CQL	URAP
Three or more times	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Twice	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	2%
Once	2%	0%	0%	0%	0%	1%	0%	0%	0%	3%	2%	1%
Never	98%	100%	100%	100%	100%	99%	100%	100%	100%	96%	97%	97%

Mentor Demographics

Mentor demographic data are summarized in Table 15. As with students, more females (55%) than males (45%) responded to the questionnaire. All but one of the responding mentors were teachers and most (90%) identified their role in JSS as a competition advisor. Additional mentor characteristics are included in Appendix C.

Table 15. 2015 JSS Mentor Profile		
Demographic Category	**Questionnaire Respondents**	
Survey Respondent Gender (n = 22)		
Female	12	55%
Male	10	45%
Participating Mentor Race/Ethnicity (n=23)		
Hispanic or Latino	0	0%
Asian	2	9%
Black or African American	0	0%
Native American or Alaskan Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	19	83%
Other	0	0%
Choose not to report	2	9%
Survey Respondent Occupation (n = 22)		
Teacher	21	95%
Scientist, Engineer, or Mathematics Professional	1	5%
Survey Respondent Role in JSS (n = 22)		
Competition advisor	20	90%
Chaperone	0	0%
Event coordinator or staff	1	5%
Other, (specify)[§]	1	5%

[§] Other = "Advisor."

Actionable Program Evaluation

The 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. A focus of the Actionable Program Evaluation is efforts toward the long-term goal of JSS and all of the AEOPs to increase and diversify the future pool of talent capable of contributing to the nation's scientific and technology progress. Thus, it is important to consider how JSS is marketed to and ultimately recruits student participants, the factors that motivate students to participate in JSS, 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 perceptions of students and mentors that pertain to current programmatic efforts and recommend evidence-based improvements to help JSS achieve outcomes related to AEOP programs and objectives. While outreach to underrepresented and underserved populations is not a key objective of JSS hosts and educators nationwide, it is an

Army priority across AEOPs and therefore it is important to view these results with a perspective that focuses on how JSS can expand participation from and support STEM education for students from underrepresented and underserved groups.

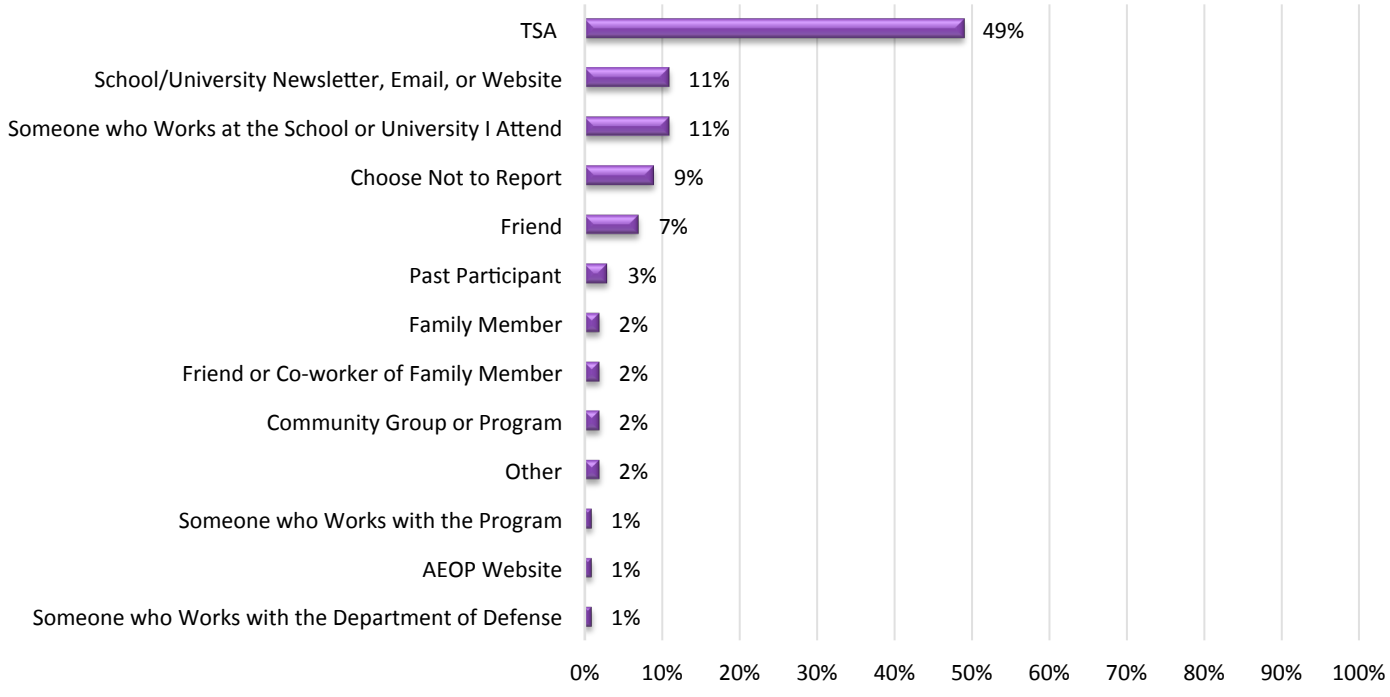
Marketing to and Recruiting Underrepresented and Underserved Populations

The JSS program employed multi-pronged efforts to market events to students on a broad scale. Although schools identified as serving large populations of traditionally underrepresented and underserved students were not a particular focus of this effort, JSS marketed its program in a variety of ways to reach a diverse population of students:

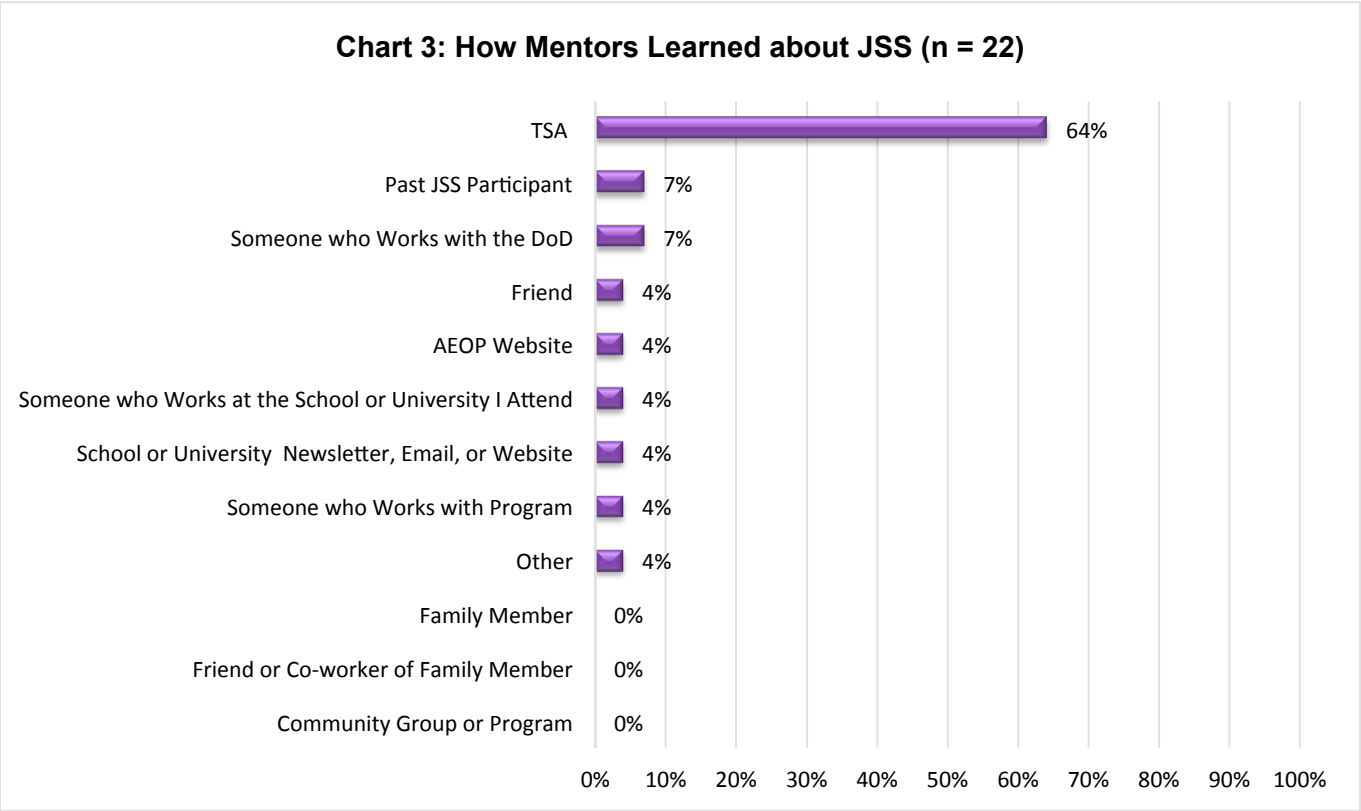
- Sent targeted emails to Title 1 schools with TSA chapters promoting the JSS program and the free solar car kit offer;
- Facilitated distribution of solar car kits to middle school TSA chapters;
- Used social media, including 1 press release, 22 Tweets, and 23 Facebook posts.

Participants were asked in the questionnaire to indicate the ways that they heard about JSS in order to understand what recruitment methods were most effective (see Chart 2). The most frequently mentioned source of information the JSS program was the TSA (49%). Other sources frequently mentioned were a school or university newsletter, email, or website (11%), or someone who works at the student's school (11%).

Chart 2: How Students Learned about JSS (n = 99)



When asked how they learned about JSS (see Chart 3), most mentors responded that they had learned about JSS through the TSA (64%). Few mentors learned about JSS from other resources, although a small percentage reported learning about JS from sources such a past JSS participant (7%) or from someone who works with the DoD (7%).



Factors Motivating Student Participation

Participants were asked in the questionnaire about what motivated them to participate in JSS. Specifically, they were asked how motivating a number of factors were in their decision to participate. As can be seen in Table 16, the top motivators students reported were interest in STEM (19%), desire to learn something new and interesting (16%), having fun (16%), and teacher encouragement (14%).

Table 16. Factors Motivating Students "Very Much" to Participate in JSS (n = 99)	
Item	**Questionnaire Respondents**
Interest in science, technology, engineering, or mathematics (STEM)	19%
Desire to learn something new or interesting	16%
Having fun	16%
Teacher or professor encouragement	14%
Opportunity to do something with friends	7%
The mentor(s)	4%
Learning in ways that are not possible in school	4%
An academic requirement or school grade	3%
Choose not to report	3%
Building college application or resume	2%
Opportunity to use advanced laboratory technology	2%
Figuring out education or career goals	2%
Exploring a unique work environment	2%
Other	2%
Interest in STEM careers with the Army	2%
Seeing how school learning applies to real life	1%
Recommendations of past participants	1%
Networking opportunities	0%
Desire to expand laboratory or research skills	0%
Serving the community or country	0%

Students in the focus groups were also asked about their reasons for participating in JSS. These students also mentioned having fun and also mentioned past participation as a motivation to participate in JSS. For example:

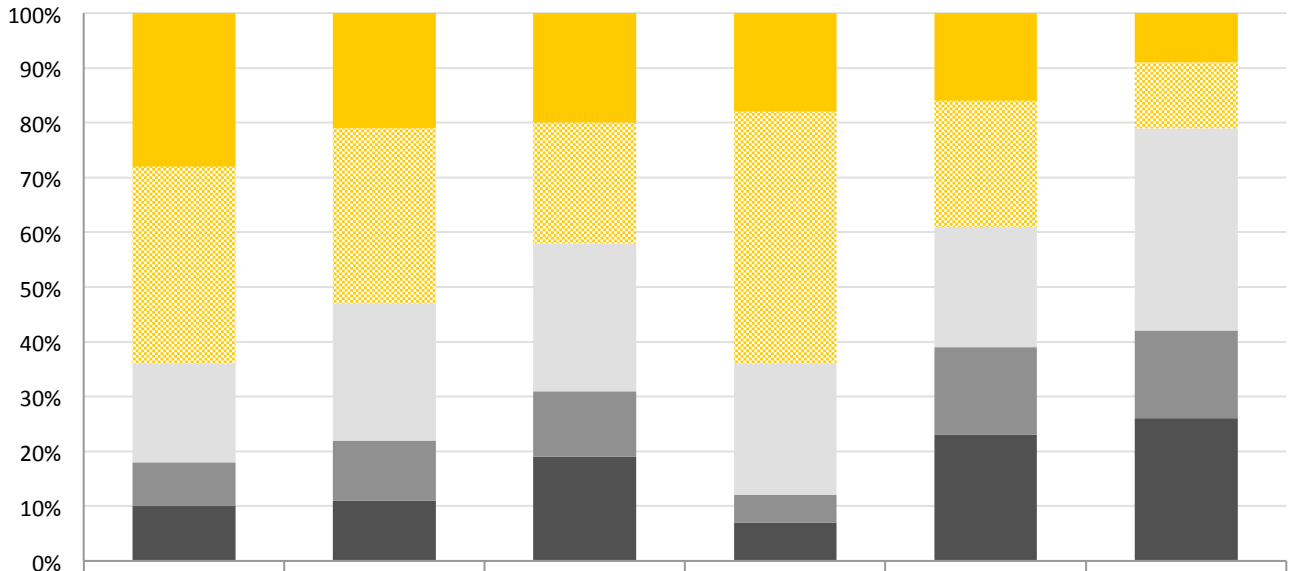
> *"I competed last year and I thought it was really fun. So I decided I wanted to try it again this year and improve on what I've been doing"* (JSS Student).

The JSS Experience

Students were asked to respond to several items asking about their experience in JSS, and how that experience compared to their STEM learning opportunities in school. When asked what field best described the focus of their JSS experience, 66% of responding students selected engineering, 24% technology, 6% science, and 3% mathematics. Students were also asked a series a questions about the nature of their JSS experience. Chart 4 illustrates student responses to a question about their activities during JSS. Over half of all respondents indicated that they communicated with other students about STEM (64%), applied STEM learning to real-life situations (53%), and learned about new STEM

topics (64%) on most or every day of their JSS experience. Fewer students reported learning about new discoveries in STEM, learning about careers that use STEM, and interacting with scientists or engineers on most days or every day. Mentors were also asked about the nature of their students' experiences.

Chart 4: Nature of Student Activities in JSS (n=90-91)



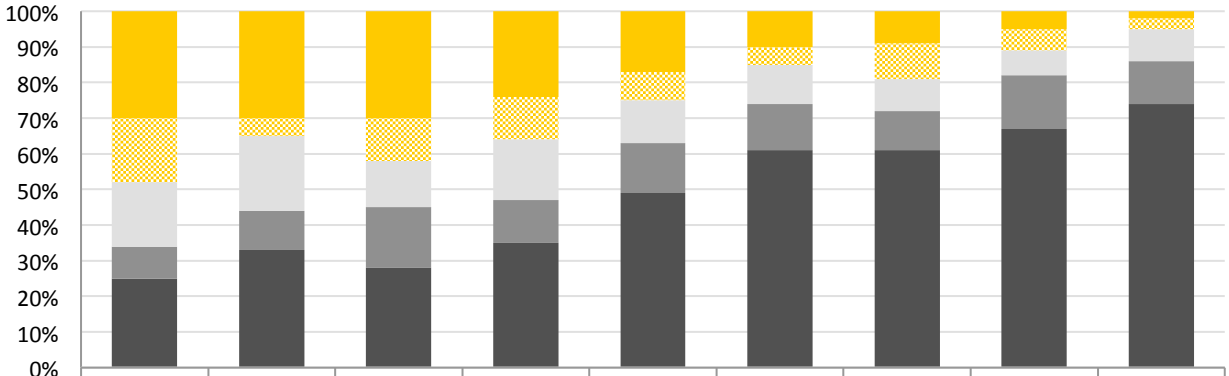
	Communicate with other students about STEM	Apply STEM knowledge to real-life situations	Learn about new discoveries in STEM	Learn about STEM topics that are new to you	Learn about careers that use STEM	Interact with scientists or engineers
Every day	28%	21%	20%	18%	16%	9%
Most days	36%	32%	22%	46%	23%	12%
A few times	18%	25%	27%	24%	22%	37%
At least once	8%	11%	12%	5%	16%	16%
Not at all	10%	11%	19%	7%	23%	26%

In keeping with the JSS goal of increasing the number and diversity of students who pursue STEM careers, the student questionnaire also asked how many jobs/careers in STEM in general, and, more specifically, STEM jobs/careers in the DoD students learned about during their experience. As illustrated in Table 17, 66% of students reported learning about at least one STEM job/career, with 26% learning about five or more. Responding students were less likely to indicate that they learned about DoD STEM jobs/careers with only 41% of students reporting learning about at least DoD STEM job/career.

Table 17. Number of STEM Jobs/Careers Students Learned about During JSS (n = 87-88)		
	STEM Jobs/Careers	DoD STEM Jobs/Careers
None	34%	59%
1	15%	16%
2	5%	4%
3	16%	3%
4	4%	4%
5 or more	26%	14%

Students also reported on the impact of resources upon their awareness of DoD STEM careers (see Chart 5). Participation in JSS events (42%), students' mentors (35%), the TSA website (48%), and the JSS website (36%) were most often reported as being somewhat or very much responsible impacting students' awareness of DoD STEM careers. Several of the resources included were not experienced by a majority of students, including the AEOP brochure (61%), invited speakers or "career" events during JSS (61%), AEOP social media (67%), and the It Starts Here! magazine (74%).

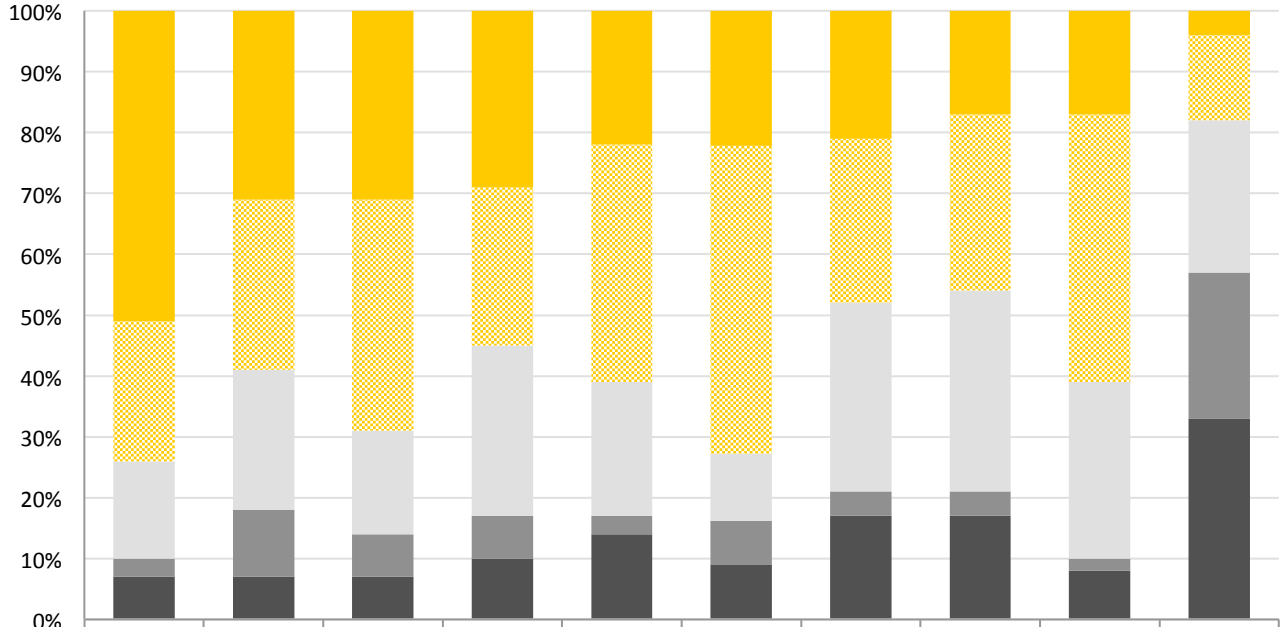
Chart 5: Impact of Resources on Student Awareness of DoD STEM Careers (n = 88-90)



	Technology Student Association (TSA) website	My mentor(s)	Participation in JSS	JSS website	AEOP website	AEOP brochure	Invited speakers or "career" events during JSS	AEOP social media	It Starts Here! magazine
Very Much	30%	30%	30%	24%	17%	10%	9%	5%	2%
Somewhat	18%	5%	12%	12%	8%	5%	10%	6%	3%
A little	18%	21%	13%	17%	12%	11%	9%	7%	9%
Not at all	9%	11%	17%	12%	14%	13%	11%	15%	12%
Did not experience	25%	33%	28%	35%	49%	61%	61%	67%	74%

Students were also asked to report on the frequency with which they engaged in various STEM practices during JSS. Findings indicate that students were very actively engaged in a variety of STEM practices during the program (see Chart 6). For example, 74% of responding students indicated working as part of a team on most days or every day; 69% reported coming up with creative explanations or solutions, and 72% reported participating in hands-on STEM activities every day or on most days. Mentor responses to a parallel item are generally aligned with the data from the student questionnaire (see Appendix C).

Chart 6: Student Engagement in STEM Practices in JSS (n = 88-90)



	Work as part of a team	Analyze data or information	Come up with creative explanations /solutions	Identify questions or problems to investigate	Draw conclusions from an investigation	Participate in hands-on STEM activities	Design an investigation	Carry out an investigation	Use laboratory procedures and tools	Build or make a computer model
Every day	51%	31%	31%	29%	22%	22%	21%	17%	17%	4%
Most days	23%	28%	38%	26%	39%	50%	27%	29%	44%	14%
A few times	16%	23%	17%	28%	22%	11%	31%	33%	29%	25%
At least once	3%	11%	7%	7%	3%	7%	4%	4%	2%	24%
Not at all	7%	7%	7%	10%	14%	9%	17%	17%	8%	33%

A composite score[2] was calculated for each of these two sets of items, the first titled "Learning about STEM in JSS,"[3] and the second "Engaging in STEM Practices in JSS."[4] 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 scores were used to test whether there were differences in student experiences by gender and race/ethnic group. Because widely varying group sizes threaten the validity of results, these tests were not conducted for FRL status and school location. No significant differences were found, indicating that students, regardless of gender or race/ethnic group, had similar experiences.

Participants were asked questions regarding how often they engaged in the same activities in school (individual item responses can be found in Appendix B). These responses were also combined into two composite variables: "Learning about STEM in School,"[5] and "Engaging in STEM Practices in School"[6] that are parallel to the ones asking about JSS. There were no significant differences between the "in JSS and "in School" versions of these composites. This lack of difference may be attributable to the fact that, unlike many other AEOPs, JSS activities are often completed in a school setting. As a result, these questionnaire items may lack meaning for students.

The Role of Mentors

JSS mentors, typically teachers (all JSS participants have a teacher who is a member of the TSA chapter), play a critical role in the JSS program by designing and facilitating learning activities, delivering content through instruction, supervising and supporting collaboration and teamwork, providing one-on-one support to students, and chaperoning students at JSS events. On average, mentors responding to the mentor questionnaire reported working with 14 students, with a range of 2 to 180 students.

Mentors were asked to report on their use of mentoring strategies when working with students. These strategies comprised five main areas of effective mentoring that are supported by research.
These five areas of effective mentoring are:

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

[2] 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.

[3] The Cronbach's alpha reliability for these 6 items was 0.889.

[4] The Cronbach's alpha reliability for these 10 items was 0.947.

[5] Cronbach's alpha reliability of 0.835.

[6] Cronbach's alpha reliability of 0.933.

5. Supporting students' STEM educational and career pathways.

The majority of mentors reported using several strategies to help make the learning activities relevant to students (see Table 18). For example, around three-quarters of mentors reported helping students become aware of the role that STEM plays in their everyday lives, becoming familiar with their students backgrounds and interests at the beginning of the program, and helping students understand how STEM can help them improve their communities. Fewer mentors selected readings or activities related to students' backgrounds (18%).

Table 18. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 22)

Item	Questionnaire Respondents
Helping students become aware of the role(s) that STEM plays in their everyday lives	77%
Become familiar with my student(s) background and interests at the beginning of the JSS experience	73%
Helping students understand how STEM can help them improve their own community	73%
Giving students real-life problems to investigate or solve	64%
Asking students to relate real-life events or activities to topics covered in JSS	36%
Encouraging students to suggest new readings, activities, or projects	32%
Selecting readings or activities that relate to students' backgrounds	18%

Mentors also used a variety of strategies to support the diverse needs of students as learners (see Table 19). A large majority of mentors (86%) used a variety of teaching and/or mentoring activities to meet the needs of all students while 75% reported interacting with students and other personnel the same way regardless of their backgrounds.

Table 19. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 20-21)	
Item	**Questionnaire Respondents**
Use a variety of teaching and/or mentoring activities to meet the needs of all students	86%
Interact with students and other personnel the same way regardless of their background	75%
Identify the different learning styles that my student (s) may have at the beginning of the JSS experience	67%
Directing students to other individuals or programs for additional support as needed	67%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	52%
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	38%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	38%

Large proportions of mentors also reported using a number of strategies to support students' development of collaboration and interpersonal skills (see Table 20). For example, 86% of mentors reported both having students work on collaborative activities or projects as a member of a team and allowing students to resolve conflicts and reach agreement within their team. Similarly, 81% of mentors reported both having students listen to the ideas of others with an open mind and having students give and receive constructive feedback with others.

Table 20. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 21)	
Item	**Questionnaire Respondents**
Having students work on collaborative activities or projects as a member of a team	86%
Allowing my student(s) to resolve conflicts and reach agreement within their team	86%
Having my student(s) listen to the ideas of others with an open mind	81%
Having my student(s) give and receive constructive feedback with others	81%
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	76%
Having my student(s) explain difficult ideas to others	71%
Having my student(s) tell other people about their backgrounds and interests	33%

Mentors supported student engagement in authentic STEM activities in a variety of ways as well. As illustrated in Table 21, 91% of mentors encouraged students to learn collaboratively, while over three-quarters of mentors used several other strategies including allowing students to work independently to improve their self-management abilities,

Encouraging students to seek support from other team members, and providing students with constructive feedback to improve their STEM competencies.

Table 21. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 21)	
Item	**Questionnaire Respondents**
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	91%
Allowing students to work independently to improve their self-management abilities	86%
Encouraging students to seek support from other team members	86%
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	81%
Supervising my student(s) while they practice STEM research skills	81%
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	57%
Teaching (or assigning readings) about specific STEM subject matter	52%

Finally, mentors reported on strategies they used to supporting students' STEM educational and career pathways.[7] As can be seen in Table 22, most mentors reported using strategies such as asking students about their educational and career interests (67%), recommending student and professional organizations in STEM to their students (67%), and providing guidance about educational pathways to prepare students for STEM careers (62%). While 62% of mentors discussed STEM career opportunities in private industry or academia, only 24% reported discussing STEM career opportunities with the DoD or other government agencies. Given the AEOP goal of broadening the talent pool in STEM fields, this is an area of potential growth. Additionally, given the AEOP interest in having students graduate into other AEOP opportunities, it is noteworthy that less than half of mentors (43%) recommended other AEOPs to students.

[7] The student questionnaire included a subset of these items; student response data are similar to mentor data and can be found in Appendix B.

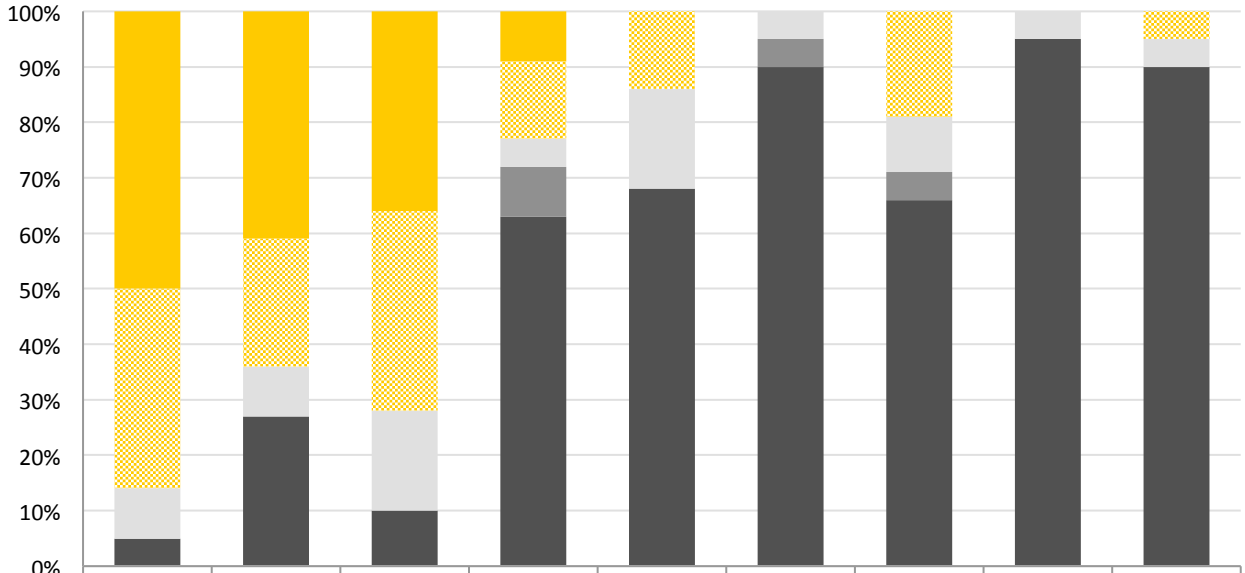
Table 22. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 21)	
Item	**Questionnaire Respondents**
Asking my student(s) about their educational and/or career goals	67%
Recommending student and professional organizations in STEM to my student(s)	67%
Recommending extracurricular programs that align with students' goals	62%
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	62%
Discussing STEM career opportunities in private industry or academia	62%
Discussing the economic, political, ethical, and/or social context of a STEM career	48%
Recommending Army Educational Outreach Programs that align with students' goals	43%
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	38%
Helping students build a professional network in a STEM field	33%
Discussing STEM career opportunities within the DoD or other government agencies	24%

Mentors were specifically asked which of the AEOP programs mentors they discussed with their students during JSS. As can be seen in Table 23, over half of mentors (52%) discussed AEOPs with students, but without reference to any particular programs. Small percentages of mentors reported discussing high school programs including SEAP (10%), REAP (5%), and HSAP, while 5% reported discussing SMART and GEMS. Interestingly, no mentors reported discussing JSHS, also a high school program, with students.

Table 23. Mentors Explicitly Discussing AEOPs with Students (n = 20-21)	
Item	**Questionnaire Respondents**
I discussed AEOP with my student(s) but did not discuss any specific program	52%
Science & Engineering Apprenticeship Program (SEAP)	10%
Research & Engineering Apprenticeship Program (REAP)	5%
High School Apprenticeship Program (HSAP)	5%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	5%
Gains in the Education of Mathematics and Science (GEMS)	5%
UNITE	0%
Junior Science & Humanities Symposium (JSHS)	0%
College Qualified Leaders (CQL)	0%
GEMS Near Peer Mentor Program	0%
Undergraduate Research Apprenticeship Program (URAP)	0%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	0%

Mentors were also asked to rate the usefulness of various resources in their efforts to expose students to the range of AEOPs. Chart 7 illustrates these findings and shows that the TSA website (86%), participation in JSS (64%), and the JSS website (72%) were most often rated as "very much" or "somewhat" useful while 23% rated the JSS program administrator or site coordinator as "very much" or "somewhat" useful for this purpose. Large proportions of mentors did not experience resources such as invited speakers or "career" events (90%), the It Starts Here! Magazine (95%), and AEOP on social media (90%).

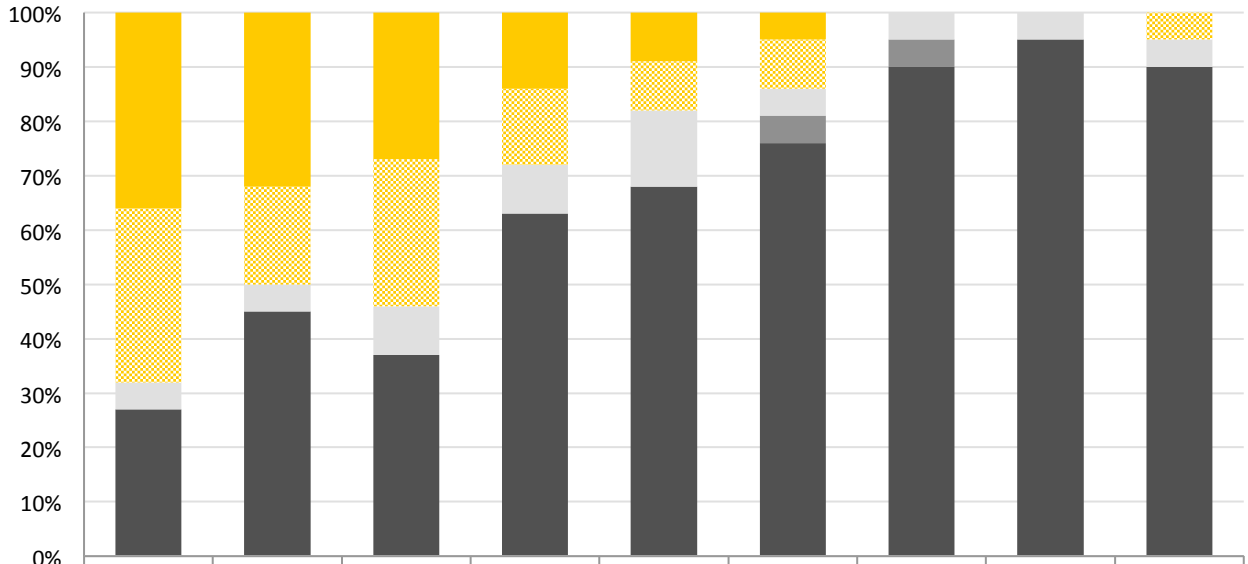
Chart 7: Usefulness of Resources for Exposing Students to AEOPs (n = 21-22)



	TSA website	Participation in JSS	JSS website	JSS Program administrator or site coordinator	AEOP website	AEOP on social media	AEOP brochure	It Starts Here! magazine	Invited speakers or "career" events
Very Much	50%	41%	36%	9%	0%	0%	0%	0%	0%
Somewhat	36%	23%	36%	14%	14%	0%	19%	0%	5%
A little	9%	9%	18%	5%	18%	5%	10%	5%	5%
Not at all	0%	0%	0%	9%	0%	5%	5%	0%	0%
Did not experience	5%	27%	10%	63%	68%	90%	66%	95%	90%

Similarly, mentors were asked how useful these resources were for exposing students to DoD STEM careers (see Chart 8). Responses paralleled those to the previous item, with mentors most likely to rate the TSA website (68%), participation in JSS (50%), and the JSS website (52%) as "very much" or "somewhat" useful for exposing students to DoD STEM careers. Again, most responding mentors reported not having experienced resources such as invited speakers or "career" events (90%), the It Starts Here! Magazine (95%), and AEOP on social media (90%).

Chart 8: Usefulness of Resources for Exposing Students to DoD STEM Careers (n = 22)



	TSA website	Participation in JSS	JSS website	AEOP website	AEOP brochure	JSS Program administrator or site coordinator	AEOP on social media	It Starts Here! Magazine	Invited speakers or "career" events
Very Much	36%	32%	27%	14%	9%	5%	0%	0%	0%
Somewhat	32%	18%	27%	14%	9%	9%	0%	0%	5%
A little	5%	5%	9%	9%	14%	5%	5%	5%	5%
Not at all	0%	0%	0%	0%	0%	5%	5%	0%	0%
Did not experience	27%	45%	37%	63%	68%	76%	90%	95%	90%

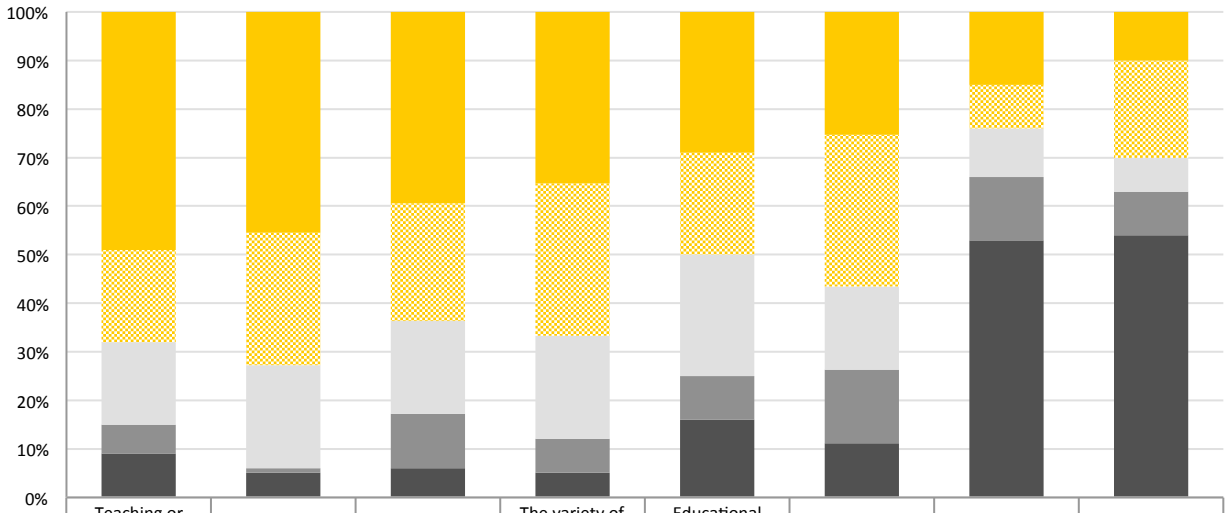
Student Satisfaction with JSS

Students were asked how satisfied they were with a number of features of the JSS program. The majority of students were somewhat or very much satisfied with most aspects of the program (see Chart 9). For example, 68% of students were very much or somewhat satisfied with the teaching or mentoring provided during JSS activities while 72% expressed this level of satisfaction with the physical location(s) of JSS activities, and 66% with the variety of STEM topics available to them. The most commonly cited areas of student dissatisfaction were with applying or registering for the program (11%), field trips and career events (13%), and communicating with site organizers (15%)

Another questionnaire item gauged participant opinions regarding the usefulness of various online resources (see Chart 10). Over three quarters of respondents (82%) found the official TSA competition rules very much or somewhat useful. Local competition rules and STEM standards were rated as at least somewhat useful by over half (61% and 51% respectively) of respondents. Several other resources received these ratings from nearly half of respondents, including

Build a Car resources (47%), Course Outline (43%), and Calendar of Events (43%). The other resources were found to be somewhat or very much useful by 30-34% of the responding students.

Chart 9: Student Satisfaction with JSS Features (n = 88-90)



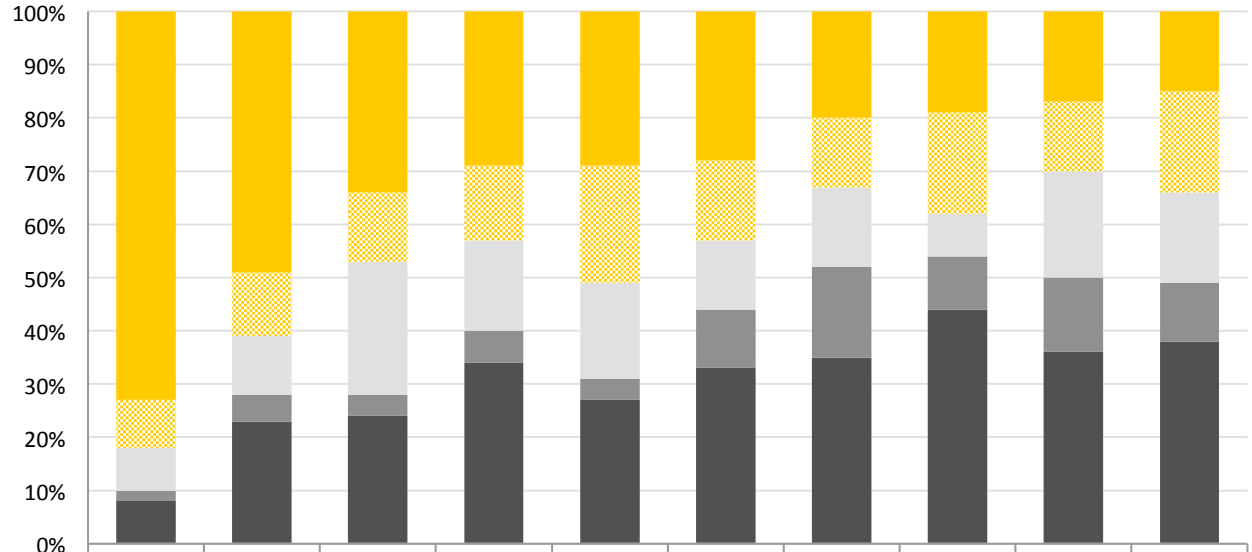
	Teaching or mentoring provided during JSS activities	The physical location(s) of JSS's activities	Applying or registering for the program	The variety of STEM topics available to you in JSS	Educational materials used during program activities	Communication with your JSS host site organizers	Field trips or laboratory tours	Invited speakers or "career" events
Very Much	49%	45%	39%	35%	29%	25%	15%	10%
Somewhat	19%	27%	24%	31%	21%	31%	9%	20%
A little	17%	21%	19%	21%	25%	17%	10%	7%
Not at all	6%	1%	11%	7%	9%	15%	13%	9%
Did not experience	9%	5%	6%	5%	16%	11%	53%	54%

Items in Chart 10 were combined into a composite variable titled "Satisfaction with Website Resources."[8] The composite was used to test for differential impacts across sub-groups of students in terms of gender and race/ethnicity. No significant differences were found in this variable by gender or race/ethnicity.

"JSS has taught me to work with my peers and stay on task. It has opened me up to new STEM jobs and ideas available to me. I had fun." -- JSS Student

[8] The Cronbach's alpha reliability for these 10 items was 0.935.

Chart 10: Student Satisfaction with JSS Online Supports (n = 87-90)



	Official TSA Competition Rules	Local Competition Rules	Build A Car resources	Course Outline	STEM Standards	Calendar of Events	JSS Host Guide	Video Tutorials	Lesson Plans	Terminology
Very Much	73%	49%	34%	29%	29%	28%	20%	19%	17%	15%
Somewhat	9%	12%	13%	14%	22%	15%	13%	19%	13%	19%
A little	8%	11%	25%	17%	18%	13%	15%	8%	20%	17%
Not at all	2%	5%	4%	6%	4%	11%	17%	10%	14%	11%
Did not experience	8%	23%	24%	34%	27%	33%	35%	44%	36%	38%

An open-ended questionnaire item also asked students about their satisfaction with their JSS experience. The responses were positive overall. Of the 65 students who responded to this question with an interpretable answer, 55 (85%) commented on only positive aspects of the program. Many of the responses were simple affirmations such as "it was fun," or "it was amazing! Other students provided more detail about what they enjoyed about the program. For example:

I love STEM and being in JSS; it has opened my eyes to new possible career choices. (JSS Student)

I was very happy with the way the competition was organized and laid out. (JSS Student)

It is AWESOME! I learned a lot about STEM through JSS. (JSS Student)

I absolutely enjoyed it! It was a great time, and I learned some new thing. In addition that that, I met new people and had a great experience. (JSS Student)

Of the remaining 10 responses, 4 (6%) responses included positive comments, but had some caveats. The majority of the caveats had to do with the event itself in some way, but responses varied widely. Two students expressed dissatisfaction with event features (guide wires differed from description in the guidebook) or mentor support. The two other mixed responses were non-specific in nature, for example, "I am satisfied but the experience could have been better."

Another open-ended item asked students to list three ways in which JSS could be improved; 52 students responded to this item. The two most common themes that emerged from responses centered on improved rules and directions and the desire for more resources. Thirty of the responding students made suggestion relating to the program's official rules and regulations, though the suggestions varied widely. For example, 11 students (20%) mentioned wanting more detailed directions, clearer rules, or fewer restrictions. Six students (11%) suggested specific modifications including allowing larger car dimensions, having a longer track, allowing cars to use more powerful motors, and allowing the use of other solar panels. Other suggestions included expanding the program to high school, providing solar panels to teams, allowing more teams per school, and having fewer disqualifications. Ten students (18%) focused their suggestions on providing additional resources. For example, three students (5%) felt that more access to videos would be helpful while another three students (5%) indicated that examples would be beneficial. Other resource-focused responses included facilitating student access to rubrics and requirements, having an "advice page," and providing more support for teachers. Other comments included eliminating the survey (3 students or 5%), encouraging girls to participate (1 student or 2%), and making the registration site more user-friendly (2 students or 5%).

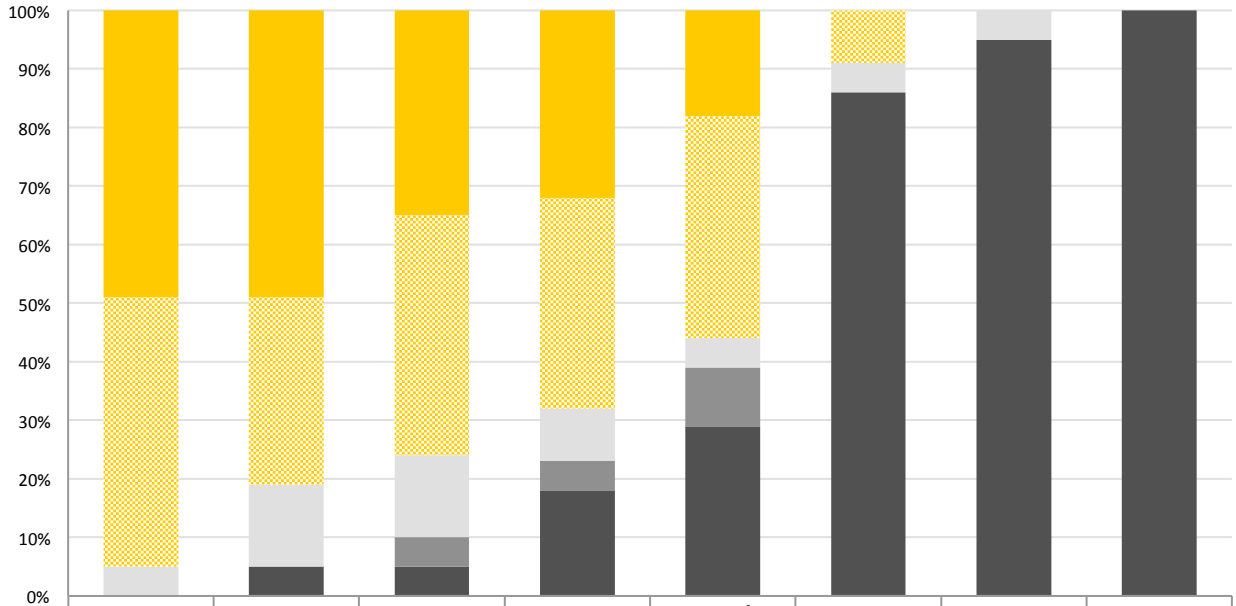
Students were also asked to respond to an open-ended item asking them what resources were most useful for their participation in JSS. Of the 76 students who answered this question, only 2 students (3%) reported not using any resources. The most commonly reported resources were the TSA competition rules or the TSA website, cited by 27 students (35%). Other common responses included a general reference to "website" (8%). Three students (4%) specified that the JSS website was very useful, while 15 students (20%) cited human resources, including mentors, teammates, staff, and parents, as the most useful resource.

Additionally, students were asked to respond to an open-ended item specifically about resources that could be improved or added to better support them in JSS. Of the 73 students who answered, 13 (18%) had no suggestions for improvement. Of the students who suggested improvements, 8 (11%) suggested improvements in the rules and guidelines, 8 (11%) felt that videos or examples would be helpful, 6 (8%) cited the registration process for the national event as an area for improvement; 4 (5%) indicated that their mentorship could be improved, 4 (5%) suggested improving the website (3 of these students specified the JSS website and 1 specified the AEOP website); and 4 students (5%) felt that receiving more career information would improve their JSS experience. Less common responses (made by 1 or 2 students) included transportation, location of the national event, car materials, a map of the event venue, and supplies.

Mentor Satisfaction with JSS

Mentors were also asked to rate their level of satisfaction with features of JSS. Like students, mentors reported being somewhat or very much satisfied with the program components they experienced (see Chart 11). For example, all 95% of mentors were at least somewhat satisfied with the physical location of JSS activities, 81% with their communication with the TSA, and 76% with the application or registration process. The most commonly cited area of dissatisfaction for mentors was support for instruction or mentorship during program activities (10%).

Chart 11: Mentor Satisfaction with JSS Features (n = 21-22)

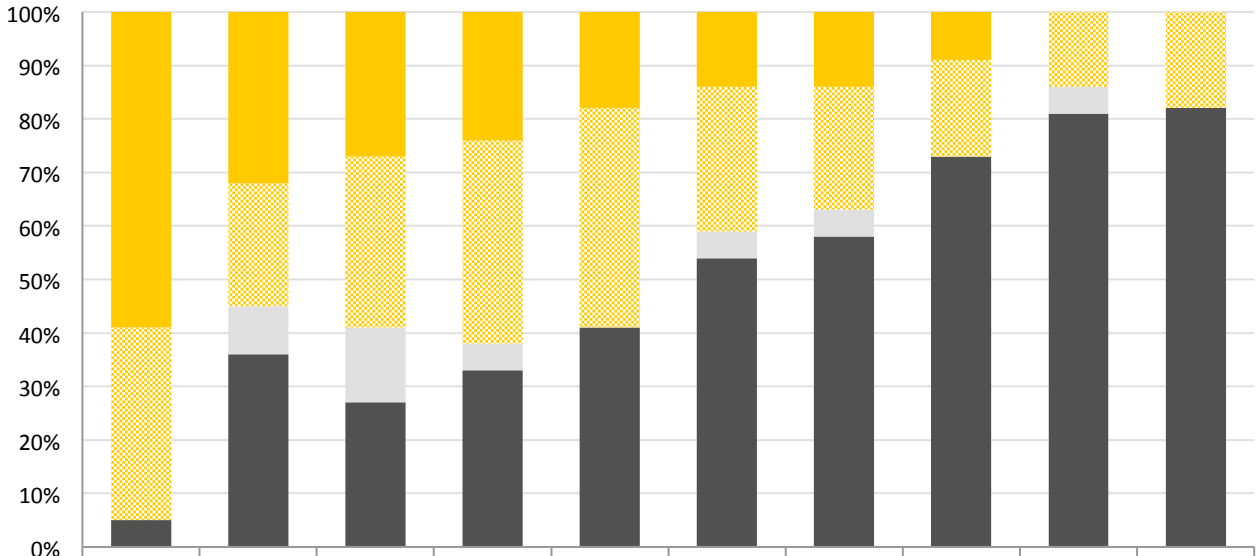


	The physical location(s) of JSS's activities	Communicating with TSA	Application or registration process	Communicating with JSS site coordinators	Support for instruction or mentorship during program activities	Stipends (payment)	Invited speakers or "career" events	Field trips or laboratory tours
Very Much	49%	49%	35%	32%	18%	0%	0%	0%
Somewhat	46%	32%	41%	36%	38%	9%	0%	0%
A little	5%	14%	14%	9%	5%	5%	5%	0%
Not at all	0%	0%	5%	5%	10%	0%	0%	0%
Did not experience	0%	5%	5%	18%	29%	86%	95%	100%

Chart 12 summarizes mentor responses to a question asking them how satisfied they were with a variety of online supports. Mentors were overwhelmingly likely to find the official TSA competition rules useful, and all 95% of mentors who had experience with the rules rated them as somewhat or very much helpful. Other resources mentors were at

least somewhat satisfied with included Build a Car resources (62%), JSS terminology (59%), and local competition rules (59%). No mentors indicated dissatisfaction with any of the online supports or resources.

Chart 12: Mentor Satisfaction with JSS Online Supports (n = 21-22)



	Official TSA Competition Rules	STEM Standards	Terminology	Build A Car resources	Local Competition Rules	Course Outline	Lesson Plans	Video Tutorials	JSS Host Guide	Calendar of Events
Very Much	59%	32%	27%	24%	18%	14%	14%	9%	0%	0%
Somewhat	36%	23%	32%	38%	41%	27%	23%	18%	14%	18%
A little	0%	9%	14%	5%	0%	5%	5%	0%	5%	0%
Not at all	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Did not experience	5%	36%	27%	33%	41%	54%	58%	73%	81%	82%

In an open-ended question, mentors were asked to identify the three most important strengths of JSS. The 11 mentors who responded to this question mentioned six benefits of the program: opportunities for student collaboration and teamwork (64%), opportunities for hands-on learning (36%), engaging students in the design process (36%), engaging students in problem solving (27%), the competitive nature of the program (18%), and the resources provided by JSS (18%). Several of these strengths were echoed in the rapid interviews. For example:

> *I think it's a great opportunity to see the kids put what they learned in the classroom into action* (JSS Mentor)
>
> *It gives me some ideas for teaching engineering and design in the classroom. And it gives a real world application for the kids too.* (JSS Mentor)

I think it's a great program for the kids…it's really been a wonderful experience – they had to learn to work together. And in the end they came up with something that they created together. (JSS Mentor)

In another open-ended questionnaire item, mentors were asked to note three ways in which JSS should be improved for future participants. The ten mentors who responded provided a variety of suggestions. Like the students, mentors suggested improvements to the rules/regulations (40%), e.g., ensuring that local rules are consistent with national rules, allowing more creative freedom. Several mentors (40%) also felt that JSS would benefit from more publicity and outreach and one mentor specifically suggested publicizing available resources more. Two mentors (20%) also suggested modifications in materials, including providing more materials in the kit, providing more than one kit while one mentor pointed out that the timing of the competition was not conducive to using solar cells in the cars.

Mentors were also asked to share their overall satisfaction with their JSS experience in an open-ended questionnaire item. Of the 11 mentors who responded to this question, 91% had something positive to say. For example:

Very pleased. Excellent program and great details to ensure students understand that both their engineering design process and production are equally important. (JSS Mentor)

I love it! My students love it! Keep up the great work. (JSS Mentor)

Of the 11 positive comments, 3 were offered with some caveats. These caveats centered on wishing that the event had been held at a time when cars could have run with solar power (1 mentor), a desire to test the car on the rack before time trials and being able to modify cars between trials (1 mentor), and a comment that the organization and facilities of the competition contributed negatively to student experience (1 mentor). Only 1 mentor expressed dissatisfaction in response to this question saying,

I was really disappointed with how many kit cars that were able to be purchased and a part of the racing. Many Pitsco.com cars were purchased and the majority of the top winners were all the same car. PA TSA allowed these kit cars to compete. What does this teach the children? Many cars were over $50 in price. I think it would be better if the people running the event paid more attention to these two areas. (JSS Mentor)

Mentors were also asked to respond to open-ended items specifically regarding the resources associated with JSS. Sixteen mentors responded to the item asking them which resources were most useful to them in JSS, and only 1 mentor (6%) reported not using any JSS resources. The most commonly reported resource cited (by 8 mentors, or 50%) was TSA guidelines and rules. Four mentors (25%) responded that the kit materials were the most useful while 1 mentor noted the importance of the grant they received for the solar panel and motor, adding "without that, we would not have participated."

Eleven mentors responded to an open-ended item asking what resources could be improved or added to better support them in JSS, and all but two of these respondents had suggestions for improvement. Three mentors (27%) suggested

streamlining the registration process while another 3 (27%) suggested improving communication about materials and strategies. One mentor (9%) recommended adding an online Skype component to communicate with experts, another recommended requiring competitors to bring batteries to the event to prepare for low-light conditions, and another suggested simplifying requirements. Two mentors (18%) also recommended improvements in instructional resources, including more current instructional videos and improvements to the course outline. As one mentor said,

> *"The course outline could be more fleshed out, as well as activities designed to stimulate divergent thinking…Also, it was cumbersome to register because there were no clear indications that I needed to register for the state TSA competitions AS WELL AS on the JSS site….Also, just in general, I thought the required items for this event were a bit advanced for middle school. Streamlining the requirements, and making it easier to get a novice on board would really help."* (JSS Mentor)

Findings from the Actionable Program Evaluation indicate that JSS is actively engaging students in authentic STEM experiences. There is evidence that students are learning about STEM jobs/careers although they are learning about DoD STEM jobs/careers to a lesser extent, which may be an area for attention, particularly at TSA-hosted sites.

Furthermore, there is evidence that JSS actively engages students in learning about STEM and in STEM practices. The range of mentoring strategies employed to help make the learning activities relevant to students, support the diverse needs of students as learners, support students' development of collaboration and interpersonal skills, and support student engagement in authentic STEM activities supports student learning and engagement. Students and mentors alike reported overall satisfaction with the JSS features they experienced during their participation.

"A lot of [students] haven't even used tools themselves yet. So teaching them how to use their hands and actually build something, create something that they could actually see the results in has been very rewarding. I've gotten a lot of comments from parents and administrators, and other teachers just very impressed with how the kids have worked together." -- JSS Mentor

Outcomes Evaluation

The evaluation of JSS 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 towards research, and their knowledge of and interest in participating in additional AEOP opportunities.[9] STEM competencies, including foundational knowledge, skills, and abilities in STEM, as well as the confidence to apply them appropriately, are necessary for a STEM-literate citizenry. STEM competencies are important not only 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 JSS 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

The vast majority of participants reported at least some gains in their STEM knowledge after participating in the JSS program with large or extreme gains reported by many (see Chart 13). Large or extreme gains were reported, for example, by 47% of students in their knowledge of how scientists and engineers work on real problems, by 53% in their knowledge of research processes, ethics, and rules for conduct in STEM, and by 52% in their in depth knowledge of STEM topics. Mentors were asked a parallel question and reported similar impacts on their students' STEM knowledge (see Appendix C).

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

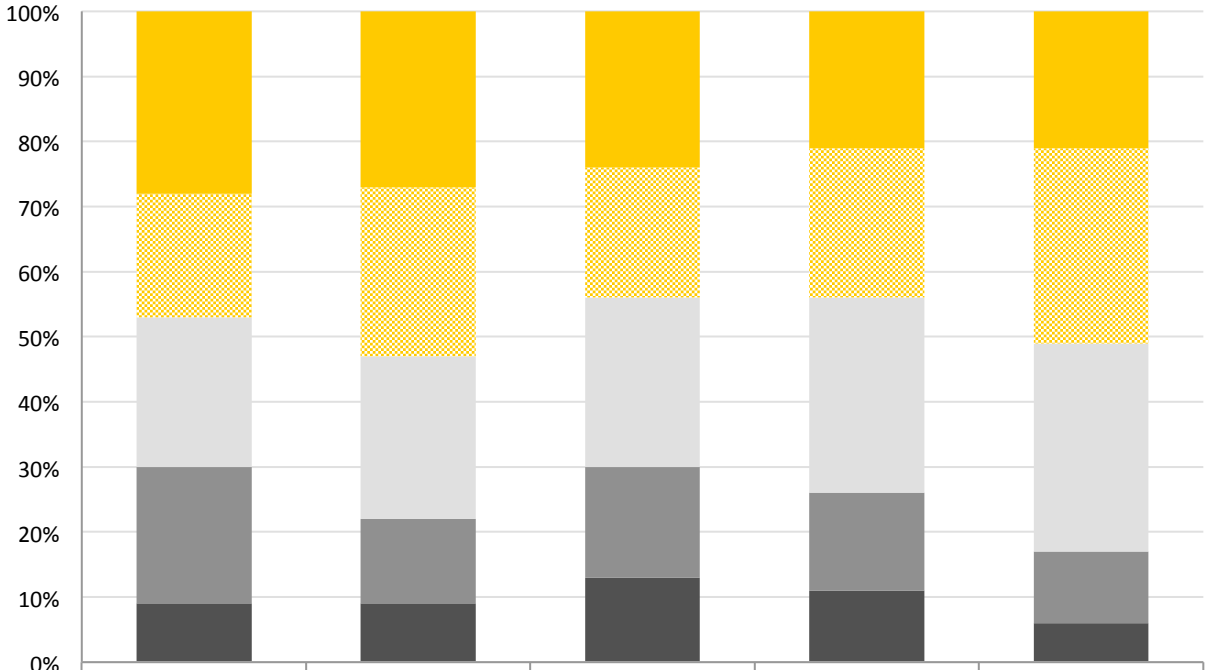
Committee on STEM Education. (2013). Federal Science, Technology, Engineering, and Mathematics (STEM) education 5-year strategic plan: A report from the Committee on STEM Education, National Science and Technology Council. Washington, DC: The White House, Office of Science and Technology Policy.

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

President's Council of Advisors on Science and Technology (P-CAST). (February 2012). Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics. Executive Office of the President.

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

Chart 13: Student Report of Impacts on STEM Knoweldge (n = 89-91)



	Knowledge of how scientists and engineers work on real problems in STEM	Knowledge of research processes, ethics, and rules for conduct in STEM	Knowledge of what everyday research work is like in STEM	Knowledge of research conducted in a STEM topic or field	In depth knowledge of a STEM topic(s)
Extreme gain	28%	27%	24%	21%	21%
Large gain	19%	26%	20%	23%	30%
Some gain	23%	25%	26%	30%	32%
A little gain	21%	13%	17%	15%	11%
No gain	9%	9%	13%	11%	6%

A composite variable[10] was compiled using these items (Chart 13) to test for differential impacts across sub-groups of students in terms of gender and race/ethnicity. No significant differences were found between boys and girls or between races/ethnicities for this variable.

Participants were also asked to rate the impact of JSS on both their STEM competencies, i.e., their abilities to use STEM practices. Table 24 and Table 25 show the percentage of responding students reporting large or extreme gains in their STEM competencies. Table 24 reports data for students who indicated that science was the focus of their JSS experience while Table 25 reports data for students who indicated that engineering or technology was the focus of their experience.

[10] The Cronbach's alpha reliability for these 5 items was 0.937.

For science-focused students, the greatest gains were in making a model of an object showing its parts and how they work (75% of respondents) followed by carrying out procedures for an experiment and recording data accurately (63%). For engineering-focused students, the greatest perceived gains were in students' ability to carry out procedures for an experiment and record data accurately (60%), make a model of an object or system to show its parts and how they work (60%), communicate information about their investigations and explanations in different formats (57%), and apply knowledge, logic, and creativity to propose a testable solution for a problem (52%). Less than a third of responding students reported large gains on their ability to use computer models of an object or system models to investigate cause and effect relationships (26%).

Table 24. Students Reporting Large or Extreme Gains in their Science Competencies (n = 6)

Item	Questionnaire Respondents
Making a model of an object or system showing its parts and how they work	75%
Carrying out procedures for an experiment and recording data accurately	63%
Asking a question that can be answered with one or more scientific experiments	50%
Considering different interpretations of data when deciding how the data answer a question	50%
Supporting an explanation for an observation with data from experiments	50%
Defending an argument that conveys how an explanation best describes an observation	50%
Integrating information from technical or scientific texts and other media to support your explanation of an observation	50%
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	50%
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	38%
Using computer models of objects or systems to test cause and effect relationships	38%
Organizing data in charts or graphs to find patterns and relationships	38%

Table 24. Students Reporting Large or Extreme Gains in their Engineering Competencies (n = 65-68)	
Item	**Questionnaire Respondents**
Carrying out procedures for an experiment and recording data accurately	60%
Making a model of an object or system to show its parts and how they work	60%
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	57%
Using knowledge and creativity to propose a testable solution for a problem	52%
Defining a problem that can be solved by developing a new or improved object, process, or system	46%
Defending an argument that conveys how a solution best meets design criteria	43%
Supporting a solution for a problem with data from experiments	37%
Considering different interpretations of the data when deciding if a solution works as intended	37%
Organizing data in charts or graphs to find patterns and relationships	35%
Integrating information from technical or scientific texts and other media to support your solution to a problem	33%
Using computer models of an object or system to investigate cause and effect	26%

Composite scores were calculated for both sets of items related to student-reported gains in either science[11] or engineering[12] competencies to examine whether the JSS program had differential impacts on sub-groups of students related to gender or race/ethnicity. No significant differences were found for any of the groups (i.e. gender, ethnicity).

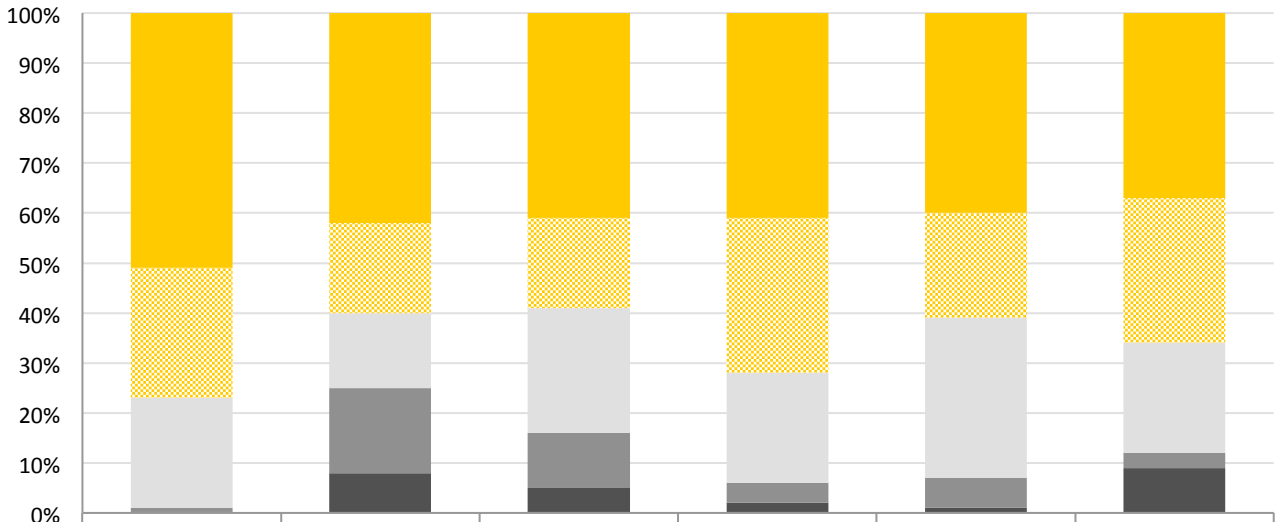
Students were asked to rate the impact of JSS on their 21st Century Skills, defined as skills such as communication and collaboration that are necessary across a wide variety of fields (see Chart 14). A large majority of students reported large or extreme gains in nearly all 21st Century Skills. For instance, 77% of students reported large or extreme impacts in making changes when thing do not go as planned, 72% in including others' perspectives when making decisions, and 66% in communicating effectively with others. Mentor reports of student gains in these areas are similar to those of the students.

[11] The Cronbach's alpha reliability for these 11 items was 0.945.

[12] The Cronbach's alpha reliability for these 11 items was 0.937.

The items from Chart 14 were combined into a composite variable[13] to test for differential impacts across sub-groups of students in gender and race/ethnicity. No statistically significant differences were found or any of the groups (i.e. gender, ethnicity).

Chart 14: Student Report of Impacts on 21st Century Skills (n = 84-88)



	Making changes when things do not go as planned	Viewing failure as an opportunity to learn	Working well with students from all backgrounds	Including others' perspectives when making decisions	Sticking with a task until it is finished	Communicating effectively with others
Extreme gain	51%	42%	41%	41%	40%	37%
Large gain	26%	18%	18%	31%	21%	29%
Some gain	22%	15%	25%	22%	32%	22%
A little gain	1%	17%	11%	4%	6%	3%
No gain	0%	8%	5%	2%	1%	9%

STEM Identity and Confidence

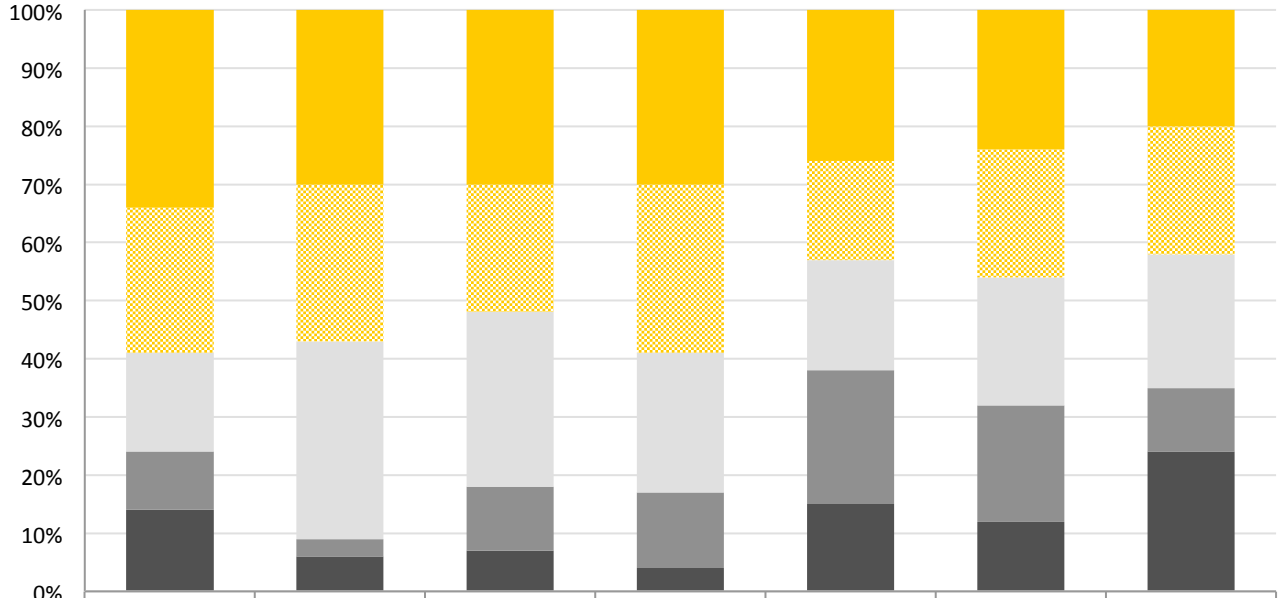
In order to increase the likelihood that students will pursue STEM further in their education and/or careers, they must see themselves as capable of succeeding in STEM.[14] The student questionnaire therefore included a series of items intended to measure the impact of JSS on students' STEM identity. Chart 15 illustrates these data, which suggest that JSS positively impacted students' STEM identities. For example, 59% of responding students reported large or extreme gains in their interest in a new STEM topic, 57% in their ability to think creatively about a STEM project or activity, and 59% in feeling prepared for more challenging STEM activities. Interestingly, nearly a quarter of students (24%) reported no gain

[13] The Cronbach's alpha reliability for these 6 items was 0.878.

[14] 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.

in connecting a STEM field or topic to their personal values. Students reported similar gains regardless of gender or race/ethnicity.

Chart 15: Student Report of Impacts on STEM Identity (n = 85-87)



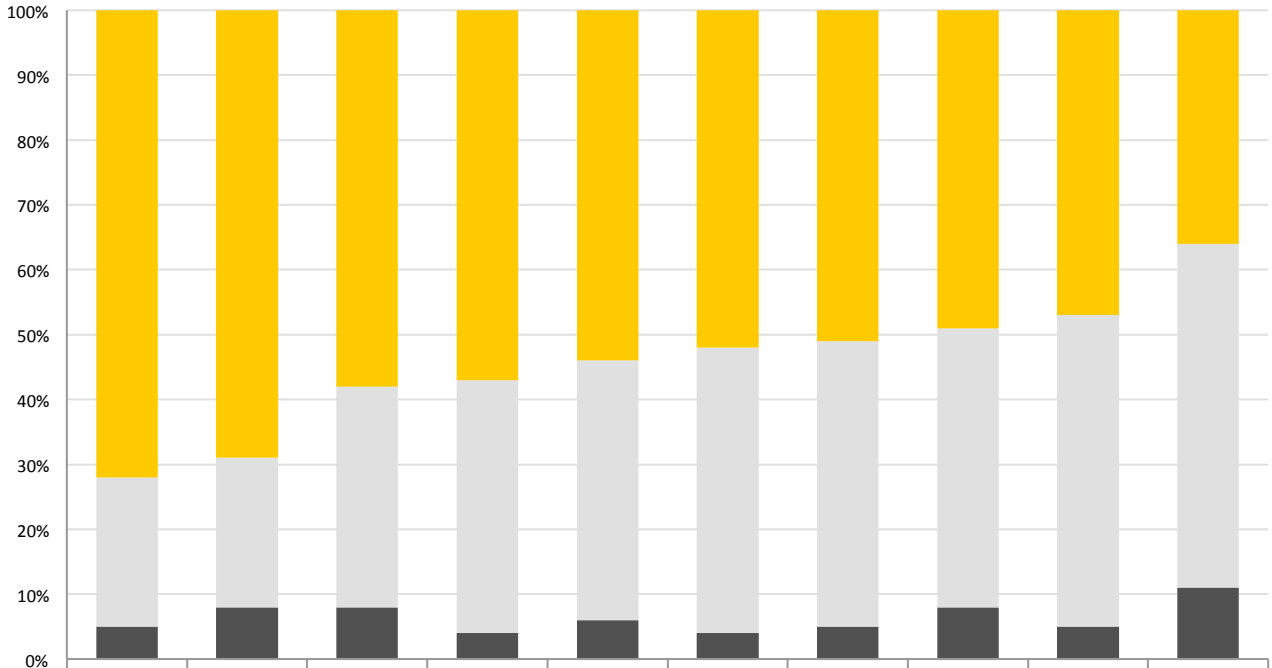
	Interest in a new STEM topic	Thinking creatively about a STEM project or activity	Sense of accomplishing something in STEM	Feeling prepared for more challenging STEM activities	Deciding on a path to pursue a STEM career	Desire to build relationships with mentors who work in STEM	Connecting a STEM topic or field to my personal values
Extreme gain	34%	30%	30%	30%	26%	24%	20%
Large gain	25%	27%	22%	29%	17%	22%	22%
Some gain	17%	34%	30%	24%	19%	22%	23%
A little gain	10%	3%	11%	13%	23%	20%	11%
No gain	14%	6%	7%	4%	15%	12%	24%

Interest and Future Engagement in STEM

Since a key goal of the AEOP is to develop a STEM-literate citizenry, it is important that students be engaged in and out of school with high-quality STEM activities. To examine the impact of JSS on students' interest in future engagement in STEM, the questionnaire asked them to reflect on whether the likelihood of their engaging in STEM activities outside of school changed as a result of their experience (Chart 16), as well as their interest level in participating in future AEOP programs (Chart 17). As can be seen in Chart 16, participants indicated they were more likely to engage in a number of STEM activities as a result of JSS. For example, 72% reported being more likely to tinker with a mechanical or electrical device; 59% to participate in a STEM club, student association, or professional organization; 69% to take an elective

STEM class; and 58% to participate in a STEM camp, fair, or competition. A composite score was created from the items in Chart 16,[15] and scores were compared across sub-groups of students. There were no statistically significant differences by gender or race/ethnicity.

Chart 16: Change in Likelihood Students Will Engage in STEM Activities Outside of School (n = 86-87)

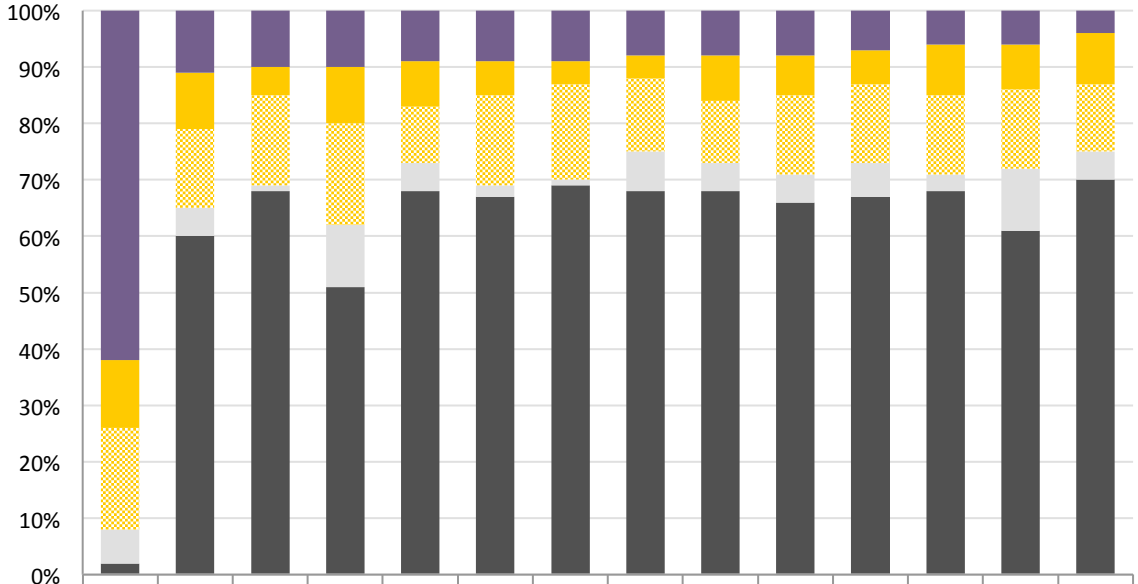


	Tinker (play) with a mechanical or electrical device	Take an elective (not required) STEM class	Participate in a STEM camp, club, or competition	Mentor or teach other students about STEM	Talk with friends or family about STEM	Work on solving mathematical or scientific puzzles	Work on a STEM project or experiment in a university or professional setting	Use a computer to design or program something	Help with a community service project related to STEM	Watch or read non-fiction STEM
More likely	72%	69%	58%	57%	54%	52%	51%	49%	47%	36%
About the same	23%	23%	34%	39%	40%	44%	44%	43%	48%	53%
Less likely	5%	8%	8%	4%	6%	4%	5%	8%	5%	11%

[15] The behavioral STEM intentions composite with 10 items has a Cronbach's alpha reliability of 0.926.

Students were also asked how interested they are in participating in future AEOP programs. While a majority (74%) indicated being somewhat or very much interested in participating in JSS again (see Chart 17), there was generally less interest in participating in other AEOP programs. For example, 20% of students indicated that they were at least somewhat interested in participating in GEMS, 13% in SEAP, and 16% in JSHS. Given the goal of having students move through a continuum of AEOP programs, this is an area with potential for growth.

Chart 17: Student Interest in Future AEOP Programs (n = 84-88)

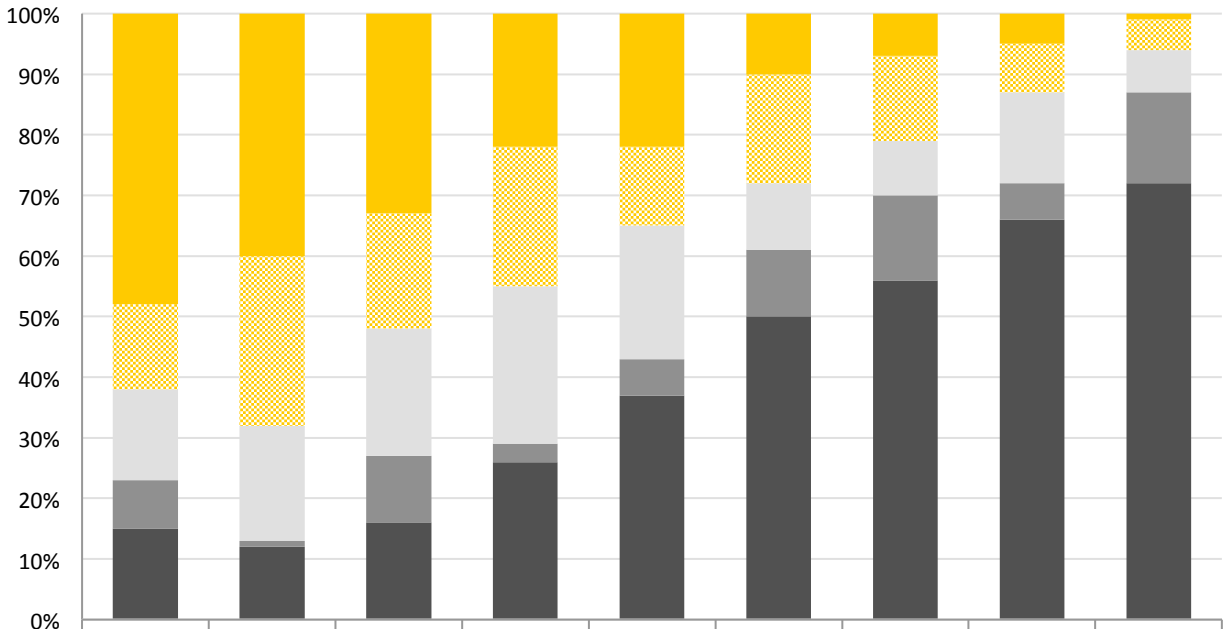


	JSS	Camp Invention	REAP	GEMS	NDSEG	SMART	SEAP	UNITE	JSHS	GEMS Near Peer Mentor	HSAP	CQL	eCYBERMISSION	URAP
Very Much	62%	11%	10%	10%	9%	9%	9%	8%	8%	8%	7%	6%	6%	4%
Somewhat	12%	10%	5%	10%	8%	6%	4%	4%	8%	7%	6%	9%	8%	9%
A little	18%	14%	16%	18%	10%	16%	17%	13%	11%	14%	14%	14%	14%	12%
Not at all	6%	5%	1%	11%	5%	2%	1%	7%	5%	5%	6%	3%	11%	5%
I've Never Heard of This Program	2%	60%	68%	51%	68%	67%	69%	68%	68%	66%	67%	68%	61%	70%

In order to understand the effectiveness of various resources on student awareness of AEOPs, students were asked to identify which resources impacted their awareness of the various AEOPs. Chart 18 illustrates that the TSA website was most likely to be rated as impacting students' awareness somewhat or very much (68% of respondents), followed by participation in JSS (62% of respondents). Other resources that substantial numbers of students reported as impacting their awareness at least somewhat included their mentors (52%), the JSS website (55%), and, to a lesser extent, the

AEOP website (35%). The It Starts Here! Magazine and AEOP on social media were rated as having the least impact on student awareness of AEOPs. It is noteworthy that in the 2014 evaluation, 73% of reporting students indicated never having heard of the AEOP website, while in 2015 that percentage dropped to 37%. Likewise, in 2014, 71% of students reported never having heard of the AEOP brochure, while in 2015 only 56% indicated that they were not familiar with this resource. The AEOP website, instructional supplies, brochure, and social media were rated as having the least impact on student awareness, with about three-fourths of students indicating not experiencing them at all.

Chart 18: Impact of Resources on Student Awareness of AEOPs (n = 89-92)

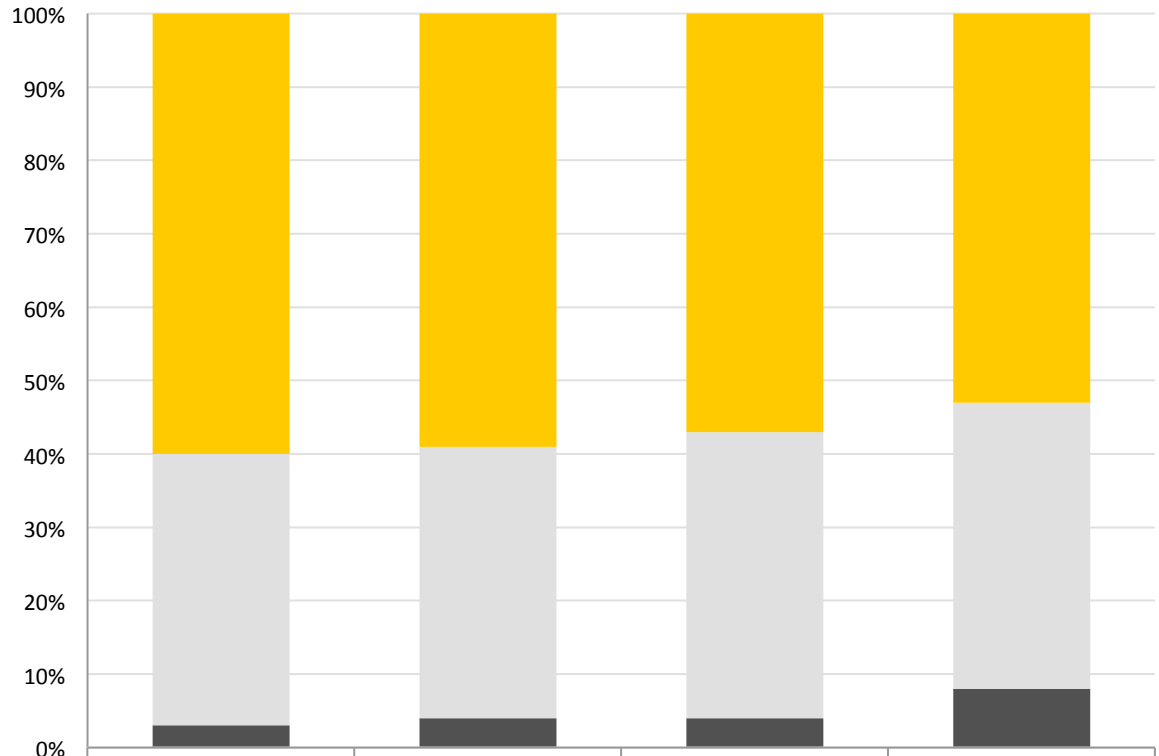


	Participation in JSS	TSA website	My JSS mentor(s)	The Junior Solar Sprint website	AEOP website	Invited speakers or "career" events during JSS	AEOP brochure	AEOP on Facebook, Twitter, Pinterest or other social media	It Starts Here! Magazine
Very Much	48%	40%	33%	22%	22%	10%	7%	5%	1%
Somewhat	14%	28%	19%	23%	13%	18%	14%	8%	5%
A little	15%	19%	21%	26%	22%	11%	9%	15%	7%
Not at all	8%	1%	11%	3%	6%	11%	14%	6%	15%
Did not experience	15%	12%	16%	26%	37%	50%	56%	66%	72%

Attitudes toward Research

An indicator of students' potential future involvement in DoD STEM careers and research is students' attitudes about the importance of DoD research. Therefore, students were asked their opinions of what DoD researchers do and the value of DoD research more broadly (see Chart 19). The data indicate that majority of students have favorable opinions about DoD research and researchers. Over half of students strongly agreed or agreed that that DoD researchers develop cutting-edge technologies (62%), that DoD researchers solve real-world problems (56%), that DoD researchers advance science and engineering fields (54%), and that DoD research is valuable to society (52%).

Chart 19: Student Opinions about DoD Researchers and Research (n = 87-88)



	DoD researchers advance science and engineering fields	DoD researchers solve real-world problems	DoD research is valuable to society	DoD researchers develop new, cutting edge technologies
Strongly agree or agree	60%	59%	57%	53%
Neither agree nor disagree	37%	37%	39%	39%
Strong disagree or disagree	3%	4%	4%	8%

Education and Career Aspirations

The evaluation also examined the program's impact on students' education and career aspirations. In terms of education, the questionnaire asked students how far they wanted to go in school before and after participating in JSS (see Table 25). When students were asked to think back on how far they wanted to go in school before they participated in JSS, 51% indicated wanting to complete a Bachelor's degree and 45% indicated wanting to get more education after college. In contrast, after JSS 39% wanted to finish college while 57% wanted to get more education after college. The small percentage of positive responses to this series of questioning indicates that the questions may need revision to be more appropriate and clear for participants in the JSS grade levels.

Table 25. Student Education Aspirations (n = 88)

	Before JSS	After JSS
Graduate from high school	2%	1%
Go to a trade or vocational school	1%	2%
Go to college for a little while	1%	1%
Finish college (get a Bachelor's degree)	51%	39%
Get more education after college	45%	57%

To gauge shifts in their career aspirations, students were asked what kind of work they expect to be doing at age 30, both reflecting on what their aspirations were before participating in JSS and after JSS. Substantial portions of responding students expressed interest in STEM-related careers both before and after participating in JSS (see Table 26). For example, 31% indicated aspiring to a career as an engineer or architect before JSS, and 40% expressed interest this career path after participating in JSS. Although some students switched their aspirations from a non-STEM field to a STEM field, a similar proportion switched from STEM to non-STEM. Thus, there was not a statistically significant change in the proportion of students aspiring to a STEM-related career.

Table 26. Student Career Aspirations (n = 77)		
	Before JSS	After JSS
Engineer or architect	31%	40%
Undecided	15%	15%
Work in the medical field (doctor, nurse, lab technician)	12%	11%
Work in computers or technology	11%	10%
Other, (specify):	11%	10%
Scientist or researcher	3%	5%
Military, police, or security	4%	2%
Skilled craftsperson (carpenter, electrician, machinist)	2%	2%
Teacher	2%	2%
Business person or manager	2%	1%
Lawyer	3%	1%
Artist (writer, dancer, painter)	2%	1%
Athlete or other work in sports	2%	0%
Work in the medical field (doctor, nurse, lab technician)	12%	11%
Work in computers or technology	11%	10%
Other, (specify):	11%	10%

† Before, other includes: "Firefighter," "media ministry," "rodeo," "designer," "environmental engineer."
† After, other includes: "Firefighter," "media ministry," "rodeo," "environmental engineer."

Another questionnaire item asked students about the extent to which they expect to use their STEM knowledge, skills, and/or abilities in their work when they are age 30. As can be seen in Table 27, 95% students expect to use STEM somewhat in their career. Nearly half expect to use STEM 76-100% of the time in their work, 313% expect to use STEM 51-75% of the time, and 13% expect to use STEM 26-50% of the time.

Table 27. Students Expecting to use STEM in Their Work at Age 30 (n = 87)	
	Questionnaire Respondents
Not at all	5%
Less than 25% of the time	6%
26% to 50% of the time	13%
51% to 75% of the time	31%
76% to 100% of the time	47%

Overall Impact

Finally, students were asked about impacts of participating in JSS more broadly. These data illustrate that students thought the program had a substantial impact on them (see Chart 20). For instance, 79% of students reported that JSS contributed to their increased confidence in their STEM knowledge, skills, and abilities and 71% in their being more interested in taking STEM classes in schools as a result of their JSS participation. This effect extended to out-of-school activities as evidenced by the majority of students who indicated that JSS contributed to them being more interested in

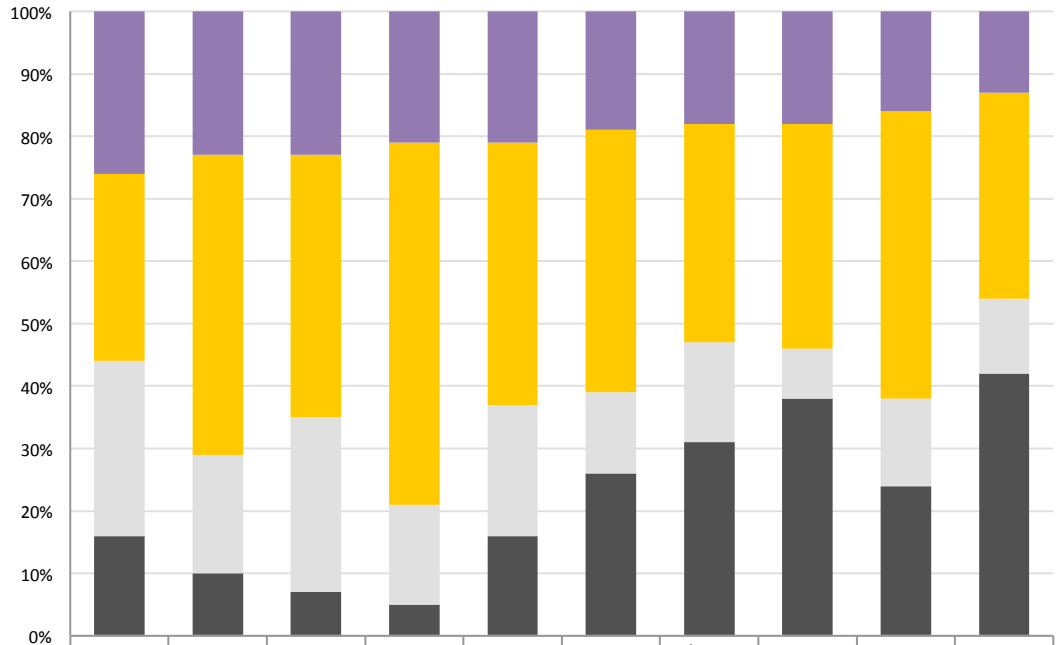
participating in other AEOPs (62%) and being more interested in participating in STEM activities outside of school (65%). Similarly, students reported greater appreciation of DoD STEM research and careers (36% reporting that JSS contributed, 18% reporting that JSS was primary reason) and having more interest in earning a STEM degree (42% and 21%). A composite was created from the items in Chart 20,[16] and scores were compared across sub-groups of students. There were no statistically significant differences by gender or race/ethnicity. Mentors were also asked about impacts on students in these areas; in general, their reports of impacts were substantially higher than those of the students.

Mentors were also asked about impacts on students in these areas; their reports of impacts were substantially higher than those of the students in some areas, including confidence in STEM knowledge, skills, and abilities and interest in pursuing a career in STEM, and substantially lower than those of students in interest in participating in other AEOPs.

"When things went wrong I learned to find other ways of doing something. I learned to work with others better." -- JSS Student

[16] The Cronbach's alpha reliability for these 11 items was 0.938.

Chart 20: Student Opinions of JSS Impacts (n = 85-87)



	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 STEM activities outside of school	I am more confident in my STEM knowledge skills, and abilities	I am more interested in earning a STEM degree	I am more aware of other AEOPs	I have a greater appreciation of Army or DoD STEM research	I am more aware of Army or DoD STEM research and careers	I am more interested in other AEOPs	I am more interested in pursuing a STEM career with the Army or DoD
Agree - JSS was primary reason	26%	23%	23%	21%	21%	19%	18%	18%	16%	13%
Agree - JSS contributed	30%	48%	42%	58%	42%	42%	35%	36%	46%	33%
Disagree - happened, but not because of JSS	28%	19%	28%	16%	21%	13%	16%	8%	14%	12%
Disagree - did not happen	16%	10%	7%	5%	16%	26%	31%	38%	24%	42%

An open-ended item on the questionnaire asked participants to list the three most important ways they benefited from the program; 65 students provided at least one answer to this question. Many students reported that learning specific skills or about STEM in general was a benefit to them (32%). Likewise, nearly a third (32%) of students noted that the opportunity for teamwork was a benefit to participating in JSS. Another 31% wrote about learning about engineering and design practices and engineering as a profession while another 6% of respondents indicated that they benefited from career information more generally. Learning about problem solving and/or learning from failure during their JSS experiences was mentioned as a benefit by 23% of students. Six students (9%) reported benefiting specifically from the opportunity to make new friends. Other benefits, each described by only a small number of students, included getting a chance to build something, having fun, competing, and learning about AEOP.

Student comments from the rapid assessments expanded on some of these impacts. As three students said:

This is really fun, I mean it teaches you about engineering…how a car works and how it goes. And that's something I think everyone should know. (JSS Student)

It's a great way to learn how to…have ideas; to create something. (JSS Student)

At school I enjoyed building the car. [We had] a little complication but that's what made the whole building it a lot more fun…I wanted to fix it and to make it better. (JSS Student)

Summary of Findings

The FY15 evaluation of JSS 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 28.

2015 JSS Evaluation Findings	
Participant Profiles	
JSS experienced a decline in applications and youth/adult participants in FY15. JSS served relatively small percentages of students from historically underrepresented and underserved populations; there is room for growth in this area as well as a need for consistent collection of enrollment demographic data.	The overall number of applications for and participants in JSS for FY15 decreased 29% from FY14. The number of adults who supported the JSS program declined 51% from FY14. Interestingly, the number of participating K12 schools grew 74% (266) in FY15 compared to FY14. Additionally, 68% of participating schools were Title I.
	Only 27% of JSS student participants in FY 15 were female —a population that is historically underrepresented and underserved in STEM fields, which is particularly so in the physical sciences. JSS had limited success in engaging students from historically underrepresented and underserved races/ethnicities. Enrollment data indicate that in FY15 only 7% of participants identified themselves as Black or African American and 9% as Hispanic or Latino. This may be due to the fact that only TSA chapter members and their students are permitted to participate in JSS and the overall TSA population may be limited in diversity.
	There is evidence that JSS's success in reaching low-income students was limited. Only 20% of enrolled participants identified themselves as qualifying for free or reduced-price lunch (FRL), a commonly used indicator of family income. It is noteworthy, however, that 16% of participants chose not to report their FRL status.

	No enrollment demographic data is available for FY14, therefore it is not possible to compare FY15 student demographic data with the prior year's data to track emerging trends in enrollment (data is available for FY14 questionnaire respondents, however since only 9% of students and 5% of mentors responded it cannot be assumed that these respondents are representative of participant demographics for the year). There is a need for consistent tracking of JSS participant demographics.
JSS participants have little experience with other AEOPs and only limited interest in participating in other AEOPs in the future.	Only a very small number of students reported having participated in other AEOPs in the past. In addition, the majority of students have not heard of AEOPs that they currently qualify for or that they may qualify for in high school. This is an area for potential growth for JSS. It is unclear how much TSA promotes non-TSA events/competitions to their membership.
Actionable Program Evaluation	
There is evidence that the national infrastructure for JSS benefits participants and enhances marketing efforts.	Nearly half (49%) of students questionnaire respondents reported learning about JSS from the TSA while over half (64%) of mentors reported learning about JSS from the TSA; this was by far the most common method of learning about JSS for both groups and indicates that TSA's infrastructure and outreach efforts are key to the continued success of JSS.
	Students and mentors reported high levels of satisfaction with TSA online resources, and the TSA website was cited by students as a major source of information about other AEOPs.
JSS students reported a variety of motivators for participating in the program.	Students were most frequently motivated to participate in JSS by an interest in STEM (19%), a desire to learn something new or interesting (16%), to have fun (16%), and because of teacher encouragement (14%).
JSS students reported engaging in meaningful STEM learning through team-based and hands-on activities.	Most students (53-64%) report communicating with other students about STEM and learning about new STEM topics on most days or every day of their JSS experience.
	Teamwork, participating in hands-on STEM activities, and coming up with creative explanations/solutions were key to students' work in JSS. Student respondents reported engaging in these practices most days or every day (74%, 72% and 59% respectively). Students engaged in a variety of other STEM practices on a frequent basis, including analyzing data or information (59%) and drawing conclusions from an investigation (55%).
	Mentors reported using a variety of strategies to help make learning activities to students relevant, support the needs of diverse learners, develop students' collaboration and interpersonal skills, and engage students in authentic STEM activities.

JSS involved more Army/DoD S&E's in the program in FY15. However, JSS has an opportunity to improve student and mentor awareness of other AEOPs and DoD STEM careers.	The number of Army/DoD S&E's grew to 26 in FY15 for JSS. Although 62% of students reported that participating in JSS impacted their awareness of other AEOPs, most students reported never hearing about any of the other AEOP initiatives. Only small proportions of mentors (10% or less) reported discussing specific programs with students although over half of mentors (52%) indicated that they discussed AEOP in general with their students.
	The majority of mentors (68%) found the TSA website to be a useful resource to expose students to DoD STEM careers. Student attitudes toward DoD researchers and research were positive, although 58% of students indicated learning about no DoD STEM careers during JSS. In comparison, 66% of students reported learning about at least one career in STEM more generally.
Students and mentors value the JSS experience.	Most students indicated being satisfied with their JSS experience. Learning about various topics, learning about STEM in general, and opportunities for teamwork were particular areas of satisfaction noted by students.
	Like students, nearly all responding mentors reported having a positive experience with JSS. Teamwork and the opportunity for hands-on learning were two of the most commonly mentioned benefits for students named by mentors.
Outcomes Evaluation	
JSS students reported gains in STEM knowledge and competencies.	Most students reported at least some gains in their STEM knowledge, including knowledge of how scientists and engineers work on real problems in STEM, an in-depth knowledge of a STEM topic, and knowledge of the research processes, ethics, and rules for conduct in STEM.
	Students also reported gains in their STEM competencies, including making a model of an object or system showing its parts and how they work, carrying out procedures for an experiment and recording data accurately, and communicating information about their design experiments and solutions in different ways.
JSS participants reported gains in 21st Century Skills.	Nearly all students reported gains in their 21st century skill. For instance, all students reported gains in making changes when things do not go as planned. A majority of students reported large or extreme gains in all categories of 21st Century Skills, including working well with students from all backgrounds, including others' perspectives when making decisions, and communicating effectively with others.
JSS participants reported gains in their identity in STEM and in their interest in engaging in STEM in the future.	The majority of students reported gains in areas related to their STEM identity, defined as confidence in one's ability to succeed in STEM. Over half reported large or extreme gains in areas such as interest in a new STEM topic (59%), feeling prepared for more challenging STEM activities (59%), and thinking creatively about a STEM project or activity (57%).
	Students also reported gains in the likelihood that they would engage in STEM activities outside of school. For instance, 72% indicated that as a result of JSS they were more likely to tinker with a mechanical or electrical device, 69% that they were more likely to take an elective STEM class, and 58% that they were more likely to participate in a STEM camp, club, or competitions.

Students had higher education aspirations after participating in JSS, although their career aspirations showed little change.	After participating in JSS, there was an increase in the number of students aspiring to continuing their education after college (57% as compared with 45% reporting this as their aspiration before JSS participation).
	Students reported similar career aspirations before and after participating in JSS, although more students aspired to a career as an engineer or architect after participation in JSS (31% before versus 40% after). Overall, there was not a statistically significant difference in career aspirations from before JSS to after.
Although JSS students are largely unaware of AEOP initiatives, students showed some interest in future AEOP opportunities.	In spite of results that showed a majority of students were unaware of most other AEOP initiatives, 62% of students indicated that JSS impacted their awareness of other AEOPs. Students had at least a little interest in participating in all other AEOPs for which they are currently eligible or will be eligible in high school, including GEMS (49%), eCYBERMISSION (39%), and SEAP (31%).

Recommendations

Evaluation findings indicate that FY15 some success overall for the JSS program. Notable successes for the year include high levels of mentor and student satisfaction with the program, evidence of an expanding national infrastructure to support JSS activities, and satisfaction with TSA resources. Both students and mentors reported gains in students' STEM knowledge and competencies and gains in students' 21st Century Skills as a result of the JSS experience.

While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. Specifically, the JSS program experienced significant decline in number of participants and overall lack of diversity in participant demographics. The membership model associated with TSA chapters being the sole source of recruitment may be limiting the ability of JSS to grow and reach the desired target populations. 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. The AEOP goal of broadening the talent pool in STEM fields continues to be a challenge for JSS. The recommendations made in the 2013 and 2014 JSS evaluation reports for the program to consider doing more to engage and interest students from schools serving historically underrepresented and underserved groups is therefore repeated. However, it is unclear if TSA has the capacity to do this within their current chapter membership. Additionally, the program may wish to consider ways to revise its outreach and marketing strategies to reach and appeal to female students and other groups underrepresented in STEM careers. It is recommended that TSA coordinate regional promotional activities associated with Army JSS Host Sites with POCs at Army research centers and labs. It should be noted that the lack of demographic data for 2014 JSS enrollment prevented identifying any growth that occurred in this area over the past year. The universal use of

CVENT for participant enrollment going forward should permit for enhanced data collection and the ability to more effectively track enrollment trends. The evaluation team would also like for TSA to provide overall demographics for their TSA chapter membership nationally to have a better understanding of how reflective the JSS participation is of the overall potential recruitment base within the TSA chapters.

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

1. Responding mentors reported an overall high level of satisfaction with resources, including TSA website resources, TSA instructional materials, and materials. Although the program met and exceeded its goal of distributing 240 car kits (a total of 300 PITSCO car kits were distributed in FY15), there was no funding for JSS-in-a-box kits or for instructional videos and webinars. It is noteworthy that over 50% of students reported dissatisfaction with (10%) or lack of experience with (44%) JSS video tutorials. When asked about resource improvements, 18% of students specifically suggested providing videos or examples, indicating that these resources would be welcome instructional supports. In light of this, the program should continue to pursue opportunities to create video content to support teachers and students.

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

1. The JSS program objective of creating a national infrastructure to support local, regional, and national events and increase participation in JSS was supported by a number of program activities. Student comments about frustration with the event registration process (in particular the requirement to register in two separate places for events) should be taken into consideration as the program continues to build this infrastructure. The evaluation team would like to explore the ability of AEOP to import the current JSS registrations from the TSA system into CVENT. JSS should follow up with the AEOP CAM office to explore this as soon as possible.

2. In order to create a robust pipeline of AEOP programs in which students' progress from other AEOPs into JSS and beyond, the program may want to consider innovative ways to work with other AEOPs to create a more seamless continuum of programs. 2015 saw a slight increase in the number of mentors who recommended AEOPs to students that align with students' educational goals (43% versus 33% in 2014), however few mentors discussed specific AEOPs with students. The recommendation made in 2013 and 2014 to devise strategies to increase students' exposure to other AEOP opportunities will therefore be repeated. In particular, the program may want to work with each site to ensure that all students have access to structured opportunities that both describe the other AEOPs and provide information to students on how they can apply to them. Since teachers provide much of the program information students receive during JSS, efforts should be made to ensure that teachers are informed about the range of AEOPs. Other means of educating students about AEOPs should be combined with teacher information, especially given the very real consideration of teacher time constraints in

working with students. Given the limited use of the AEOP website, print materials, and social media, the program should consider how these materials could be more effectively utilized to provide students with information and facilitate their enrollment in other AEOPs.

3. The JSS program's participation in evaluation activities continues to be a source of concern. Although the response rates were slightly higher for FY15 than for FY14 (14% versus 9% for students and 8% versus 5% for mentors), the low response rates for both the student and mentor questionnaires raise questions about the representativeness of the results. The program may want to consider emphasizing the importance of these evaluations with individual program sites and communicating expectations for evaluation activities to be conducted on-site directly following the actual race. In addition, the evaluation instruments may need to be streamlined and revised with age-appropriate language to reduce the time commitment of respondents.

Appendices

Appendix A

FY15 JSS Evaluation Plan

Purpose:

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

1. AEOP Youth Questionnaire to be completed by student participants of the National TSA Conference JSS event and the three local Army-sponsored JSS events; and
2. AEOP Mentor Questionnaire to be completed by competition advisors, chaperones, or event organizers who supported students as they prepared for or participated in National TSA Conference JSS event and the three local Army-sponsored JSS events.

Questionnaires were the primary method of data collection for AEOP evaluation and collected 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 revised in FY14 to align 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 Youth and Mentor questionnaires provided for their program. Both the Youth 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 are 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 JSS (data collected by VT and analyzed by Purdue University) includes site visits/onsite focus groups at the National TSA Conference JSS event.

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, the evaluation 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 JSS 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 your 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 random sampling of participants.

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 JSS program. 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 JSS Participant Data Summaries

JSS Participant Data Summary

At which of the following regional JSS sites did you participate? (Select ONE)

	%	Freq.
Alabama - Tuscaloosa	1.9%	2
ARMY: AMRDEC - Huntsville, AL	1.9%	2
ARMY: APG - Aberdeen, MD	2.9%	3
ARMY: ARDEC - Picatinny, NJ	13.3%	4
Colorado - Denver	1.9%	2
Delaware - Harrington	6.2%	4
Florida - Orlando	6.2%	4
Georgia - Athens	9.6%	5
Iowa - Altoona	0.0%	0
Kentucky - Louisville	0.0%	0
Mississippi	7.7%	8
Missouri - Rolla	5.3%	3
New Hampshire - Lincoln	0.0%	0
New Jersey - Ewing	1.9%	2
New York - Oswego	2.9%	3
North Carolina - Greensboro	2.9%	3
Oklahoma - Midwest City	6.7%	7
Pennsylvania - Champion	8.6%	4
South Carolina - Columbia	0.0%	0
Tennessee - Murfeesboro	1.0%	1
Texas - Wayco	4.3%	2
Utah - Kaysville	0.0%	0
Virginia - Hampton	12.9%	6
Washington - Bellevue	1.0%	1
West Virginia - Ripley	1.0%	1
Total	**100%**	**67**

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

	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	5.3%	5.3%	21.9%	45.1%	22.5%	91	**3.88**	1.02
	4	4	17	40	26			
Apply STEM learning to real-life situations	6.7%	14.0%	30.0%	29.4%	20.0%	90	**3.48**	1.12
	6	9	29	28	18			
Learn about new discoveries in STEM	7.3%	11.3%	40.5%	29.8%	11.3%	91	**3.35**	1.09
	7	9	33	29	13			
Learn about different careers that use STEM	8.0%	12.0%	43.3%	22.0%	14.7%	90	**3.34**	1.06
	4	14	33	25	14			
Interact with scientists or engineers	30.6%	27.2%	29.8%	8.6%	4.0%	91	**2.52**	1.20
	22	25	25	13	6			
Communicate with other students about STEM	16.6%	5.3%	30.6%	25.2%	22.5%	91	**3.40**	1.33
	13	8	22	26	22			

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

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

	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	7.3%	4.6%	23.8%	45.8%	18.6%	91	**3.53**	1.11
	7	7	24	37	16			
Apply STEM learning to real-life situations	10.7%	10.7%	24.7%	32.0%	22.0%	90	**3.38**	1.20
	8	12	25	28	17			
Learn about new discoveries in STEM	18.6%	11.9%	26.5%	21.8%	21.3%	91	**3.21**	1.28
	12	14	24	25	16			
Learn about different careers that use STEM	22.7%	16.0%	22.0%	22.7%	16.7%	90	**2.96**	1.35
	18	16	21	22	13			
Interact with scientists or engineers	25.8%	16.2%	37.1%	12.3%	8.9%	88	**2.64**	1.33
	26	12	27	14	9			
Communicate with other students about STEM	10.0%	8.0%	18.0%	36.0%	28.0%	90	**3.53**	1.33
	11	8	19	26	26			

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

How often did 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	n	Avg.	SD
Use laboratory procedures and tools	4.6%	5.9%	44.5%	28.5%	16.5%	91	**3.46**	1.18
	7	9	31	23	21			
Participate in hands-on STEM activities	7.3%	13.3%	32.5%	31.1%	15.9%	91	**3.49**	1.16
	7	8	29	27	20			
Work as part of a team	2.7%	9.3%	23.2%	48.4%	16.5%	91	**3.80**	1.06
	4	6	19	37	25			
Identify questions or problems to investigate	6.0%	17.3%	20.5%	34.5%	21.8%	91	**3.64**	1.16
	5	10	23	28	25			
Design an investigation	17.3%	23.9%	31.1%	21.1%	6.6%	91	**3.00**	1.23
	14	16	27	24	10			
Carry out an investigation	13.9%	20.6%	39.8%	18.5%	7.3%	91	**3.05**	1.22
	13	15	28	24	11			
Analyze data or information	2.7%	20.6%	17.9%	37.1%	21.8%	91	**3.69**	1.13
	4	11	19	32	25			
Draw conclusions from an investigation	10.6%	14.0%	27.1%	39.2%	9.2%	91	**3.37**	1.13
	8	9	29	31	14			
Come up with creative explanations or solutions	6.7%	12.0%	20.0%	44.0%	17.4%	90	**3.62**	1.17
	6	10	18	34	22			
Build or make a computer model	44.5%	17.9%	23.8%	8.6%	5.3%	91	**2.47**	1.33
	31	15	24	13	8			

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

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

	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Use laboratory procedures and tools	8.0%	2.0%	28.7%	44.0%	17.3%	90	**3.57**	1.12
	8	3	27	34	18			
Participate in hands-on STEM activities	9.4%	7.4%	11.5%	50.3%	21.5%	89	**3.76**	1.14
	6	7	13	39	24			
Work as part of a team	6.8%	2.8%	16.2%	23.0%	51.3%	88	**4.07**	1.20
	6	4	12	22	44			
Identify questions or problems to investigate	10.0%	6.7%	28.0%	26.0%	29.3%	90	**3.61**	1.18
	7	6	26	27	24			
Design an investigation	17.4%	4.0%	31.4%	27.4%	20.0%	90	**3.34**	1.31
	14	6	23	29	18			
Carry out an investigation	16.7%	4.0%	33.4%	29.4%	16.7%	90	**3.38**	1.28
	13	6	22	32	17			
Analyze data or information	6.7%	11.3%	22.7%	28.0%	31.3%	90	**3.70**	1.19
	6	9	18	30	27			
Draw conclusions from an investigation	14.0%	2.7%	22.0%	38.7%	22.7%	90	**3.62**	1.20
	9	4	21	34	22			
Come up with creative explanations or solutions	6.7%	7.4%	16.7%	38.0%	31.4%	90	**3.80**	1.19
	6	7	17	29	31			
Build or make a computer model	32.9%	24.1%	24.9%	13.5%	4.8%	89	**2.60**	1.29
	25	16	25	16	7			

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

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

	Yes - my mentor used this strategy with me	No - my mentor did not use this strategy with me	n
Helped me become aware of STEM in my everyday life	81.7%	18.4%	92
	72	20	
Helped me understand how I can use STEM to improve my community	67.1%	32.9%	92
	62	30	
Used a variety of strategies to help me learn	87.5%	12.5%	92
	81	11	
Gave me extra support when I needed it	88.9%	11.2%	92
	79	13	
Encouraged me to share ideas with others who have different backgrounds or viewpoints than I do	74.8%	25.2%	91
	73	18	
Allowed me to work on a team project or activity	90.8%	9.2%	92
	82	10	
Helped me learn or practice a variety of STEM skills	78.8%	21.3%	91
	75	16	
Gave me feedback to help me improve in STEM	82.2%	17.8%	92
	77	15	
Talked to me about the education I need for a STEM career	63.6%	36.5%	91
	60	31	
Recommended Army Educational Outreach Programs that match my interests	42.5%	57.6%	91
	36	55	
Discussed STEM careers with the DoD or government	28.4%	71.7%	91
	35	56	

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	n	Avg.	SD
The Junior Solar Sprint website (jrsolarsprint.org)	25.7%	2.6%	25.6%	23.1%	23.1%	92	**3.08**	1.45
	23	4	27	19	19			
Technology Student Association (TSA) website	11.9%	1.3%	19.2%	27.8%	39.8%	91	**3.66**	1.38
	14	2	17	26	32			
Army Educational Outreach Program (AEOP) website	37.4%	5.5%	21.6%	12.8%	22.9%	90	**2.63**	1.61
	39	4	15	15	17			
AEOP on Facebook, Twitter, Pinterest or other social media	65.7%	5.6%	15.2%	8.0%	5.6%	89	**1.94**	1.32
	55	4	14	12	4			
AEOP brochure	56.3%	14.0%	9.2%	13.9%	6.7%	91	**2.10**	1.37
	49	9	14	13	6			
It Starts Here! Magazine	72.0%	14.7%	6.7%	5.4%	1.4%	90	**1.69**	1.12
	60	10	10	8	2			
My JSS mentor(s)	16.0%	11.3%	21.4%	19.4%	32.0%	90	**3.36**	1.46
	16	9	20	17	28			
Invited speakers or "career" events during JSS	50.3%	10.7%	10.8%	18.2%	10.1%	89	**2.31**	1.45
	43	8	12	19	7			
Participation in JSS	15.1%	8.0%	15.1%	14.4%	47.5%	92	**3.70**	1.47
	15	4	15	18	40			

Note. Response scale: 0 = "Did not experience," 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)?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
The Junior Solar Sprint website (jrsolarsprint.org)	34.7%	12.0%	17.4%	12.0%	24.0%	90	**2.64**	1.50
	32	10	22	10	16			
Technology Student Association (TSA) website	24.7%	8.7%	18.0%	18.0%	30.7%	90	**3.04**	1.56
	25	9	15	19	22			
Army Educational Outreach Program (AEOP) website	48.7%	14.1%	12.3%	8.2%	16.8%	88	**2.24**	1.45
	44	9	14	12	9			
AEOP on Facebook, Twitter, Pinterest or other social media	67.1%	14.8%	6.8%	6.1%	5.4%	89	**1.82**	1.24
	56	10	10	9	4			
AEOP brochure	60.8%	12.5%	10.9%	5.4%	10.5%	89	**1.97**	1.34
	52	10	12	8	7			
It Starts Here! Magazine	73.8%	12.1%	8.8%	3.4%	2.1%	89	**1.71**	1.12
	58	10	13	5	3			
My JSS mentor(s)	33.3%	11.3%	21.4%	4.7%	29.3%	90	**2.84**	1.61
	30	9	20	7	24			
Invited speakers or "career" events during JSS	60.8%	11.5%	8.9%	10.2%	8.7%	88	**2.00**	1.32
	50	9	13	11	5			
Participation in JSS	27.6%	17.4%	12.8%	12.2%	30.2%	89	**3.04**	1.59
	25	10	15	14	25			

Note. Response scale: 0 = "Did not experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much."

How SATISFIED were you with the following JSS features?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Applying or registering for the program	6.0%	11.4%	19.3%	24.0%	39.4%	90	**3.83**	1.13
	5	5	21	28	31			
Communicating with your JSS host site organizers	11.4%	14.7%	17.3%	31.3%	25.4%	90	**3.39**	1.35
	13	10	18	27	22			
The physical location(s) of JSS's activities	4.7%	1.4%	21.3%	27.4%	45.4%	90	**3.81**	1.18
	7	2	24	25	32			
The variety of STEM topics available to you in JSS	4.7%	7.3%	21.4%	31.3%	35.3%	90	**3.84**	1.19
	7	3	20	27	33			
Teaching or mentoring provided during JSS activities	8.8%	6.1%	17.5%	18.8%	49.0%	89	**3.84**	1.34
	9	5	18	16	41			
Educational materials (e.g., workbooks, online resources, etc.) used during program activities	16.0%	9.3%	24.7%	21.4%	28.7%	90	**3.40**	1.44
	16	6	21	20	27			
Invited speakers or "career" events	53.9%	9.4%	6.9%	20.3%	9.6%	88	**2.55**	1.60
	40	6	10	18	14			
Field trips or laboratory tours	52.6%	13.4%	10.3%	8.9%	15.0%	88	**2.56**	1.60
	38	8	15	9	18			

Note. Response scale: 0 = "Did not experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much."

How USEFUL were the following JSS resources provided at jrsolarsprint.org?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Official Technology Student Association Competition Rules	8.1%	2.1%	8.1%	9.5%	72.4%	89	**4.07**	1.44
	12	3	8	10	56			
Local Competition Rules	22.8%	4.7%	10.8%	12.2%	49.6%	89	**3.66**	1.57
	18	3	12	14	42			
Build A Car resources	23.5%	4.1%	25.5%	12.8%	34.3%	89	**3.37**	1.63
	23	2	18	11	35			
Course Outline	34.2%	6.1%	16.8%	14.2%	28.9%	89	**3.13**	1.64
	27	5	13	17	27			
STEM Standards	27.3%	4.1%	17.7%	21.8%	29.3%	87	**3.28**	1.60
	24	2	14	20	27			
Lesson Plans	36.0%	14.0%	20.0%	12.7%	17.3%	90	**2.80**	1.54
	30	9	18	15	18			
Terminology	38.0%	10.7%	16.7%	18.7%	16.0%	90	**2.89**	1.57
	29	8	17	16	20			
Video Tutorials	44.0%	10.0%	8.0%	18.7%	19.3%	90	**2.81**	1.64
	34	7	12	16	21			
JSS Host Guide	35.3%	16.7%	15.3%	12.7%	20.0%	90	**2.78**	1.63
	33	9	15	11	22			
Calendar of Events	32.7%	10.7%	12.7%	15.3%	28.7%	90	**3.03**	1.67
	29	8	11	15	27			

Note. Response scale: 0 = "Did not experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much."

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
In depth knowledge of a STEM topic(s)	6.0%	11.3%	31.9%	29.8%	21.2%	91	**3.59**	1.11
	5	9	24	33	20			
Knowledge of research conducted in a STEM topic or field	12.0%	14.6%	29.8%	23.1%	20.6%	91	**3.47**	1.14
	6	10	29	27	19			
Knowledge of research processes, ethics, and rules for conduct in STEM	8.6%	12.6%	25.2%	26.5%	27.2%	91	**3.54**	1.14
	5	11	26	28	21			
Knowledge of how scientists and engineers work on real problems in STEM	8.7%	20.8%	22.9%	18.9%	28.8%	89	**3.51**	1.21
	5	15	22	24	23			
Knowledge of what everyday research work is like in STEM	12.7%	17.5%	25.5%	20.2%	24.2%	89	**3.47**	1.26
	7	14	22	22	24			

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

Which category best describes the focus of your JSS experience?

	%	Freq.
Science	6.2%	5
Technology	24.3%	19
Engineering	66.1%	60
Mathematics	3.3%	5
Total	**100%**	**89**

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	0.0%	25.0%	25.0%	25.0%	25.0%	6	**3.83**	1.17
	0	1	1	2	2			
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	0.0%	12.5%	50.0%	25.0%	12.5%	6	**3.50**	1.05
	0	1	2	2	1			
Making a model of an object or system showing its parts and how they work	0.0%	0.0%	25.0%	25.0%	50.0%	6	**4.50**	0.84
	0	0	1	1	4			
Carrying out procedures for an experiment and recording data accurately	0.0%	12.5%	25.0%	50.0%	12.5%	6	**3.67**	1.03
	0	1	1	3	1			
Using computer models of objects or systems to test cause and effect relationships	0.0%	37.5%	25.0%	25.0%	12.5%	6	**3.33**	1.21
	0	2	1	2	1			
Organizing data in charts or graphs to find patterns and relationships	25.0 %	12.5%	25.0%	25.0%	12.5%	6	**3.17**	1.47
	1	1	1	2	1			
Considering different interpretations of data when deciding how the data answer a question	0.0%	25.0%	25.0%	25.0%	25.0%	6	**3.83**	1.17
	0	1	1	2	2			
Supporting an explanation for an observation with data from experiments	0.0%	25.0%	25.0%	25.0%	25.0%	6	**3.83**	1.17
	0	1	1	2	2			
Defending an argument that conveys how an explanation best describes an observation	0.0%	25.0%	25.0%	25.0%	25.0%	6	**3.83**	1.17
	0	1	1	2	2			
Integrating information from technical or scientific texts and other media to support your explanation of an observation	0.0%	25.0%	25.0%	25.0%	25.0%	6	**3.83**	1.17
	0	1	1	2	2			
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	0.0%	25.0%	25.0%	12.5%	37.5%	6	**4.00**	1.26
	0	1	1	1	3			

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

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	1.5%	10.5%	42.2%	22.4%	23.5%	81	**3.47**	1.01
	2	10	32	22	15			
Using knowledge and creativity to propose a testable solution for a problem	10.0%	8.4%	29.4%	31.1%	21.4%	80	**3.40**	1.05
	5	7	31	25	12			
Making a model of an object or system to show its parts and how they work	6.9%	12.1%	21.0%	22.8%	37.4%	80	**3.48**	1.21
	5	12	24	18	21			
Carrying out procedures for an experiment and recording data accurately	6.8%	9.0%	23.9%	27.8%	32.7%	81	**3.56**	1.14
	5	8	24	25	19			
Using computer models of an object or system to investigate cause and effect relationships	25.2%	18.9%	29.5%	16.7%	9.8%	80	**2.86**	1.22
	13	17	27	14	9			
Considering different interpretations of the data when deciding if a solution works as intended	19.9%	10.6%	32.5%	18.2%	19.0%	80	**3.15**	1.21
	10	10	31	16	13			
Organizing data in charts or graphs to find patterns and relationships	25.9%	8.1%	30.9%	21.0%	14.3%	81	**3.04**	1.28
	14	11	25	20	11			
Supporting a solution for a problem with data from experiments	19.8%	7.4%	35.5%	16.4%	21.1%	81	**3.25**	1.26
	10	10	27	18	16			
Defending an argument that conveys how a solution best meets design criteria	23.8%	14.5%	19.0%	26.0%	16.8%	79	**3.06**	1.36
	15	11	21	18	14			
Integrating information from technical or scientific texts and other media to support your solution to a problem	17.7%	9.3%	40.0%	16.2%	17.0%	78	**3.09**	1.19
	11	8	32	17	10			
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	10.0%	4.6%	28.5%	30.8%	26.2%	78	**3.51**	1.08
	5	6	25	28	14			

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

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Sticking with a task until it is finished	0.7%	6.1%	32.4%	21.0%	39.9%	88	**3.93**	1.03
	1	5	28	19	35			
Making changes when things do not go as planned	0.0%	1.4%	22.4%	25.9%	50.5%	87	**4.29**	0.86
	0	2	17	22	46			
Working well with students from all backgrounds	4.8%	11.5%	25.0%	18.3%	40.5%	88	**3.68**	1.28
	7	9	21	19	32			
Including others' perspectives when making decisions	2.1%	4.1%	22.4%	31.1%	40.5%	88	**3.89**	1.09
	3	6	21	26	32			
Communicating effectively with others	8.8%	3.5%	22.4%	28.7%	36.8%	87	**3.91**	1.16
	5	5	17	26	34			
Viewing failure as an opportunity to learn	8.1%	17.0%	15.4%	18.3%	41.3%	84	**3.94**	1.23
	4	9	14	18	39			

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

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Interest in a new STEM topic	14.2%	10.3%	17.1%	25.3%	33.2%	87	**3.53**	1.31
	9	11	17	25	25			
Deciding on a path to pursue a STEM career	15.0%	23.0%	19.4%	17.5%	25.3%	86	**3.34**	1.32
	10	14	20	21	21			
Sense of accomplishing something in STEM	6.9%	11.5%	30.2%	21.7%	29.8%	85	**3.71**	1.18
	6	5	24	23	27			
Feeling prepared for more challenging STEM activities	3.6%	12.9%	24.1%	29.1%	30.5%	85	**3.76**	1.17
	5	7	19	26	28			
Thinking creatively about a STEM project or activity	6.2%	2.8%	34.1%	27.5%	29.6%	86	**3.74**	1.13
	5	4	26	24	27			
Desire to build relationships with mentors who work in STEM	11.6%	19.7%	22.0%	22.0%	24.8%	86	**3.43**	1.32
	9	13	20	20	24			
Connecting a STEM topic or field to my personal values	23.5%	11.1%	22.7%	22.0%	20.8%	86	**3.35**	1.34
	11	12	21	20	22			

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

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

	Much less likely	Less likely	About the same before and after	More likely	Much more likely	n	Avg.	SD
Watch or read non-fiction STEM	2.8%	8.2%	53.1%	21.0%	15.0%	87	**3.31**	1.00
	4	8	46	15	14			
Tinker (play) with a mechanical or electrical device	0.7%	4.1%	23.3%	35.3%	36.7%	87	**3.97**	0.92
	1	2	26	28	30			
Work on solving mathematical or scientific puzzles	1.4%	2.1%	43.5%	32.6%	20.4%	87	**3.66**	0.93
	2	3	36	28	18			
Use a computer to design or program something	1.4%	6.2%	43.3%	26.0%	23.2%	87	**3.70**	0.99
	2	5	32	26	22			
Talk with friends or family about STEM	2.8%	3.5%	39.6%	32.9%	21.3%	86	**3.62**	1.04
	4	5	30	28	19			
Mentor or teach other students about STEM	2.8%	1.4%	38.8%	33.3%	23.8%	87	**3.66**	1.00
	4	2	33	29	19			
Help with a community service project related to STEM	2.8%	2.1%	48.3%	25.0%	21.8%	86	**3.57**	0.99
	4	3	35	28	16			
Participate in a STEM camp, club, or competition	2.1%	6.2%	33.9%	35.4%	22.5%	87	**3.72**	1.01
	3	5	26	32	21			
Take an elective (not required) STEM class	5.5%	2.1%	23.2%	36.0%	33.3%	87	**3.87**	1.07
	4	3	22	29	29			
Work on a STEM project or experiment in a university or professional setting	2.8%	2.1%	43.6%	24.6%	26.9%	86	**3.73**	1.09
	4	3	32	20	27			

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

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

	%	Freq.
Graduate from high school	2.1%	3
Go to a trade or vocational school	1.4%	2
Go to college for a little while	1.4%	2
Finish college (get a Bachelor's degree)	51.3%	44
Get more education after college	43.9%	37
Total	**100%**	**88**

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

	%	Freq.
Graduate from high school	0.7%	1
Go to a trade or vocational school	2.1%	3
Go to college for a little while	0.7%	1
Finish college (get a Bachelor's degree)	38.6%	37
Get more education after college	58.0%	46
Total	**100%**	**88**

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	4.9%	3
up to 25% of the time	4.8%	7
up to 50% of the time	13.2%	15
up to 75% of the time	30.6%	32
up to 100% of the time	46.5%	30
Total	**100%**	**87**

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

	%	Freq.
Undecided	15.3%	10
Scientist or researcher	3.0%	4
Work in computers or technology	10.9%	11
Engineer or architect	31.4%	21
Work in the medical field (doctor, nurse, lab technician)	12.0%	9
Teacher	2.3%	3
Business person or manager	1.5%	2
Lawyer	3.3%	1
Military, police, or security	3.8%	5
Artist (writer, dancer, painter)	2.3%	3
Skilled craftsperson (carpenter, electrician, machinist)	2.3%	3
Athlete or other work in sports	1.5%	2
Other, (specify): †	10.5%	7
Total	**100%**	**81**

† Other includes: "Firefighter," "media ministry," "rodeo," "designer," "environmental engineer."

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

	%	Freq.
Undecided	14.5%	9
Scientist or researcher	4.5%	6
Work in computers or technology	10.0%	10
Engineer or architect	39.8%	29
Work in the medical field (doctor, nurse, lab technician)	11.1%	8
Teacher	1.5%	2
Business person or manager	1.5%	2
Lawyer	1.5%	2
Military, police, or security	2.2%	3
Artist (writer, dancer, painter)	1.5%	2
Skilled craftsperson (carpenter, electrician, machinist)	2.2%	3
Athlete or other work in sports	0.0%	0
Other, specify: †	9.7%	6
Total	**100%**	**82**

†Other includes: "Firefighter," "media ministry," "rodeo," "environmental engineer."

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

	I've never heard of this program	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Camp Invention	59.9%	5.5%	13.6%	10.3%	10.8%	87	**2.07**	1.45
	52	4	12	11	8			
eCYBERMISSION	61.0%	10.7%	13.9%	7.6%	6.9%	86	**1.94**	1.33
	53	4	16	7	6			
Junior Solar Sprint (JSS)	2.1%	6.1%	17.6%	11.6%	62.8%	88	**4.23**	1.12
	3	5	14	13	53			
Gains in the Education of Mathematics and Science (GEMS)	51.1%	10.6%	17.6%	10.4%	10.4%	87	**2.26**	1.51
	45	7	13	11	11			
UNITE	68.1%	6.8%	13.0%	4.1%	8.2%	88	**1.98**	1.37
	53	6	15	6	8			
Junior Science & Humanities Symposium (JSHS)	67.8%	4.8%	11.0%	8.4%	8.2%	87	**2.09**	1.46
	52	3	12	12	8			
Science & Engineering Apprenticeship Program (SEAP)	69.3%	0.7%	16.7%	3.6%	9.8%	85	**2.04**	1.46
	53	1	16	5	10			
Research & Engineering Apprenticeship Program (REAP)	67.8%	1.4%	15.7%	4.9%	10.3%	87	**2.11**	1.50
	52	2	15	7	11			
High School Apprenticeship Program (HSAP)	66.5%	6.2%	13.8%	6.2%	7.5%	87	**1.92**	1.33
	54	5	16	5	7			
College Qualified Leaders (CQL)	68.5%	3.5%	14.3%	8.9%	4.9%	87	**1.99**	1.39
	53	5	13	9	7			
GEMS Near Peer Mentor Program	65.8%	5.5%	13.8%	6.8%	8.2%	87	**1.99**	1.39
	53	4	16	6	8			
Undergraduate Research Apprenticeship Program (URAP)	69.7%	4.8%	12.1%	9.2%	4.4%	84	**1.95**	1.37
	53	3	13	9	6			
Science Mathematics, and Research for Transformation (SMART) College Scholarship	66.8%	2.1%	15.8%	6.4%	9.0%	86	**2.12**	1.46
	50	3	15	9	9			
National Defense Science & Engineering Graduate (NDSEG) Fellowship	68.2%	5.5%	10.4%	7.8%	8.3%	86	**2.06**	1.45
	52	4	11	11	8			

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 JSS?

	%	Freq.
None	33.7%	26
1	14.8%	10
2	5.5%	8
3	16.3%	16
4	4.1%	6
5 or more	25.7%	22
Total	**100%**	**88**

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

	%	Freq.
None	58.3%	46
1	15.7%	15
2	4.2%	6
3	3.5%	5
4	4.2%	6
5 or more	14.2%	9
Total	**100%**	**87**

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

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n	Avg.	SD
DoD researchers advance science and engineering fields	3.4%	0.0%	37.2%	34.3%	25.1%	88	**3.72**	1.06
	5	0	35	23	25			
DoD researchers develop new, cutting edge technologies	4.8%	2.8%	39.1%	27.1%	26.4%	88	**3.59**	1.16
	7	4	30	24	23			
DoD researchers solve real-world problems	3.4%	0.7%	37.1%	27.3%	31.6%	87	**3.71**	1.08
	5	1	33	23	25			
DoD research is valuable to society	3.4%	0.7%	39.2%	25.7%	31.1%	88	**3.72**	1.08
	5	1	34	22	26			

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 THE JSS PROGRAM?

	Disagree - This did not happen	Disagree - This happened but not because of JSS	Agree - JSS contributed	Agree - JSS was primary reason	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	5.5%	15.7%	58.4%	20.6%	87	**2.99**	0.78
	4	15	46	22			
I am more interested in participating in STEM activities outside of school requirements	6.8%	27.7%	41.6%	24.0%	87	**2.98**	0.89
	6	17	37	27			
I am more aware of other AEOPs	26.4%	12.9%	42.1%	18.7%	87	**2.70**	1.09
	19	11	34	23			
I am more interested in participating in other AEOPs	23.6%	13.6%	46.3%	16.6%	87	**2.75**	1.00
	15	12	40	20			
I am more interested in taking STEM classes in school	10.1%	18.9%	48.4%	22.6%	87	**2.99**	0.87
	7	12	43	25			
I am more interested in earning a STEM degree	16.4%	21.1%	41.9%	20.8%	86	**2.80**	0.98
	12	15	37	22			
I am more interested in pursuing a career in STEM	16.4%	28.5%	29.7%	25.5%	86	**2.80**	1.02
	12	18	31	25			
I am more aware of Army or DoD STEM research and careers	37.8%	7.7%	36.1%	18.5%	87	**2.54**	1.12
	24	11	33	19			
I have a greater appreciation of Army or DoD STEM research	30.6%	16.3%	34.8%	18.4%	85	**2.64**	1.10
	19	15	29	22			
I am more interested in pursuing a STEM career with the Army or DoD	42.2%	11.7%	33.4%	12.9%	85	**2.49**	1.14
	26	9	32	18			

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

Appendix C

FY15 JSS Mentor Questionnaire Data Summaries

JSS Mentor Data Summary

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

	%	Freq.
No organization	0.0%	0
School or district (K-12)	95.5%	21
State educational agency	0.0%	0
Institution of higher education (vocational school, junior college, college, or university)	0.0%	0
Private Industry	0.0%	0
Department of Defense or other government agency	4.5%	1
Non-profit	0.0%	0
Other, (specify)	0.0%	0
Total	**100%**	**22**

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

	%	Freq.
Teacher	95.5%	21
Other school staff	0.0%	0
University educator	0.0%	0
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	0.0%	0
Scientist, Engineer, or Mathematics professional	4.5%	1
Other, (specify):	0.0%	0
Total	**100%**	**22**

What grade level(s) do you teach (select all that apply)?

	%	Freq.
Upper elementary	9.5%	2
Middle school	100.0%	21
High school	14.3%	3
Total	**100%**	**26**

Which best describes the location of your school?

	%	Freq.
Frontier or tribal school	0.0%	0
Rural (country)	38.1%	8
Suburban	38.1%	8
Urban (city)	23.8%	5
Total	100%	21

At what kind of school did you teach while participating in JSS?

	%	Freq.
Public school	95.2%	20
Private school	4.8%	1
Home school	0.0%	0
Online school	0.0%	0
Department of Defense school (DoDDS, DoDEA)	0.0%	0
Total	100%	21

Do you work at a "Title-I" school?

	%	Freq.
Yes	38.1%	8
No	42.9%	9
I am not sure	19.0%	4
Total	100%	21

Which of the following subjects do you teach? (select ALL that apply)

	%	Freq.
Other, (specify):	4.8%	1
Upper elementary	9.5%	2
Physical science (physics, chemistry, astronomy, materials science, etc.)	4.8%	1
Biological science	4.8%	1
Earth, atmospheric, or oceanic science	4.8%	1
Environmental science	4.8%	1
Computer science	9.5%	2
Technology	90.5%	19
Engineering	66.7%	14
Mathematics or statistics	9.5%	2
Medical, health, or behavioral science	0.0%	0
Social Science (psychology, sociology, anthropology)	0.0%	0
Total	**100%**	**44**

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

	%	Freq.
Other, (specify):	4.5%	1
Physical science (physics, chemistry, astronomy, materials science, etc.)	4.5%	1
Biological science	0.0%	0
Earth, atmospheric, or oceanic science	0.0%	0
Environmental science	0.0%	0
Computer science	0.0%	0
Technology	40.9%	9
Engineering	45.5%	10
Mathematics or statistics	4.5%	1
Medical, health, or behavioral science	0.0%	0
Social Science (psychology, sociology, anthropology)	0.0%	0
Total	**100%**	**22**

At which of the following JSS sites did you participate? (Select ONE)

	%	Freq.
Alabama - Tuscaloosa	0.0%	0
ARMY: AMRDEC - Huntsville, AL	0.0%	0
ARMY: APG - Aberdeen, MD	0.0%	0
ARMY: ARDEC - Picatinny, NJ	9.1%	2
Colorado - Denver	9.1%	2
Delaware - Harrington	0.0%	0
Florida - Orlando	4.5%	1
Georgia - Athens	27.3%	6
Iowa - Altoona	4.5%	1
Kentucky - Louisville	0.0%	0
Mississippi	0.0%	0
Missouri - Rolla	0.0%	0
New Hampshire - Lincoln	4.5%	1
New Jersey - Ewing	0.0%	0
New York - Oswego	0.0%	0
North Carolina - Greensboro	4.5%	1
Oklahoma - Midwest City	4.5%	1
Pennsylvania - Champion	13.6%	3
South Carolina - Columbia	0.0%	0
Tennessee - Murfeesboro	0.0%	0
Texas - Wayco	9.1%	2
Utah - Kaysville	4.5%	1
Virginia - Hampton	4.5%	1
Washington - Bellevue	0.0%	0
West Virginia - Ripley	0.0%	0
Total	**100%**	**22**

Which of the following BEST describes your role during JSS?

	%	Freq.
Competition advisor	86.4%	19
Event or site host/director	4.5%	1
Other, (specify):	9.1%	2
Total	**100%**	**22**

How SATISFIED were you with the following JSS features?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Application or registration process	4.5%	4.5%	13.6%	40.9%	36.4%	22	**4.00**	1.07
	1	1	3	9	8			
Communicating with Technology Student Association (TSA)	4.5%	0.0%	13.6%	31.8%	50.0%	22	**4.23**	1.02
	1	0	3	7	11			
Communicating with JSS site coordinators	18.2%	4.5%	9.1%	36.4%	31.8%	22	**3.59**	1.47
	4	1	2	8	7			
The physical location(s) of JSS's activities	0.0%	0.0%	4.5%	45.5%	50.0%	22	**4.45**	0.60
	0	0	1	10	11			
Support for instruction or mentorship during program activities	28.6%	9.5%	4.8%	38.1%	19.0%	21	**3.10**	1.58
	6	2	1	8	4			
Stipends (payment)	86.4%	0.0%	4.5%	9.1%	0.0%	22	**1.36**	0.95
	19	0	1	2	0			
Invited speakers or "career" events	95.5%	0.0%	4.5%	0.0%	0.0%	22	**1.09**	0.43
	21	0	1	0	0			
Field trips or laboratory tours	100.0%	0.0%	0.0%	0.0%	0.0%	21	**1.00**	0.00
	21	0	0	0	0			

Note. Response scale: 0 = "Did not experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much."

How USEFUL were the following JSS resources provided at jrsolarsprint.org?

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Official Technology Student Association Competition Rules	4.5%	0.0%	0.0%	36.4%	59.1%	22	**4.45**	0.91
	1	0	0	8	13			
Local Competition Rules	40.9%	0.0%	0.0%	40.9%	18.2%	22	**2.95**	1.70
	9	0	0	9	4			
Build A Car resources	33.3%	0.0%	4.8%	38.1%	23.8%	21	**3.19**	1.66
	7	0	1	8	5			
Course Outline	54.5%	0.0%	4.5%	27.3%	13.6%	22	**2.45**	1.68
	12	0	1	6	3			
STEM Standards	36.4%	0.0%	9.1%	22.7%	31.8%	22	**3.14**	1.75
	8	0	2	5	7			
Lesson Plans	59.1%	0.0%	4.5%	22.7%	13.6%	22	**2.32**	1.67
	13	0	1	5	3			
Terminology	27.3%	0.0%	13.6%	31.8%	27.3%	22	**3.32**	1.59
	6	0	3	7	6			
Video Tutorials	72.7%	0.0%	0.0%	18.2%	9.1%	22	**1.91**	1.54
	16	0	0	4	2			
JSS Host Guide	81.8%	0.0%	4.5%	13.6%	0.0%	22	**1.50**	1.10
	18	0	1	3	0			
Calendar of Events	81.8%	0.0%	0.0%	18.2%	0.0%	22	**1.55**	1.18
	18	0	0	4	0			

Note. Response scale: 0 = “Did not experience,” 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 JSS.

	Yes - I used this strategy	No - I did not use this strategy	n
Become familiar with my student(s) background and interests at the beginning of the JSS experience	72.7%	27.3%	22
	16	6	
Giving students real-life problems to investigate or solve	63.6%	36.4%	22
	14	8	
Selecting readings or activities that relate to students' backgrounds	18.2%	81.8%	22
	4	18	
Encouraging students to suggest new readings, activities, or projects	31.8%	68.2%	22
	7	15	
Helping students become aware of the role(s) that STEM plays in their everyday lives	77.3%	22.7%	22
	17	5	
Helping students understand how STEM can help them improve their own community	72.7%	27.3%	22
	16	6	
Asking students to relate real-life events or activities to topics covered in JSS	36.4%	63.6%	22
	8	14	

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 JSS.

	Yes - I used this strategy	No - I did not use this strategy	n
Identify the different learning styles that my student (s) may have at the beginning of the JSS experience	66.7%	33.3%	21
	14	7	
Interact with students and other personnel the same way regardless of their background	75.0%	25.0%	20
	15	5	
Use a variety of teaching and/or mentoring activities to meet the needs of all students	85.7%	14.3%	21
	18	3	
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	52.4%	47.6%	21
	11	10	
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	38.1%	61.9%	21
	8	13	
Directing students to other individuals or programs for additional support as needed	66.7%	33.3%	21
	14	7	
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	38.1%	61.9%	21
	8	13	

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 JSS.

	Yes - I used this strategy	No - I did not use this strategy	n
Having my student(s) tell other people about their backgrounds and interests	33.3%	66.7%	21
	7	14	
Having my student(s) explain difficult ideas to others	71.4%	28.6%	21
	15	6	
Having my student(s) listen to the ideas of others with an open mind	81.0%	19.0%	21
	17	4	
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	76.2%	23.8%	21
	16	5	
Having my student(s) give and receive constructive feedback with others	81.0%	19.0%	21
	17	4	
Having students work on collaborative activities or projects as a member of a team	85.7%	14.3%	21
	18	3	
Allowing my student(s) to resolve conflicts and reach agreement within their team	85.7%	14.3%	21
	18	3	

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 JSS.

	Yes - I used this strategy	No - I did not use this strategy	n
Teaching (or assigning readings) about specific STEM subject matter	52.4%	47.6%	21
	11	10	
Having my student(s) search for and review technical research to support their work	57.1%	42.9%	21
	12	9	
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	81.0%	19.0%	21
	17	4	
Supervising my student(s) while they practice STEM research skills	81.0%	19.0%	21
	17	4	
Providing my student(s) with constructive feedback to improve their STEM competencies	81.0%	19.0%	21
	17	4	
Allowing students to work independently to improve their self-management abilities	85.7%	14.3%	21
	18	3	
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	90.5%	9.5%	21
	19	2	
Encouraging students to seek support from other team members	85.7%	14.3%	21
	18	3	

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

	Yes - I used this strategy	No - I did not use this strategy	n
Asking my student(s) about their educational and/or career goals	66.7%	33.3%	21
	14	7	
Recommending extracurricular programs that align with students' goals	61.9%	38.1%	21
	13	8	
Recommending Army Educational Outreach Programs that align with students' goals	42.9%	57.1%	21
	9	12	
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	61.9%	38.1%	21
	13	8	
Discussing STEM career opportunities within the DoD or other government agencies	23.8%	76.2%	21
	5	16	
Discussing STEM career opportunities in private industry or academia	61.9%	38.1%	21
	13	8	
Discussing the economic, political, ethical, and/or social context of a STEM career	47.6%	52.4%	21
	10	11	
Recommending student and professional organizations in STEM to my student(s)	66.7%	33.3%	21
	14	7	
Helping students build a professional network in a STEM field	33.3%	66.7%	21
	7	14	
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	38.1%	61.9%	21
	8	13	

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

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
The Junior Solar Sprint website (jrsolarsprint.org)	9.1%	0.0%	18.2%	36.4%	36.4%	22	**3.91**	1.19
	2	0	4	8	8			
Technology Student Association (TSA) website	4.5%	0.0%	9.1%	36.4%	50.0%	22	**4.27**	0.98
	1	0	2	8	11			
Army Educational Outreach Program (AEOP) website	68.2%	0.0%	18.2%	13.6%	0.0%	22	**1.77**	1.19
	15	0	4	3	0			
AEOP on Facebook, Twitter, Pinterest or other social media	90.9%	4.5%	4.5%	0.0%	0.0%	22	**1.14**	0.47
	20	1	1	0	0			
AEOP brochure	66.7%	4.8%	9.5%	19.0%	0.0%	21	**1.81**	1.25
	14	1	2	4	0			
It Starts Here! Magazine	95.5%	0.0%	4.5%	0.0%	0.0%	22	**1.09**	0.43
	21	0	1	0	0			
JSS Program administrator or site coordinator	63.6%	9.1%	4.5%	13.6%	9.1%	22	**1.95**	1.46
	14	2	1	3	2			
Invited speakers or "career" events	90.9%	0.0%	4.5%	4.5%	0.0%	22	**1.23**	0.75
	20	0	1	1	0			
Participation in JSS	27.3%	0.0%	9.1%	22.7%	40.9%	22	**3.50**	1.68
	6	0	2	5	9			

Note. Response scale: 0 = "Did not experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much."

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

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
The Junior Solar Sprint website (jrsolarsprint.org)	36.4%	0.0%	9.1%	27.3%	27.3%	22	**3.09**	1.72
	8	0	2	6	6			
Technology Student Association (TSA) website	27.3%	0.0%	4.5%	31.8%	36.4%	22	**3.50**	1.65
	6	0	1	7	8			
Army Educational Outreach Program (AEOP) website	63.6%	0.0%	9.1%	13.6%	13.6%	22	**2.14**	1.61
	14	0	2	3	3			
AEOP on Facebook, Twitter, Pinterest or other social media	90.9%	4.5%	4.5%	0.0%	0.0%	22	**1.14**	0.47
	20	1	1	0	0			
AEOP brochure	68.2%	0.0%	13.6%	9.1%	9.1%	22	**1.91**	1.44
	15	0	3	2	2			
It Starts Here! Magazine	95.5%	0.0%	4.5%	0.0%	0.0%	22	**1.09**	0.43
	21	0	1	0	0			
JSS Program administrator or site coordinator	77.3%	4.5%	4.5%	9.1%	4.5%	22	**1.59**	1.22
	17	1	1	2	1			
Invited speakers or "career" events	90.9%	0.0%	4.5%	4.5%	0.0%	22	**1.23**	0.75
	20	0	1	1	0			
Participation in JSS	45.5%	0.0%	4.5%	18.2%	31.8%	22	**2.91**	1.85
	10	0	1	4	7			

Note. Response scale: 0 = "Did not experience," 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 JSS? (check ALL that apply)

	Yes - I discussed this program with my student(s)	No - I did not discuss this program with my student(s)	n
Gains in the Education of Mathematics and Science (GEMS)	4.8%	95.2%	21
	1	20	
UNITE	0.0%	100.0%	21
	0	21	
Junior Science & Humanities Symposium (JSHS)	0.0%	100.0%	21
	0	21	
Science & Engineering Apprenticeship Program (SEAP)	9.5%	90.5%	21
	2	19	
Research & Engineering Apprenticeship Program (REAP)	4.8%	95.2%	21
	1	20	
High School Apprenticeship Program (HSAP)	4.8%	95.2%	21
	1	20	
College Qualified Leaders (CQL)	0.0%	100.0%	21
	0	21	
GEMS Near Peer Mentor Program	0.0%	100.0%	21
	0	21	
Undergraduate Research Apprenticeship Program (URAP)	0.0%	100.0%	20
	0	20	
Science Mathematics, and Research for Transformation (SMART) College Scholarship	4.8%	95.2%	21
	1	20	
National Defense Science & Engineering Graduate (NDSEG) Fellowship	0.0%	100.0%	21
	0	21	
I discussed AEOP with my student(s) but did not discuss any specific program	52.4%	47.6%	21
	11	10	

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

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n	Avg.	SD
DoD researchers advance science and engineering fields	0.0%	0.0%	40.0%	40.0%	20.0%	20	**3.80**	0.77
	0	0	8	8	4			
DoD researchers develop new, cutting edge technologies	0.0%	0.0%	40.0%	40.0%	20.0%	20	**3.80**	0.77
	0	0	8	8	4			
DoD researchers solve real-world problems	0.0%	0.0%	40.0%	40.0%	20.0%	20	**3.80**	0.77
	0	0	8	8	4			
DoD research is valuable to society	0.0%	0.0%	40.0%	35.0%	25.0%	20	**3.85**	0.81
	0	0	8	7	5			

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 to do each of the following in JSS?

	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Learn new science, technology, engineering, or mathematics (STEM) topics	0.0%	0.0%	26.3%	42.1%	31.6%	19	**4.05**	0.78
	0	0	5	8	6			
Apply STEM knowledge to real-life situations	0.0%	5.3%	15.8%	36.8%	42.1%	19	**4.16**	0.90
	0	1	3	7	8			
Learn about new discoveries in STEM	5.3%	21.1%	21.1%	26.3%	26.3%	19	**3.47**	1.26
	1	4	4	5	5			
Learn about different careers that use STEM	5.3%	36.8%	26.3%	21.1%	10.5%	19	**2.95**	1.13
	1	7	5	4	2			
Interact with scientists or engineers	47.4%	15.8%	36.8%	0.0%	0.0%	19	**1.89**	0.94
	9	3	7	0	0			
Communicate with other students about STEM	21.1%	10.5%	10.5%	31.6%	26.3%	19	**3.32**	1.53
	4	2	2	6	5			
Use laboratory or field techniques, procedures, and tools	5.6%	0.0%	16.7%	44.4%	33.3%	18	**4.00**	1.03
	1	0	3	8	6			
Participate in hands-on STEM activities	0.0%	5.3%	10.5%	36.8%	47.4%	19	**4.26**	0.87
	0	1	2	7	9			
Work as part of a team	0.0%	0.0%	5.3%	36.8%	57.9%	19	**4.53**	0.61
	0	0	1	7	11			
Identify questions or problems to investigate	0.0%	5.3%	26.3%	47.4%	21.1%	19	**3.84**	0.83
	0	1	5	9	4			
Design an investigation	26.3%	5.3%	15.8%	47.4%	5.3%	19	**3.00**	1.37
	5	1	3	9	1			
Carry out an investigation	15.8%	5.3%	21.1%	47.4%	10.5%	19	**3.32**	1.25
	3	1	4	9	2			
Analyze data or information	5.3%	10.5%	31.6%	42.1%	10.5%	19	**3.42**	1.02
	1	2	6	8	2			
Draw conclusions from an investigation	10.5%	5.3%	26.3%	47.4%	10.5%	19	**3.42**	1.12
	2	1	5	9	2			
Come up with creative explanations or solutions	5.3%	10.5%	21.1%	42.1%	21.1%	19	**3.63**	1.12
	1	2	4	8	4			
Build or make a computer model	52.6%	5.3%	21.1%	15.8%	5.3%	19	**2.16**	1.38
	10	1	4	3	1			

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

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
In depth knowledge of a STEM topic(s)	5.0%	5.0%	40.0%	40.0%	10.0%	20	**3.45**	0.94
	1	1	8	8	2			
Knowledge of research conducted in a STEM topic or field	5.0%	10.0%	50.0%	25.0%	10.0%	20	**3.25**	0.97
	1	2	10	5	2			
Knowledge of research processes, ethics, and rules for conduct in STEM	5.0%	15.0%	25.0%	45.0%	10.0%	20	**3.40**	1.05
	1	3	5	9	2			
Knowledge of how professionals work on real problems in STEM	15.0%	10.0%	45.0%	20.0%	10.0%	20	**3.00**	1.17
	3	2	9	4	2			
Knowledge of what everyday research work is like in STEM	10.0%	15.0%	45.0%	25.0%	5.0%	20	**3.00**	1.03
	2	3	9	5	1			

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

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

	%	Freq.
Science	0.0%	0
Technology	19.0%	4
Engineering	81.0%	17
Mathematics	0.0%	0
Total	**100%**	**21**

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	0.0%	15.8%	21.1%	42.1%	21.1%	19	**3.68**	1.00
	0	3	4	8	4			
Using knowledge and creativity to propose a testable solution for a problem	5.3%	15.8%	10.5%	42.1%	26.3%	19	**3.68**	1.20
	1	3	2	8	5			
Making a model of an object or system to show its parts and how they work	5.3%	0.0%	21.1%	52.6%	21.1%	19	**3.84**	0.96
	1	0	4	10	4			
Carrying out procedures for an experiment and recording data accurately	5.3%	10.5%	36.8%	36.8%	10.5%	19	**3.37**	1.01
	1	2	7	7	2			
Using computer models of an object or system to investigate cause and effect relationships	42.1%	10.5%	21.1%	15.8%	10.5%	19	**2.42**	1.46
	8	2	4	3	2			
Considering different interpretations of the data when deciding if a solution works as intended	26.3%	15.8%	36.8%	15.8%	5.3%	19	**2.58**	1.22
	5	3	7	3	1			
Organizing data in charts or graphs to find patterns and relationships	47.4%	26.3%	15.8%	10.5%	0.0%	19	**1.89**	1.05
	9	5	3	2	0			
Supporting a solution for a problem with data from experiments	26.3%	26.3%	31.6%	15.8%	0.0%	19	**2.37**	1.07
	5	5	6	3	0			
Defend an argument that conveys how a solution best meets design criteria	21.1%	21.1%	42.1%	10.5%	5.3%	19	**2.58**	1.12
	4	4	8	2	1			
Integrating information from technical or scientific texts and other media to support your solution to a problem	33.3%	16.7%	44.4%	5.6%	0.0%	18	**2.22**	1.00
	6	3	8	1	0			
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	10.5%	15.8%	26.3%	31.6%	15.8%	19	**3.26**	1.24
	2	3	5	6	3			

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

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

	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Sticking with a task until it is finished	0.0%	5.3%	15.8%	52.6%	26.3%	19	**4.00**	0.82
	0	1	3	10	5			
Making changes when things do not go as planned	0.0%	0.0%	10.5%	57.9%	31.6%	19	**4.21**	0.63
	0	0	2	11	6			
Including others' perspectives when making decisions	0.0%	10.5%	31.6%	31.6%	26.3%	19	**3.74**	0.99
	0	2	6	6	5			
Communicating effectively with others	0.0%	0.0%	47.4%	31.6%	21.1%	19	**3.74**	0.81
	0	0	9	6	4			
Desire to build relationships with professionals in a field	26.3%	15.8%	31.6%	21.1%	5.3%	19	**2.63**	1.26
	5	3	6	4	1			
Connecting a topic or field with their personal values	11.1%	22.2%	33.3%	22.2%	11.1%	18	**3.00**	1.19
	2	4	6	4	2			

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 JSS program?

	Disagree - This did not happen	Disagree - This happened but not because of JSS	Agree - JSS contributed	Agree - JSS was primary reason	n	Avg.	SD
More confident in STEM knowledge, skills, and abilities	5.3%	0.0%	89.5%	5.3%	19	**2.95**	0.52
	1	0	17	1			
More interested in participating in STEM activities outside of school requirements	10.5%	0.0%	73.7%	15.8%	19	**2.95**	0.78
	2	0	14	3			
More aware of other AEOPs	50.0%	5.6%	44.4%	0.0%	18	**1.94**	1.00
	9	1	8	0			
More interested in participating in other AEOPs	55.6%	11.1%	27.8%	5.6%	18	**1.83**	1.04
	10	2	5	1			
More interested in taking STEM classes in school	5.6%	16.7%	72.2%	5.6%	18	**2.78**	0.65
	1	3	13	1			
More interested in earning a STEM degree	5.6%	11.1%	77.8%	5.6%	18	**2.83**	0.62
	1	2	14	1			
More interested in pursuing a career in STEM	5.6%	11.1%	77.8%	5.6%	18	**2.83**	0.62
	1	2	14	1			
More aware of DoD STEM research and careers	50.0%	5.6%	44.4%	0.0%	18	**1.94**	1.00
	9	1	8	0			
Greater appreciation of DoD STEM research	55.6%	0.0%	44.4%	0.0%	18	**1.89**	1.02
	10	0	8	0			
More interested in pursuing a STEM career with the DoD	55.6%	16.7%	27.8%	0.0%	18	**1.72**	0.89
	10	3	5	0			

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

Appendix D

FY15 JSS Student Focus Group Protocol

2015 Junior Solar Sprint (JSS) Evaluation Study Student Focus Group Protocol

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 JSS. 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 JSS this year?**
    - How did you hear about JSS?
    - Who did you hear about it from?

The Army Educational Outreach Program (AEOP) is a primary sponsor of JSS. 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 JSS is teaching students about STEM career opportunities in the Army and Department of Defense.**
    - During JSS, did you learn 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 JSS. You are definitely eligible to participate in some of these programs and we need to know if you learned about them during JSS.**
   - During JSS, did you learn about any of the outreach programs that the AEOP sponsors? (Camp Invention,

     GEMS, JSHS, 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 JSS this year?**
   - What, specifically do you think you got out of participating in JSS?
   - Were there any other benefits of participating in JSS?

5. **Do you have any suggestions for improving JSS 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 JSS Mentor Focus Group Protocol

2015 Junior Solar Spring (JSS) Evaluation Study Adult Focus Group Protocol

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

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

2. **We need to understand more about how JSS is helping students know more about STEM career opportunities in the Department of Defense, especially civilian positions.**
    - Have you seen any efforts by JSS to educate participants about the Army, DoD, or careers in the DoD?
    - What strategies seem to be the most effective for JSS students?
    - Do you have any suggestions for helping JSS teach students about careers in the DoD?

The AEOP sponsors a wide range of national STEM outreach programs that these students qualify for.

3. **The AEOP needs to know if JSS is teaching students about the other STEM outreach programs that it sponsors.**
    - First, are you aware of the other programs offered by the AEOP? (e.g., GEMS, JSHS, etc.)
    - Have you seen any efforts at JSS 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 JSS to help engage underserved or underrepresented groups of adults and youth?
    - What strategies seem to work the best? The worst?
    - Any suggestions for helping JSS reach new populations of adult and youth participants?

5. **What suggestions do you have for improving JSS?**
6. **Last Chance - Have we missed anything? Tell us anything you want us to know that we didn't ask about.**

Appendix F

FY15 JSS Student Questionnaire

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

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

6. At which of the following JSS sites did you participate? (Select ONE)	
Select one.	
○	Alabama - Tuscaloosa
○	ARMY: AMRDEC - Huntsville, AL
○	ARMY: APG - Aberdeen, MD
○	ARMY: ARDEC - Picatinny, NJ
○	Colorado - Denver
○	Delaware - Harrington
○	Florida - Orlando
○	Georgia - Athens
○	Iowa - Altoona
○	Kentucky - Louisville
○	Mississippi
○	Missouri - Rolla
○	New Hampshire - Lincoln
○	New Jersey - Ewing
○	New York - Oswego
○	North Carolina - Greensboro
○	Oklahoma - Midwest City
○	Pennsylvania - Champion
○	South Carolina - Columbia
○	Tennessee - Murfeesboro
○	Texas - Wayco
○	Utah - Kaysville
○	Virginia - Hampton
○	Washington - Bellevue
○	West Virginia - Ripley

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

Select one per row.

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

8. How often did you do each of the following in JSS this year?

Select one per row.

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

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

Select one per row.

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

10. How often did you do each of the following in JSS this year?

Select one per row.

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

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

Select one per row.

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

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
The Junior Solar Sprint website (jrsolarsprint.org)	○	○	○	○	○
Technology Student Association (TSA) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My JSS mentor(s)	○	○	○	○	○
Invited speakers or “career” events during JSS	○	○	○	○	○
Participation in JSS	○	○	○	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
The Junior Solar Sprint website (jrsolarsprint.org)	○	○	○	○	○
Technology Student Association (TSA) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My JSS mentor(s)	○	○	○	○	○
Invited speakers or "career" events during JSS	○	○	○	○	○
Participation in JSS	○	○	○	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Applying or registering for the program	○	○	○	○	○
Communicating with your JSS host site organizers	○	○	○	○	○
The physical location(s) of JSS's activities	○	○	○	○	○
The variety of STEM topics available to you in JSS	○	○	○	○	○
Teaching or mentoring provided during JSS activities	○	○	○	○	○
Educational materials (e.g., workbooks, online resources, etc.) used during program activities	○	○	○	○	○
Invited speakers or "career" events	○	○	○	○	○
Field trips or laboratory tours	○	○	○	○	○

15. How USEFUL were the following JSS resources provided at jrsolarsprint.org?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Official Technology Student Association Competition Rules	○	○	○	○	○
Local Competition Rules	○	○	○	○	○
Build A Car resources	○	○	○	○	○
Course Outline	○	○	○	○	○
STEM Standards	○	○	○	○	○
Lesson Plans	○	○	○	○	○
Terminology	○	○	○	○	○
Video Tutorials	○	○	○	○	○
JSS Host Guide	○	○	○	○	○
Calendar of Events	○	○	○	○	○

16. Which resources were MOST USEFUL for you in JSS?

17. What resources could be IMPROVED OR ADDED to better support you in JSS?

18. As a result of your JSS experience, how much did you GAIN in the following areas?					
Select one per row.					
	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
In depth knowledge of a STEM topic(s)	○	○	○	○	○
Knowledge of research conducted in a STEM topic or field	○	○	○	○	○
Knowledge of research processes, ethics, and rules for conduct in STEM	○	○	○	○	○
Knowledge of how scientists and engineers work on real problems in STEM	○	○	○	○	○
Knowledge of what everyday research work is like in STEM	○	○	○	○	○

19. Which category best describes the focus of your student(s) JSS activities?		
Select one.		
○	Science	(Go to question number 20.)
○	Technology	(Go to question number 21.)
○	Engineering	(Go to question number 21.)
○	Mathematics	(Go to question number 21.)

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

Select one per row.

If answered, go to question number 22.

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

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

Select one per row.

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

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

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Sticking with a task until it is finished	○	○	○	○	○
Making changes when things do not go as planned	○	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○	○
Communicating effectively with others	○	○	○	○	○
Desire to build relationships with professionals in a field	○	○	○	○	○
Connecting a topic or field with their personal values	○	○	○	○	○

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

Select one per row.

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

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

Select one per row.

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

25. Before you participated in JSS, how far did you want to go in school?	
Select one.	
○	Graduate from high school
○	Go to a trade or vocational school
○	Go to college for a little while
○	Finish college (get a Bachelor's degree)
○	Get more education after college

26. After you have participated in JSS, how far do you want to go in school?	
Select one.	
○	Graduate from high school
○	Go to a trade or vocational school
○	Go to college for a little while
○	Finish college (get a Bachelor's degree)
○	Get more education after college

27. When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your job?	
Select one.	
○	not at all
○	up to 25% of the time
○	up to 50% of the time
○	up to 75% of the time
○	up to 100% of the time

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

Select one.

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

29. After you have participated in JSS, what kind of work do you want to do when you are 30 years old? (select one)	
Select one.	
○	Undecided
○	Scientist or researcher
○	Work in computers or technology
○	Engineer or architect
○	Work in the medical field (doctor, nurse, lab technician)
○	Teacher
○	Business person or manager
○	Lawyer
○	Military, police, or security
○	Artist (writer, dancer, painter)
○	Skilled craftsperson (carpenter, electrician, machinist)
○	Athlete or other work in sports
○	Other, specify::

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

Select one per row.

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

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

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

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

Select one per row.

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

34. Which of the following statements describe you AFTER PARTICIPATING IN THE JSS PROGRAM?

Select one per row.

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

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

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

37. Please tell us about your overall satisfaction with your JSS experience.

Appendix G

FY15 JSS Mentor Questionnaire

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

*1. Do you agree to participate in this survey? (required)(*Required)

Select one.

○	Yes, I agree to participate in this survey	(Go to question number 2.)
○	No, I do not wish to participate in this survey	Go to end of chapter

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

Select one.

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

7. Which of the following BEST describes your current occupation (select ONE)		
Select one.		
○	Teacher	(Go to question number 8.)
○	Other school staff	(Go to question number 8.)
○	University educator	(Go to question number 13.)
○	Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	(Go to question number 13.)
○	Scientist, Engineer, or Mathematics professional	(Go to question number 13.)
○	Other, (specify)::	(Go to question number 13.)

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

9. Which best describes the location of your school?	
Select one.	
○	Frontier or tribal school
○	Rural (country)
○	Suburban
○	Urban (city)

10. At what kind of school did you teach while participating in JSS?	
Select one.	
○	Public school
○	Private school
○	Home school
○	Online school
○	Department of Defense school (DoDDS, DoDEA)

11. Do you work at a "Title-I" school?	
Select one.	
○	Yes
○	No
○	I am not sure

12. Which of the following subjects do you teach? (select ALL that apply)

Select all that apply.

☐	Upper elementary
☐	Physical science (physics, chemistry, astronomy, materials science, etc.)
☐	Biological science
☐	Earth, atmospheric, or oceanic science
☐	Environmental science
☐	Computer science
☐	Technology
☐	Engineering
☐	Mathematics or statistics
☐	Medical, health, or behavioral science
☐	Social Science (psychology, sociology, anthropology)
☐	Other, (specify)::

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

Select one.

○	Physical science (physics, chemistry, astronomy, materials science, etc.)
○	Biological science
○	Earth, atmospheric, or oceanic science
○	Environmental science
○	Computer science
○	Technology
○	Engineering
○	Mathematics or statistics
○	Medical, health, or behavioral science
○	Social Science (psychology, sociology, anthropology)
○	Other, (specify)::

14. At which of the following JSS sites did you participate? (Select ONE)	
Select one.	
○	Alabama - Tuscaloosa
○	ARMY: AMRDEC - Huntsville, AL
○	ARMY: APG - Aberdeen, MD
○	ARMY: ARDEC - Picatinny, NJ
○	Colorado - Denver
○	Delaware - Harrington
○	Florida - Orlando
○	Georgia - Athens
○	Iowa - Altoona
○	Kentucky - Louisville
○	Mississippi
○	Missouri - Rolla
○	New Hampshire - Lincoln
○	New Jersey - Ewing
○	New York - Oswego
○	North Carolina - Greensboro
○	Oklahoma - Midwest City
○	Pennsylvania - Champion
○	South Carolina - Columbia
○	Tennessee - Murfeesboro
○	Texas - Wayco
○	Utah - Kaysville
○	Virginia - Hampton
○	Washington - Bellevue
○	West Virginia - Ripley

15. Which of the following BEST describes your role during JSS?	
Select one.	
○	Competition advisor
○	Event or site host/director
○	Other, (specify)::

16. How many JSS students did you work with this year?
_____ students.

19. How SATISFIED were you with the following JSS features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Application or registration process	○	○	○	○	○
Communicating with Technology Student Association (TSA)	○	○	○	○	○
Communicating with JSS site coordinators	○	○	○	○	○
The physical location(s) of JSS's activities	○	○	○	○	○
Support for instruction or mentorship during program activities	○	○	○	○	○
Stipends (payment)	○	○	○	○	○
Invited speakers or "career" events	○	○	○	○	○
Field trips or laboratory tours	○	○	○	○	○

20. How USEFUL were the following JSS resources provided at jrsolarsprint.org?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Official Technology Student Association Competition Rules	○	○	○	○	○
Local Competition Rules	○	○	○	○	○
Build A Car resources	○	○	○	○	○
Course Outline	○	○	○	○	○
STEM Standards	○	○	○	○	○
Lesson Plans	○	○	○	○	○
Terminology	○	○	○	○	○
Video Tutorials	○	○	○	○	○
JSS Host Guide	○	○	○	○	○
Calendar of Events	○	○	○	○	○

21. Which resources were MOST USEFUL for you in JSS?

22. What resources could be IMPROVED OR ADDED to better support you in JSS?

23. 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 JSS.
Select one per row.

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

24. 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 JSS.

Select one per row.

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

25. 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 JSS.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Having my student(s) 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 others 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	○	○
Having students work on collaborative activities or projects as a member of a team	○	○
Allowing my student(s) to resolve conflicts and reach agreement within their team	○	○

26. 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 JSS.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Teaching (or assigning readings) about specific STEM subject matter	○	○
Having my 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	○	○
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	○	○
Encouraging students to seek support from other team members	○	○

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

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Asking my student(s) about their educational and/or career goals	○	○
Recommending extracurricular programs that align with students' 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 student(s) with their resume, application, personal statement, and/or interview preparations	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
The Junior Solar Sprint website (jrsolarsprint.org)	○	○	○	○	○
Technology Student Association (TSA) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
JSS Program administrator or site coordinator	○	○	○	○	○
Invited speakers or “career” events	○	○	○	○	○
Participation in JSS	○	○	○	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
The Junior Solar Sprint website (jrsolarsprint.org)	○	○	○	○	○
Technology Student Association (TSA) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
JSS Program administrator or site coordinator	○	○	○	○	○
Invited speakers or “career” events	○	○	○	○	○
Participation in JSS	○	○	○	○	○

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

Select one per row.

	Yes - I discussed this program with my student(s)	*No - I did not discuss this program with my student(s)*
Gains in the Education of Mathematics and Science (GEMS)	○	○
UNITE	○	○
Junior Science & Humanities Symposium (JSHS)	○	○
Science & Engineering Apprenticeship Program (SEAP)	○	○
Research & Engineering Apprenticeship Program (REAP)	○	○
High School Apprenticeship Program (HSAP)	○	○
College Qualified Leaders (CQL)	○	○
GEMS Near Peer Mentor Program	○	○
Undergraduate Research Apprenticeship Program (URAP)	○	○
Science Mathematics, and Research for Transformation (SMART) College Scholarship	○	○
National Defense Science & Engineering Graduate (NDSEG) Fellowship	○	○
I discussed AEOP with my student(s) but did not discuss any specific program	○	○

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

Select one per row.

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

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

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Learn new science, technology, engineering, or mathematics (STEM) topics	○	○	○	○	○
Apply STEM knowledge to real-life situations	○	○	○	○	○
Learn about new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○
Use laboratory or field techniques, procedures, and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

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

Select one per row.

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

34. Which category best describes the focus of your student(s) JSS activities?

Select one.

○	Science	(Go to question number 35.)
○	Technology	(Go to question number 36.)
○	Engineering	(Go to question number 36.)
○	Mathematics	(Go to question number 36.)

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

Select one per row.

If answered, go to question number 37.

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

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

Select one per row.

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

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

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Sticking with a task until it is finished	○	○	○	○	○
Making changes when things do not go as planned	○	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○	○
Communicating effectively with others	○	○	○	○	○
Desire to build relationships with professionals in a field	○	○	○	○	○
Connecting a topic or field with their personal values	○	○	○	○	○

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

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of JSS*	*Agree - JSS contributed*	*Agree - JSS was primary reason*
More confident in STEM knowledge, skills, and abilities	○	○	○	○
More interested in participating in STEM activities outside of school requirements	○	○	○	○
More aware of other AEOPs	○	○	○	○
More interested in participating in other AEOPs	○	○	○	○
More interested in taking STEM classes in school	○	○	○	○
More interested in earning a STEM degree	○	○	○	○
More interested in pursuing a career in STEM	○	○	○	○
More aware of DoD STEM research and careers	○	○	○	○
Greater appreciation of DoD STEM research	○	○	○	○
More interested in pursuing a STEM career with the DoD	○	○	○	○

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

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

41. Please tell us about your overall satisfaction with your JSS experience.

Appendix H

Technology Student Association (TSA)
FY15 Evaluation Report Response