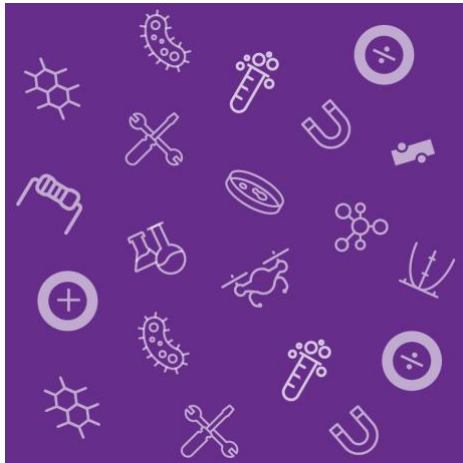
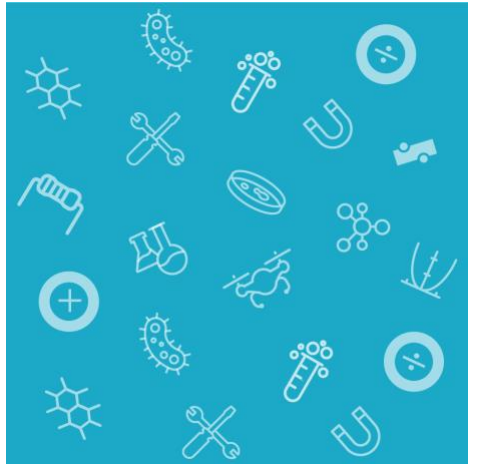


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ARMY EDUCATIONAL OUTREACH PROGRAM

JSS

2018 Annual Program Evaluation Report Executive Summary

June 2019



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2 | 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 FY18 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, eight focus groups with students at the national event and one focus group with team advisors and other adults associated with the program at the national event.

In 2018, students participated in JSS through 28 TSA-affiliated state competitions, two regional Army laboratory-hosted locations, and one national competition in Atlanta, GA.

JSS 2018 Fast Facts	
Description of program	Junior Solar Sprint (JSS), managed by the Technology Student Association (TSA), is an Army Educational Outreach Program (AEOP) which focuses on science, technology, engineering and mathematics (STEM) concepts. The program is available for 5 th to 8 th grade students and provides the opportunity for students to apply scientific understanding, creativity, experimentation, and teamwork to design, build, and race solar electric vehicles. Junior Solar Sprint activities occur nationwide, in classrooms and schools, through

JSS 2018 Fast Facts	
	extracurricular clubs, student associations and as community-based events that are independently hosted and sponsored.
Participant Population (who is eligible for program)	5 th -8 th grade students
Number of Applicants/Participants	1,170 total registered applicants; 1,081 participants
Number/Percentage of U2 Participants	368 / 34%
Placement Rate	NA (all students who register may participate)
Number of Adults (Mentors and Volunteers – incl. Teachers and Army S&Es)	328
Number of K–12 Teachers (including preservice)	299
Number of Army S&Es	0
Number of Army/DoD Research Laboratories	NA
Number of K-12 Schools	373
Number of K-12 Schools – Title I	96
Number of Other Collaborating Organizations	4
Total Cost	\$184,552
Administrative/Overhead & Indirect	\$124,918
National Scholarships	\$17,701
JSS Solar Panel Kits	\$12,296
Other Operational Costs	\$29,637
Cost Per Student Participant	\$171

Summary of Findings

The FY18 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.

2018 JSS Evaluation Findings	
Priority #1: <i>Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base</i>	
JSS served increasing numbers of students in FY18 and continues to reach students from populations historically underrepresented and underserved in STEM, indicating that JSS’s efforts to engage these groups has been met with some success.	In FY18 JSS registered 1,081 students, a 21% increase in enrollment compared to FY17 when 892 students registered. Over a third (37%) of JSS participants in FY18 were female.
	There were slightly fewer participants identifying as Black or African American in FY18 (11%) as compared to FY17 (15%). The proportion of participants identifying as Hispanic/Latino (8%) also declined slightly relative to FY17 levels (10%).
	About a third (34%) of JSS participants were classified as underserved in STEM according to AEOP’s definition of U2. This is similar to the proportion of U2 students enrolled in FY17 (29%).
Students reported engaging in STEM practices during JSS; minority students reported being more engaged than their non-minority peers and low-income students were more engaged than those who were not low-income.	Nearly all students (approximately 90% or more) indicated engaging with most STEM Practices at least once during JSS. An exception to this was that 30% of students reported that they had not interacted with scientists or engineers during JSS.
	Minority students reported significantly greater STEM engagement in JSS compared to non-minority students (medium effect size) and students who received free/reduced lunch in school reported significantly greater engagement compared to students who do not receive free/reduced lunch (large effect size). Although no statistical differences were identified between students’ STEM engagement in school and in JSS (perhaps due to the fact that JSS activities are often completed as a class requirement), students in focus groups reported that their JSS activities more hands-on and more focused on creative, independent problem-solving than their STEM experiences in school.
Students experienced gains in STEM knowledge during JSS and viewed STEM learning as	A large majority of students (89% - 94%) reported gains in their knowledge about STEM topics, practices, and real-world research.
	The most frequently mentioned benefit of JSS, identified by more than half of students (59%) in an open-ended question, was STEM learning.

<p>a primary benefit of the program.</p>	<p>There were no significant differences in STEM knowledge gains were found by U2 status or any demographic area examined.</p>
<p>Students experienced gains in their STEM competencies or skills, although the gains reported varied across skills.</p>	<p>More than half of students (70% - 95%) reported gains in all STEM competencies or skills about which they were asked, although gains varied across specific skills, with students most likely to report having skills in using knowledge and creativity to suggest a solution to a problem and in using knowledge and creativity to suggest a potential guess for the outcome of an experiment, and least likely to report having gained skills in defending an argument and in organizing data in charts and graphs.</p>
	<p>No significant differences in STEM Competencies were found by U2 status or any demographic area examined.</p>
<p>Students reported substantial gains in areas of 21st Century skills, although learning varied across specific skills.</p>	<p>More than three-quarters of students (79% - 94%) reported gains in all 21st Century skills about which they were asked. Students were most likely to report gains in sticking with a task until it is finished, making changes when things do not go as planned, and including others' ideas when making decisions. They were least likely to report gains in connecting a topic or idea with personal values or beliefs.</p>
	<p>Students reported in open-ended questions and in focus groups that the opportunity to develop 21st Century skills such as teamwork, critical thinking, communication, and problem solving are primary benefits of participating in JSS.</p>
	<p>No significant differences in 21st Century Skill gains were found by U2 status or any demographic area examined.</p>
<p>Students reported substantial gains in their learning related to their STEM identities – their interest in and feelings of capability about STEM.</p>	<p>A large majority of students (78% - 99%) reported gains in all areas of their STEM identities as a result of participating in JSS. Students were most likely to report gains in feeling like they had accomplished something in STEM, feeling more prepared for a more challenging STEM activities, and thinking creatively about a STEM project or activity. They were least likely to report gains in interest in a new STEM topic.</p>
	<p>No significant differences in STEM identity gains were found by U2 status or any demographic area examined.</p>
<p>Priority #2: <i>Support and empower educators with unique Army research and technology resources.</i></p>	
<p>Mentors reported using a range of mentoring strategies with students, although very few mentors responded to the questionnaire.</p>	<p>A majority of mentors reported using all strategies associated with each area of effective mentoring with the exception of helping students with their resumes, applications, personal statements, and/or interview preparation.</p>
	<p>Very few mentors (n=3-4) responded to questionnaire items.</p>



<p>Most students expressed high levels of satisfaction with their JSS experiences, although students also had a variety of suggestions for program improvement.</p>	<p>Large majorities of students expressed some level of satisfaction with all features of JSS they had experienced. Students were most likely to be somewhat or very much satisfied with the help they received from their teachers/mentors during JSS (79%) and the location of JSS (74%). Few students expressed dissatisfaction with any JSS feature (less than 8%). Nearly half of students (42%) had not experienced guest speakers during JSS.</p> <p>Students were overwhelmingly positive in their comments about their satisfaction in open-ended questions and in focus groups. Students particularly attributed their satisfaction to the opportunity to learn about STEM topics, have fun, work in teams, learn about careers, and develop their critical thinking and problem solving skills</p> <p>Students made a wide variety of suggestions for program improvement including providing more or better materials and/or equipment; clarifying JSS rules; aligning regional and national competition rules; revising rules to allow more diverse car designs; and providing more online resources and information about AEOPs.</p>
<p>Mentors reported satisfaction with JSS features and online supports and noted a number of strengths of JSS. Mentors also made suggestions for program improvement.</p>	<p>Mentors who responded to the questionnaire reported being satisfied with JSS features they had experienced and the online supports they had experienced (50%-75% somewhat or very much satisfied).</p> <p>Mentors responding to open-ended questions and participating in the focus group noted a number of strengths of JSS including students' exposure to hands-on STEM problem solving, the opportunity to see other teams' projects, teamwork, the opportunity to overcome adversity and learn from failure, STEM learning, and career information.</p> <p>Mentors suggested a range of program improvements, including standardizing rules and competition conditions at the state and national levels, clarifying rules, providing more examples of successful cars and presentations, creating a discussion board for team advisors and/or providing a list of email contacts for experienced team advisors who could answer questions from less experienced advisors, providing more questions for advisors to use to prompt student thinking, changing the challenge or the competition track from year to year, and adding a kick-off event.</p>
<p>Priority #3: <i>Develop and implement a cohesive, coordinated and sustainable STEM education outreach infrastructure across the Army</i></p>	
<p>Students reported various motivations for participating in JSS, and most had learned</p>	<p>The few students (n=8) who responded to a questionnaire items about their motivation for participating in JSS cited having fun, an interest in STEM, and the desire to learn something new as primary motivators for participation.</p>

<p>about the program through their teachers or communications through their schools.</p>	<p>Students in focus groups were motivated to participate in JSS because of the problem-solving and engineering aspects of the program, interest in alternative energy sources, to be with friends, and to get career information.</p>
	<p>Students learned about AEOP and JSS through their teachers; school newsletters, emails, or websites; and from friends.</p>
<p>Few students had participated in any AEOP other than JSS and most were not interested in participating in AEOPs other than JSS in the future.</p>	<p>A small number of students (12%) had participated in GEMS and/or eCYBERMISSION in the past. No other students had participated in any other AEOP other than JSS although nearly 40% reported having participated in JSS in the past.</p>
	<p>Few students (15% or less) expressed interest in participating in any AEOP other than JSS in the future. Over half (64%) expressed some level of interest in participating in JSS again, however.</p>
<p>Students reported learning about STEM careers generally during their JSS experiences and, to a lesser extent, about STEM careers within the Army or DoD and identified the AEOP website as the most helpful resource for learning about DoD STEM careers.</p>	<p>A large majority of students (78%) reported learning about at least one STEM career in general while fewer (56%) reported learning about at least one STEM career within the Army or DoD.</p>
	<p>Students were most likely to report that the AEOP website impacted their awareness of DoD STEM careers (56%). A third of students reported that the AEOP brochure impacted this awareness. Very few students (4%) indicated that their mentors were impactful in terms of their awareness of DoD STEM careers.</p>
<p>Students who had opinions about DoD research and researchers held positive perceptions, although many students did not have an opinion about these topics.</p>	<p>Approximately two-thirds of students had favorable opinions about DoD research and researchers. For example, most students agreed that DoD researchers solve real-world problems (67%) and that DoD research is valuable to society (65%).</p>
	<p>Many students (24%-31%) had no opinion about DoD research and researchers.</p>
<p>Students reported being somewhat more likely to engage in STEM activities in the future after participating</p>	<p>About half or more of JSS students indicated they were more likely to engage in a number of STEM activities after participating in JSS including playing or working with a mechanical or electrical device (63%); using a computer to design or program something (59%); and working on a STEM project or</p>



<p>in JSS, although many reported no change in their likelihood of future engagement, and male participants experienced larger impacts than females in this area.</p>	<p>experiment at a university or professional setting (57%). More than a third of students (31%-61%) reported that their likelihood of engaging in each activity was about the same as before participating.</p>
	<p>While few students reported that they were less likely to engage in STEM activities after participating in JSS (5%-12%), many students (31%-61%) reported that there was no change in the likelihood that they would engage in future STEM activities after participating in JSS.</p>
	<p>No significant differences in likelihood to engage in STEM activities in the future were found by U2 status or any demographic area examined.</p>
<p>JSS had positive impacts on students in areas of their STEM learning, interest, appreciation for STEM research, and interest in STEM careers.</p>	<p>Most students (51%-72%) reported that JSS impacted their interest in, awareness of, and appreciation for STEM. Items for which students were most likely to report high levels of JSS impact included confidence in their STEM knowledge, skills, and abilities; interest in participating in STEM activities outside of school requirements; and their appreciation of Army or DoD STEM research.</p>
	<p>More than a third of students (40%) reported that JSS had not increased their awareness of Army or DoD STEM research and careers. In spite of this, slightly over half (51%) indicated that after JSS they were more interested in pursuing a STEM career with the Army or DoD.</p>
	<p>No significant differences in overall impact of JSS participation were found by U2 status or any demographic area examined.</p>

Responsiveness to FY17 Evaluation Recommendations

The primary purpose of the AEOP program evaluation is to serve as a vehicle to inform future programming and continuous improvement efforts with the goal of making progress toward the AEOP priorities. In previous years the timing of the delivery of the annual program evaluation reports has precluded the ability of programs to use the data as a formative assessment tool. However, beginning with the FY17 evaluation, the goal is for programs to be able to leverage the evaluation reports as a means to target specific areas for improvement and growth.

Evaluation recommendations from FY17 made to programs are highlighted along with a summary of efforts and outcomes reflected in the FY18 APR toward these areas.

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



FY17 Finding: JSS has made strong strides in FY17 to grow the representation of participants from underserved groups, as mentioned above. We recommend that JSS continues to focus on growing the percentage of ethnic/racial groups again in FY18 to bring even more participation of students from those groups in the program.

JSS FY18 Efforts and Outcomes:

- Marketing and communications will focus primarily on TSA Title 1 Schools (early in the school year) to implement JSS into the curriculum. Kits will be provided to a certain number of TSA Title 1 Schools.
- Solar kits will continue to be provided to populations/STEM groups that have contacted TSA regarding interest in the JSS program. Examples include Girls, Inc. (Florida), Florida's Governors Council on Indian Affairs, STEM in American Samoa.
- JSS Jumpstart will continue to be promoted to 5th and 6th graders housed in elementary schools with an emphasis on Title 1 schools. Most JSS Jumpstart schools that participated in 2017-2018 were Title 1 Schools.

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

FY17 Finding: As in FY16, participants (adult and youth) valued the resources available to them through TSA. However, many students reported that directions for the JSS competition were unclear or incorrect. It is recommended that TSA review all rules, guidelines, and resources and update with relevant current information.

Nearly half of students (48%) reported no awareness of Army/DoD STEM jobs or careers. Further, 24% shared JSS had not increased their awareness of Army/DoD STEM research. Mentors reported very little knowledge of other AEOPs and AEOP/DoD careers. Interestingly, 55% of participants indicated an interest in STEM careers with the Army/DoD. Therefore, it is recommended that JSS continue to find ways to integrate this content into the programming at regional and national competitions. Further, JSS should provide more support to adults who will serve as mentors to students in the form of training and awareness of AEOPs and AEOP/DoD careers. One potential strategy may be to engage more Army/DoD scientists & engineers in the national and regional competitions.

JSS FY18 Efforts and Outcomes:

- Updates to the TSA JSS event guidelines are made at the start of the school year to address any changes or modifications that are necessary to clarify rules. Updates are then posted on the TSA updates page on the website. For the 2019-2020 school year, the TSA Middle School Guide of Competitive Events, to include JSS, will be reviewed, updated, and modified to ensure clarity.
- Resources on the JSS resource page and TSA JSS webpage have been updated to include JSS and Next Generation Science Standards, as well as a link to a recorded webinar on JSS content.



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

FY17 Finding: As in FY16, student participants continued to report having little knowledge of other programs in the AEOP. In fact, fewer than 15% were aware of any AEOPs besides JSS. As a result, most students did not indicate interest in participating in other AEOPs. Only 5% were interested in eCM and 13% in GEMS specifically. This may be due to the fact that most mentors (82%) reported they did not recommend other AEOPs to students. Similar to FY16, it is recommended that JSS invest significant efforts into making this a focus of the marketing and programming for JSS at both regional and national levels. JSS should specifically promote all AEOPs with special emphasis on those programs that would be next in the pipeline for participants (e.g. eCM, GEMS).

JSS FY18 Efforts and Outcomes:

- AEOP branded materials (brochures, age appropriate rack cards-GEMS, JSHS-pencils, stickers) were sent to TSA State Advisors for state conference events.
- A well-attended AEOP speaker panel was held at the 2018 national TSA conference. The panel shared experiences from other AEOP Programs (GEMS, JSHS).
- A well-attended AEOP Special Interest Session was held at the 2018 national TSA conference.
- Jerry Crabb, from the U-S ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND, spoke about AEOP and its' mission at a TSA General Session attended by over 7000 TSA members. The AEOP video, *IT STARTS HERE! AEOP and Your STEM Future!*, was also shown.
- AEOP presence was highly promoted at the 2018 national TSA conference through AEOP banners, door clings and brochures disseminated at advisor meetings.

FY17 Finding: The low response rates for regional completion of JSS evaluation survey(s) continued to be an issue that was more persistent in FY17. A new effort to grow national level participation produced excellent participation through the use of evaluators on site with tablets and facilitated groups of students completing the evaluation survey. It is recommended that this format continue to be followed in FY18. Further, after discussion with TSA and the CAM the evaluation will only focus on Army labs for the regional level evaluation completion in FY18. TSA should work closely with the Army labs to provide support and encouragement to complete the required components.

JSS FY18 Efforts and Outcomes:

- Participation in on- site focus groups and completion of post-event surveys is a requirement for participating in the Junior Solar Sprint event at the national conference.



- Email reminders were sent to all POC's at army hosted sites reminding of completion of post-event surveys.

Recommendations for FY19 Program Improvement/Growth

FY18 was an overall successful year for JSS, as reflected in the evaluation findings. JSS maintained and slightly grew their percentage of underseved students (from 29% in FY17 to 34% in FY18). JSS participants continued to report strong gains in their STEM content knowledge and 21st Century Skills as a result of participating in the JSS program. However, there are some areas that were identified as challenges for JSS and these areas are the basis for FY19 recommendations for program improvement.

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

In FY18 JSS slightly increased the percentage of underserved student participants in the program to 34% (compared to 29% FY17). It is recommended that in FY19 JSS continue efforts to focus on reaching more potential groups from U2 backgrounds to engage them in the program.

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

As in FY16, FY17, and FY18, participants (teachers/mentors and students) continued to report challenges with aligning regional and national competition rules. It was also suggested that JSS consider revising rules to allow for more creativity in car design. In FY18, JSS revised guidelines for the middle school level and updated the website resources related to rules. However, due to the fact that students and adults still reported issues with clarity, we recommend that JSS continue to work on making things more transparent and accessible to participants while also considering how to possibly allow for more creativity in design if at all possible.

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

1. As in FY16, FY17, and FY18 student respondents (national competition participants) continued to report having little knowledge of other programs in the AEOP. In fact, 15% or less expressed interest in participating in any AEOP other than JSS in the future. The response rate for the mentor survey was incredibly low (only four mentors responded), but of that group, only three discussed GEMS, two discussed JSHS, none discussed Unite, and only one discussed apprenticeship programs with students. This may be correlated to the lack of interest expressed by students. Therefore, we recommend that JSS develop more supports, materials, and requirements that



are embedded in the JSS program/competition for teachers at the regional level, as well as national level.

2. The low response rates for mentors/teachers in JSS (four respondents) was much too low to do any kind of meaningful analysis of findings for FY18 from this group. It is recommended that JSS develop a strategy for engaging adults in completing the survey. This strategy should include a mandate for participating teachers in the program to complete the survey, particularly for those who have students competing at the national competition.

To view the rest of the report:

[JSS Evaluation Report Narrative Part 2](#)

[JSS Evaluation Report Appendices Part 3](#)