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ARMY EDUCATIONAL OUTREACH PROGRAM

2022 Junior Solar Sprint (JSS) Evaluation Report Summative Findings

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Executive Summary

The Army Educational Outreach Program (AEOP) offers students and teachers science, technology, engineering and mathematics (STEM) programming that is designed to attract, develop, and mentor the next generation of the nation's diverse talent through United States (U.S.) Army educational outreach programs.

Education Development Center, Inc. (EDC), the external evaluation partner for AEOP, conducted a summative evaluation of the 2021-2022 program year. The FY22 evaluation sought to document and assess the benefits of participation, program strengths and challenges, and overall effectiveness in meeting AEOP and program objectives. For most AEOP programs, the primary tools for data collection were student and mentor post-surveys. Since there were only three participants and six team advisors (2% and 17% response rates, respectively) from Junior Solar Sprint (JSS) who responded to the surveys, we have not included these results. However, we also conducted a site visit during the national competition, during which we gathered data and information via focus groups with participants. The findings presented in this report are from the four student focus groups and one team advisor focus group. It is important to recognize that these findings only reflect those individuals who competed at the national event and cannot be generalized across the JSS entire program.

Key findings from the site visit and focus groups are presented below.

Overview of Participants

AEOP has a particular focus on reaching participants who have more limited access to STEM learning opportunities and/or who are from groups that are underrepresented in STEM education and careers. AEOP defines underserved and underrepresented participants as those who possess one or more of the following characteristics: attend a rural, urban, or frontier/tribal school; identify as female; identify as racial/ethnic minority in STEM (i.e., Alaska Native, Native American, Black or African American, Hispanic, Native Hawaiian and other Pacific Islander, other); receive free or reduced meals price at school; speak English as a second language (ELL); first generation college student; students with disabilities; or a dependent of a military service member or veteran. AEOP has identified a particular interest in reaching students who meet two or more of the underserved and underrepresented criteria described above (referred to hereafter as Underserved). **In FY22, 84% of all JSS student participants met two or more of the Underserved criteria. An additional 16% of student participants met just one of the AEOP Underserved criteria.**¹

Participant Experience and Outcomes

Students and team advisors noted that participants acquired STEM skills and increased awareness of and interest in STEM careers. For example, several students stated that they learned more about engineering and became more interested in the engineering field as a result of participating in the program. Team advisors also noted that students learned how to

¹ Based on demographic data included in program registrations.

experiment and conduct research and find solutions and answers for their projects, which they consider a valuable learning experience. Team advisors additionally discussed how the JSS program has encouraged students to pursue STEM classes or consider a career in STEM.

Students and team advisors indicated that the participants had opportunities to work in teams, solve problems, and resolve conflicts. Many students reported that they enjoyed working in teams. Students also indicated that they learned how to problem solve and resolve conflicts among team members as a result of their JSS experience. Team advisors also mentioned that having students working together on a project prepares them for college and future careers.

The team advisors noted that they are not very hands-on with their students, as they provided the space for students to solve their problems. Team advisors believed that this is a real-life skill, and this teaches their students to understand how to work together as a team. Therefore, when students ask the team advisors for help or advice on their projects, the team advisors generally would probe them with more questions than answers to allow them to figure out their issue.

Participants offered some suggestions for improvement; they most frequently pointed to a desire for better quality or more supplies. For example, team advisors mentioned the need for better batteries and additional panels for the solar cars. Students additionally mentioned a desire for extra parts and supplies for the solar car kits (e.g., motor, solar panels, battery packs, and small wires).

Recommendations

This report distills findings from the focus groups and observations conducted at the national competition. It is worth noting that the results only reflect a subset of individuals who competed at the national event and cannot be generalized across the entire program. In addition, the focus group topics narrowed in on a few areas of interest and were meant to supplement data gathered through surveys. As a result, while these findings offer some insights into the JSS program, this report does not provide a complete or representative account of outcomes from the program. However, based on the results presented in this report, we offer the following considerations:

Programmatic Considerations

- **Continue to offer hands-on, authentic, relevant research experiences.** Research shows these kinds of experiences are important to developing and sustaining students' interest in STEM education and career pathways.
- **Consider ways to address feedback regarding the national competition experience,** including adequate or extra supplies for the solar car kits.
- **Explore ways to improve program registration.** In FY22, 163 participants (135 students and 28 team advisors) were registered in Cvent, the program registration

platform, and verified with program staff. Accurate registration data is relevant for reporting purposes, including demographics and underserved representation.

Evaluation Considerations

- **Continue to examine ways to increase response rates.** As noted above, the low response rates makes it difficult to generalize the findings for the JSS program. The EDC evaluation team is working with IPAs to troubleshoot these issues and develop strategies to improve response rates in the future.

1 Introduction

1.1 AEOP Priorities & Goals

The Army Educational Outreach Program (AEOP) mission provide an accessible pathway of science, technology, engineering, and mathematics (STEM) opportunities to attract, develop, and mentor the next generation of our nation’s diverse talent through United States (U.S.) Army educational outreach programs.

AEOP has three priorities:

1. **STEM Literate Citizenry.** Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base (DIB).
2. **STEM Savvy Educators.** Support and empower educators with unique Army research and technology resources.
3. **Sustainable Infrastructure.** Develop and implement a cohesive coordinated, and sustainable STEM education outreach infrastructure across the Army.

The Junior Solar Sprint (JSS) program, managed by the Technology Student Association (TSA), is an AEOP program that focuses on STEM concepts. The program is available for 5th-8th grade students and provides the opportunity for students to 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, student associations, and as community-based events that are independently hosted and sponsored.

1.2 Overview of Participants

In FY22, Junior Solar Sprint served a total of 163 participants through Army sites – 83% (135) were students and 17% (28) were adults (educators, team advisors, S&E volunteers, or other adults).

In FY22, 84% of all JSS student participants met two or more of the Underserved criteria. An additional 16% of student participants met one of the AEOP Underserved criteria.

AEOP has a particular focus on reaching participants who have more limited access to STEM learning opportunities and/or who are from groups that are underrepresented in STEM education and careers. AEOP has identified an interest in reaching students who meet two or more of the underserved and underrepresented criteria (referred to hereafter as Underserved).

2 Evaluation Approach

Education Development Center, Inc. (EDC) became AEOP's external evaluation partner in fall 2021. The primary tools for data collection were student and mentor post-surveys, which were designed to evaluate the benefits of participation, program strengths and challenges, and overall effectiveness in meeting AEOP and program objectives. In addition to the surveys, we conducted site visits for Junior Solar Sprint (JSS) and a selection of other programs to further understand and document the implementation, experience, and the impact of the individual programs. The findings presented in this report are from the four student focus groups and one team advisor focus group conducted at the JSS national competition. It is important to recognize that these findings only reflect a subset of individuals who competed at the national event and cannot be generalized across the entire program.

2.1 Focus Group Respondents

This report describes results from four focus groups with students and a separate focus group team advisors during the national competition in Dallas, TX on June 29-30, 2022. Each of the focus groups was facilitated by an EDC evaluator and lasted about 30-45 minutes long. The student focus groups ranged between 10 to 25 students; the team advisor focus group included 3 participants. JSS participants voluntarily signed up to be part of a focus group during the beginning of the national competition.

2.2 Limitations

As noted above, the results shared in this report only reflect a subset of individuals who competed at the national event and cannot be generalized across the entire program. In addition, the focus group topics narrowed in on a few areas of interest and were meant to supplement data gathered through surveys. As a result, while these findings offer some insights into the JSS program, this report does not provide a complete or representative account of outcomes from the program.

2.3 Report Organization

Evaluation findings presented below are guided by the research questions and organized thematically by topic. Sections include the following:

- Overall Experience
 - Reasons for participating
- Benefits of the JSS Program
 - STEM Skills and Interest in STEM Careers
 - Development of 21st Century Skills
- Role of Team Advisors
- Suggestions for Improvement

3 Evaluation Findings

The overarching goals of the site visit and focus groups were to:

- Learn about the range of participant experiences first-hand through speaking to students, mentors/team advisors, and program staff.
- Gain a contextual understanding of program facilitation and structures through direct observations.
- Gather input on the strengths and areas of improvement of programs, adding depth to other data collection efforts (e.g., surveys, interviews with program leads).
- Understand the influence of the program on students and other participants.

Major findings from this data collection effort are presented below.

3.1 Reasons for Participating

Students. There were various reasons as to why students decided to get involved in the program. For many students, this was their first time participating in JSS and the national competition. Many students heard of the program from their team advisor or their teacher. Others learned about the program through friends. Several students mentioned that they thought the idea of building a solar car was “cool” and that the program looked interesting. Other students mentioned that they were interested in science and technology and joined because the focus was STEM.

Team Advisors. The JSS team advisors got involved in the program in several ways. One team advisor, who teaches engineering and technology, received a grant for a JSS program at his school and was able to incorporate the program into his classroom. Another team advisor, who teaches pre-engineering courses, got involved because their career and technical director wanted to get middle schoolers involved in STEM competitions. One team advisor stated that they got involved by either being invited to an event or were informed that there was a JSS grant available.

3.2 Benefits of the JSS program

During the focus groups we asked students and team advisors about their program experience and their overall learnings from the JSS program. Findings are summarized below.

STEM Skills and Interest in STEM Careers

Students and team advisors noted that participants acquired STEM skills and increased awareness of and interest in STEM careers.

- Several students stated that they learned more about engineering and became more interested in the engineering field as a result of participating in the program.
- Team advisors reported that students learned new skills as a result of their participation in JSS. For example, team advisors noted that students learned how to experiment and

conduct research and find solutions and answers for their projects, which they consider a valuable learning experience.

- Team advisors also discussed how the JSS program has encouraged students to pursue STEM classes or consider a career in STEM. One team advisor mentioned that in the state that he is from, they receive financial incentives from the department of education when students complete CTE programs. Another team advisor talked about the new push for trade or technical careers in his district, which has been encouraging students to go to trade schools, community colleges, or technical colleges.

Development of 21st Century Skills

Students and team advisors indicated that the participants had opportunities to work in teams, solve problems, and resolve conflicts.

- Many students stated that they enjoyed working in teams. Some students noted that the JSS program taught them how to work in a team environment. Students also indicated that they learned how to problem solve and resolve conflicts among team members.
- Team advisors also mentioned that having students working together on a project prepares them for college and future careers. One team advisor mentioned the importance of building the skills of students for current and future industries.

3.3 Role of Team Advisors

The team advisors also talked about their role as an advisor and the dynamics of group work. The team advisors noted that they are not very hands-on with their students, as they provided the space for students to solve their problems. Team advisors believed that this is a real-life skill, and this teaches their students to understand how to work together as a team. Therefore, when students ask the team advisors for help or advice on their projects, the team advisors generally would probe them with more questions than answers to allow them to figure out their issue. One team advisor stated that they provide students with a lot of freedom when they are building their solar cars. He allowed his students to work out their problems and only intervenes if they cannot solve their issue. Another team advisor mentioned that students are comfortable with working in groups because they do a lot of group work during the school day. Therefore, students know how to collaborate with each other, and team advisors provide guidance to students when needed.

“If they're saying, well, you know, well we want to do this. What do you think? I was like, well, I think that's an idea. Why don't you try it out? Even if he said, you know, it's going to fail... then you can say, well what did you see from that? Where can you now make changes? And they learn a lot more from that.” –JSS Mentor

3.4 Suggestions for Improvement

Students. When asked about program improvements, the students offered a range of suggestions.

- A number of students felt that the track was too bumpy and stated that the program should inform students that they should test their cars on different surfaces.
- Many students said that the competition instructions were unclear and confusing at times.
- Some students did not like that the cars were battery powered and wished that the cars were solar.
- Other suggestions included: advertise the program more to generate greater interest, have different themes for the competition, and provide extra parts and supplies for the solar car kits (e.g., motor, solar panels, battery packs, and small wires).

Team Advisors. The team advisors also provided some suggestions for improvement.

- Like the students, team advisors also mentioned that the surface that was used for the competition became an issue because the students were not aware of the type of surface they had to use for the competition. They suggested that JSS should give students time to test out the solar cars on the surface provided and give them opportunity to work out any kinks.
- A couple of the team advisors mentioned that the program should provide better batteries for the solar cars.
- The team advisors also expressed a desire for additional panels within the kits that they received because as students were building their solar cars, the panels were breaking. For example, one team advisor stated, “I wished that the kits had more solar panels and bags. They broke a lot on the way...”

4 Recommendations

This report distills findings from the focus groups and observations conducted at the national competition. As stated in the limitations, data collected for this evaluation are not necessarily representative of the entire JSS program; however, based on the results presented above, we offer the following considerations:

Programmatic Considerations

- **Continue to offer hands-on, authentic, relevant research experiences.** Research shows these kinds of experiences are important to developing and sustaining students' interest in STEM education and career pathways.
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Evaluation Considerations

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