2023 JSHS Evaluation Report
Summative Findings

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Contents

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. The Junior Science and Humanities Symposium (JSHS) is a joint DoD-sponsored STEM competition (U.S. Secretary of the Defense and the U.S. Departments of the Army, Navy, and Air Force) which promotes original STEM research and experimentation at the high school level and publicly recognizes students for outstanding achievement.

The primary tools for data collection were student post-surveys sent to all regional JSHS participants (356 surveys; 12% response rate) and 24 participants who volunteered to participated in focus groups at the national competition for JSHS. **Key findings from the evaluation are presented below.**

OVERVIEW OF PARTICIPANTS

In FY23, JSHS served a total of 3,081 student participants. A total of 60% of the JSHS participants met the JSHS definition of underrepresented populations and met one or more criterion. This underscores JSHS's focus on inclusivity, targeting those often underrepresented in STEM, such as students from diverse geographic and socioeconomic backgrounds, females[1], racial/ethnic minorities, English Language Learners, first-generation college students, individuals with disabilities, and military families.

PARTICIPANT EXPERIENCE AND OUTCOMES

Development of STEM Knowledge and Skills

Students increased their STEM knowledge and skills. The majority of students had the opportunity to conduct research, solve real-world problems, and learn from STEM researchers. Students gained knowledge about specific STEM topics, knowledge of how scientists and engineers work on real problems and knowledge about what everyday research in STEM looks like. Overwhelmingly, between 93% and 97% of students reported gains in each of these areas.

Development of 21st Century Skills

[1] In JSHS, only females engaged in certain STEM fields (physical science, computer science, mathematics, or engineering) are considered as underrepresented.

Students noted gains in 21st Century skills, including communication and collaboration; critical thinking and problem solving; and creativity and innovation. The majority of students (between 71% and 95%) indicated increased competencies in these areas.

Interest in STEM and STEM Careers

Students' interest in STEM and STEM careers increased, including Army/DoD careers. Most students reported that they were more likely to engage in STEM activities after their participation in JSHS (ranging between 82% and 96%). The vast majority of students (93%) reported that the program had influenced their interest in pursuing a STEM degree, and that they were more interested in pursuing a STEM career.

Perceptions of DoD

Students gained a greater appreciation of and interest in Army/DoD STEM research and careers through their participation in JSHS. A substantial portion of students reported that they had a greater appreciation of DoD STEM research (80%) and over half (55%) were more interested in pursuing a STEM career with the DoD.

Impact of Mentors

Mentors used a variety of strategies to engage with students. Most students reported that mentors used strategies to support the student's needs. Across an array of items, student responses fell between 64% and 96%. The highest percentages, (above 90%), were reported in three key areas; mentors gave participants feedback to improve their STEM projects, helped participants to practice a variety of STEM skills, and provided extra support when needed.

Overall Experience

Students reported generally positive experiences with JSHS. Students enjoyed learning new STEM skills, increasing their knowledge about STEM research and STEM careers, working on real-world problems to improve communities, and learning from STEM professionals.

Most suggestions for improvement pointed to a need for improving opportunities for collaboration and peer-based learning communication. Some also noted a desire to improve judging to allow for more feedback.

RECOMMENDATIONS

This report distills findings across the regional student participant surveys as they align with AEOP's overarching research questions as well as focus group discussions held at the National JSHS. Data collected for this evaluation are not necessarily representative of the entire program; however, based on the results presented above, we offer the following recommendations:

Programmatic Considerations

Continue to offer relevant research experiences connecting with communities. Student feedback indicated that they appreciated conducting research that connected their work to their communities and the world beyond.

Improve judge to participant engagement. Students indicated they wanted an opportunity to ask judges questions, receive more feedback, and engage with judges beyond the current time allocation. Students felt they would benefit from more feedback from judges.

Consider providing more opportunities for peers to learn from each other. Students wanted more opportunities to learn about the types of projects their peers were working on and better prepare for upcoming competitions.

Consider ways to support students in increasing their collaboration and team-building skills. The student surveys indicated participants were engaging in research and that collaboration was often a part of that process. However, bolstering students' experiences related to leadership and/or team-based problem-solving practices could be an opportunity for development.

Evaluation Considerations

Continue to examine ways to increase response rates. The low response rate makes it difficult to know how generalizable the findings are across JSHS.

1 Introduction

1.1 AEOP PRIORITIES & GOALS

The Army Educational Outreach Program (AEOP) mission is to 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 JSHS is a jointly DoD-sponsored STEM competition (U.S. Secretary of the Defense and the U.S. Departments of the Army, Navy, and Air Force) which promotes original STEM research and experimentation at the high school level and publicly recognizes students for outstanding achievement.

1.2 OVERVIEW OF PARTICIPANTS

In FY23, JSHS served a total of 3,081 student participants.

AEOP has a focus on reaching participants who have more limited access to STEM learning opportunities and/or who are from groups that are underserved in STEM education and careers. JSHS defines underrepresented participants as those who possess at least one of the following characteristics: attend a rural, urban, or frontier/tribal school; identify as female[2]; 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 (referred to hereafter as underrepresented).

In FY23, 60% (1,178) of all JSHS participants met one or more of the underrepresented criteria listed above.

[2] In JSHS, only females engaged in certain STEM fields (physical science, computer science, mathematics, or engineering) are considered as underrepresented..

2 Evaluation Approach

Education Development Center, Inc. (EDC) is AEOP's external evaluation partner. The primary tools for data collection were student[3] 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 administering student surveys, the evaluation team conducted a site visit to the National JSHS competition in April 2023. The main purpose of the site visit was to learn first-hand about the range of participant experiences. EDC sought to gain understanding of program facilitation and structures through direct observation, and we spoke to participants to gather their input on how program influenced their interest in STEM as well as their perspectives on program strengths and areas of improvement. Furthermore, focus groups added depth to data collected through the surveys. In general, we sought to address the overarching research questions listed in Table 1.

Table 1. Research Questions Addressed in This Report

AEOP Priority	Research Questions Regarding Participants
STEM Literate Citizenry: Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.	*Participant Research Question #1* - To what extent do participants report growth in interest and engagement in STEM?
	Research Question #2a - To what extent do participants report increased STEM competencies, 21st Century/STEM skills, STEM knowledge, STEM abilities, and STEM confidence?
	Research Question #2b – To what extent do participants demonstrate use of and growth in 21st Century skills?
	Participant Research Question #3 - To what extent do participants and mentors report increased participant interest in STEM research and careers?
	Participant Research Question #4 - To what extent do participants and mentors report increased awareness of and interest in Army/DoD STEM research and careers?
	Research Question #5 - To what extent do participants report increased enrollment, achievement, and completion of STEM degree programs?
STEM Savvy Educators: Support and empower educators with unique Army research and technology resources.	*Research Question #6* - What is the impact of scientist and engineer (S&E) mentors on AEOP participants?
	Research Question #7 - To what extent do teacher participants report increased use of new approaches to teaching research concepts within STEM practices, and infusion of careers?
Sustainable Infrastructure: Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.	*Research Question #8* - To what extent do participants report growth in awareness of and/or interest in AEOP opportunities?

[3] Throughout this report, we refer to students and participants interchangeably.

2.1 SURVEY RESPONDENTS AND SITE VISIT PARTICIPANTS

This report includes results from student surveys (356 surveys; 12% response rate) and the focus groups with 24 participants at the national competition for JSHS.

2.2 LIMITATIONS

It is important to recognize that survey results only reflect those individuals who completed surveys. Due to the low response rate (12%), these results may not accurately represent the broader population involved in JSHS.

It is also important to consider the characteristics of survey respondents. For example, none of the respondents had completed high school at the time of the survey and may not be able to provide information regarding the longer-term outcomes of AEOP programs. This limitation is important because the AEOP's goals include postsecondary achievements that respondents may not yet have experienced.

2.3 REPORT ORGANIZATION

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

- Development of STEM Knowledge and Skills
- Development of 21st Century Skills
- Interest in STEM and STEM Careers
- Perceptions of DoD
- Impact Mentors on JSHS participants
- Overall experience
- Recommendations

3 Development of STEM Knowledge and Skills

Students demonstrated notable improvement in STEM knowledge and skills through their engagement in JSHS. Students reported progress in understanding scientific concepts and their practical applications. In addition, experiential learning played a crucial role in enhancing students' STEM proficiency. These findings suggest that JSHS contributes to enhancing students' understanding of core STEM concepts and research methodologies. Overall, these results underscore the importance of AEOP in fostering a robust STEM learning environment and preparing students for future success in STEM-related fields.

JSHS participants had ample opportunities to develop their STEM knowledge. In the survey, students were asked to rate their learning in specific topics ranging from "did not learn anything new" to "learned a lot." As shown in Table 2, there is a consistent pattern of reported increases. Specifically, more than 90% of participants reported gains in, a) in-depth knowledge of STEM specific topics, b) knowledge of how scientists and engineers work on real problems in STEM, c) knowledge of research processes in STEM, and d) knowledge of what everyday research work is like in STEM.

Table 2. JSHS participants had opportunities to develop STEM knowledge in a variety of areas.

Response	I didn't learn anything new	I learned a little	I learned more than a little	I learned a lot	Overall learning
In depth knowledge of a STEM topic(s)	3%	11%	18%	68%	97%
Knowledge of how scientists and engineers work on real problems in STEM	6%	17%	23%	55%	95%
Knowledge of research processes used in STEM*	5%	13%	20%	62%	95%
Knowledge of what everyday research work is like in STEM	7%	16%	23%	55%	94%

Due to rounding, totals may not equal 100%.
Participant Survey (n = 347)

Participants also reported gains in a number of STEM research skills as a result of their participation in JSHS (see Table 3). For example, students improved their understanding of how to present an argument that uses data and/or findings from an experiment (94%), identify limitations of the methods and tools used for collecting data (93%), explain their results using STEM knowledge or data from experiments (92%), carry out an experiment (91%), and record data accurately (91%).

Table 3. Students increased their STEM skills, reporting the greatest gains in presenting an argument that uses data and/or findings from an experiment.

Response	Did not learn	Learned just a little	Learned more than a little	Learned a lot	Overall Learning or Gain
How to present an argument that uses data and/or findings from an experiment	8%	10%	19%	65%	94%
How to identify the limitations of the methods and tools used for collecting data	7%	16%	24%	54%	93%
How to support an explanation with my STEM knowledge or data from experiments	8%	10%	21%	62%	92%
How to carry out an experiment	9%	13%	20%	59%	91%
How to record data accurately	9%	14%	21%	56%	91%
How to make a model to show how something works	10%	23%	21%	46%	90%
How to create charts or graphs to display data and find patterns	11%	12%	23%	55%	90%

Due to rounding, totals may not equal 100%.
Participant Survey (n = 344)

In response to open-ended survey questions, participants reported that their experiences in JSHS taught them skills such as the *"process before"* conducting research, how to collect and analyze data, and how to follow a sequence of steps when conducting research. After engaging in research, participants honed their skills in reporting results, including *"how to formulate an idea in report"* and *"research paper writing skills."*

Students increased their knowledge of how to conduct research and some also shifted the way they thought about STEM research.

"*In the research I submitted to JSHS I was able to massively sharpen my computer science skills.* -JSHS Student

"*[JSHS] showed me that research isn't intimidating.* -JSHS Student

"*[JSHS] helped me to understand the value of research more.* -JSHS Student

4 DEVELOPMENT OF 21ST CENTURY SKILLS

Students made substantial gains in 21st Century Skills, including their problem-solving, collaboration, and communication skills. These findings suggest that JSHS helped students gain skills that could prepare themselves for future collaborative endeavors in a STEM field.

The surveys asked about 21st Century skills across three main domains, shown in Table 4. Results from each of these domains are described in the following sections.

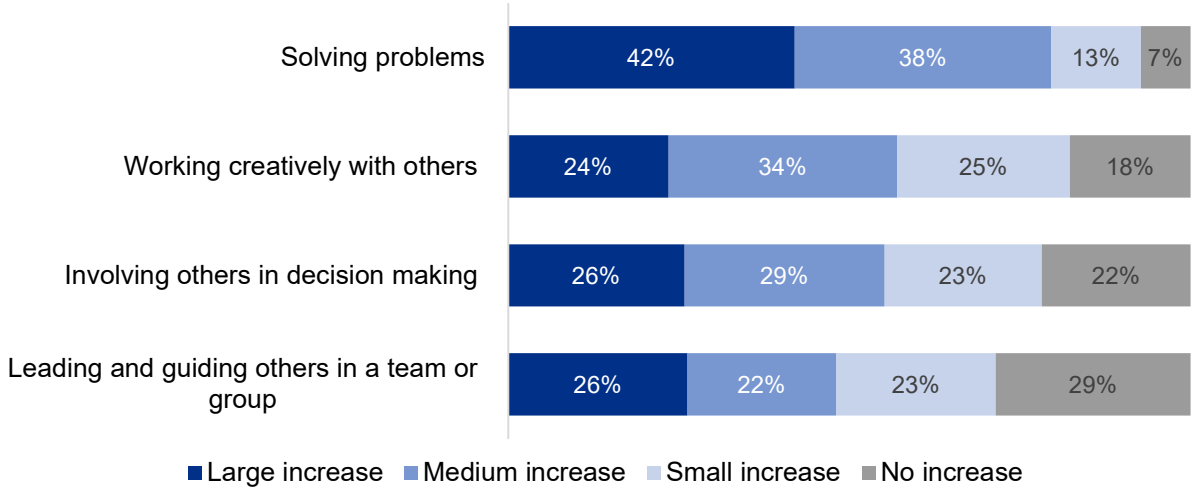
Table 4. 21st Century Skills Assessed through the Evaluation

21st Century Areas	Description
Problem-solving and collaboration	• Solving problems • Involving others in decision making • Working creatively with others • Leading and guiding others in a team
Communicating and interacting with others	• Communicate clearly with others orally • Communicate clearly with others in writing • Interacting with others in a respectful and professional manner
Community and real-world connections	• Thinking about how their work impacts the larger community

4.1 PROBLEM SOLVING AND COLLABORATION

Overall, students reported gains in their problem solving and collaboration skills. Participants reported gains in solving problems, with 93% reporting at least a "small increase." Students also gained skills in working creatively with others (with 82% reporting at least a "small increase") and in involving others in decision making (with 78% reporting at least a "small increase"). Students were least likely to report gains in leading and guiding others in a team (71%) which may be due to the design of the program where many students work individually. Figure 1 shows responses to these items across a range of responses from "large increase" to "no increase."

Figure 1. Students increased their 21st Century skills, reporting the largest gains in solving problems individually or with a team.



Participant Survey (n =343)

Many students developed their collaboration skills both through working in teams as well as through networking and connecting with others who shared similar interests. Participants reported that they "*learned to collaborate with team members and solve problems together*" as well as "*respectfully*" voice concerns. Through their JSHS experiences, students also appreciated conversations with "*renowned university scientists*" through judging and through informal activities such as round-table career talks.

Participants appreciated building an extended STEM community with peers and STEM professionals.

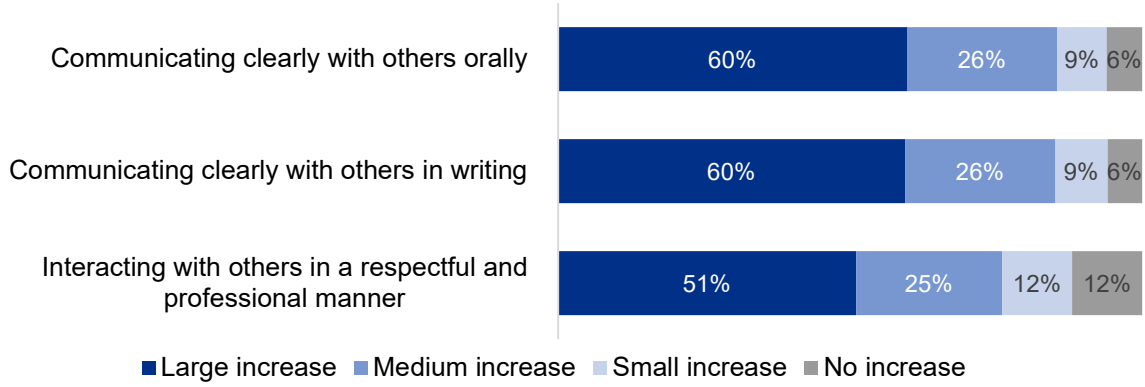
"*I learned a lot from other students, from their research presentations and posters. I found the Regional Symposium to be a healthy exchange of ideas and to be very engaging.*
-JSHS Student

"*The JSHS competition provided me with priceless connections.* -JSHS Student

4.2 COMMUNICATING AND INTERACTING WITH OTHERS

Students indicated that they improved their skills in communicating with others. The majority of students reported JSHS contributed to gains in their ability to communicate clearly with others orally (94% of students reported at least a "small increase") and in writing (95% of students). Students also improved their skills in interacting with others in a respectful and professional manner (88% of students reported at least a "small increase") (see Figure 3).

Figure 2. Students improved their communication skills.



Participant Survey (n = 346)

To strengthen their communication skills, participants engaged in presenting their projects, explaining their hypothesis, process, and their findings. Students believed that this was beneficial to them because it helped them to have a greater overall understanding of their work and to gain experience with public presentations.

Participants strengthened their communication skills through presenting their work.

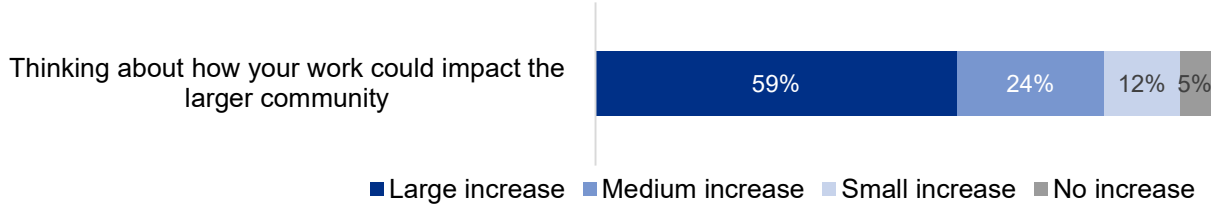
❝ *[JSHS] helped me to be more confident in communicating my research to others in a professional manner.* -JSHS Student

❝ *JSHS made me a much more confident public speaker.* -JSHS Student

4.3 COMMUNITY AND REAL-WORLD CONNECTIONS

JSHS offered many students hands-on opportunities to understand how STEM can address real-world problems that impact the larger community. As Figure 3 shows, 95% of students reported gains in thinking about how their work has the potential to impact broader communities.

Figure 3. Students increased their ability think about how their work impacts the larger community.



Participant Survey (n = 342)

Students reported that their JSHS experiences allowed them to engage in projects to better understand and solve real-world problems.

> *I learned a lot on how to relate my research to everyday life and the importance of it. It was the most important and valuable thing that I learned and had to understood when working on my project.* -JSHS Student

5 INTEREST IN STEM AND STEM CAREERS

The evaluation results show that participating in JSHS positively influenced students' interest in STEM-related pursuits, including their desire to work on future STEM projects, to explore STEM education beyond high school, and to mentor or teach other students about STEM.

5.1 STEM CONFIDENCE

Most students indicated that JSHS increased their STEM confidence. Students were asked to rate their agreement with a statement about confidence in STEM knowledge, skills, and abilities. As Table 4 shows, they overwhelmingly agreed that they were more confident in these areas as a result of their participation in JSHS (93%).

Table 5. Most Students Indicated that JSHS Increased Students' STEM Confidence

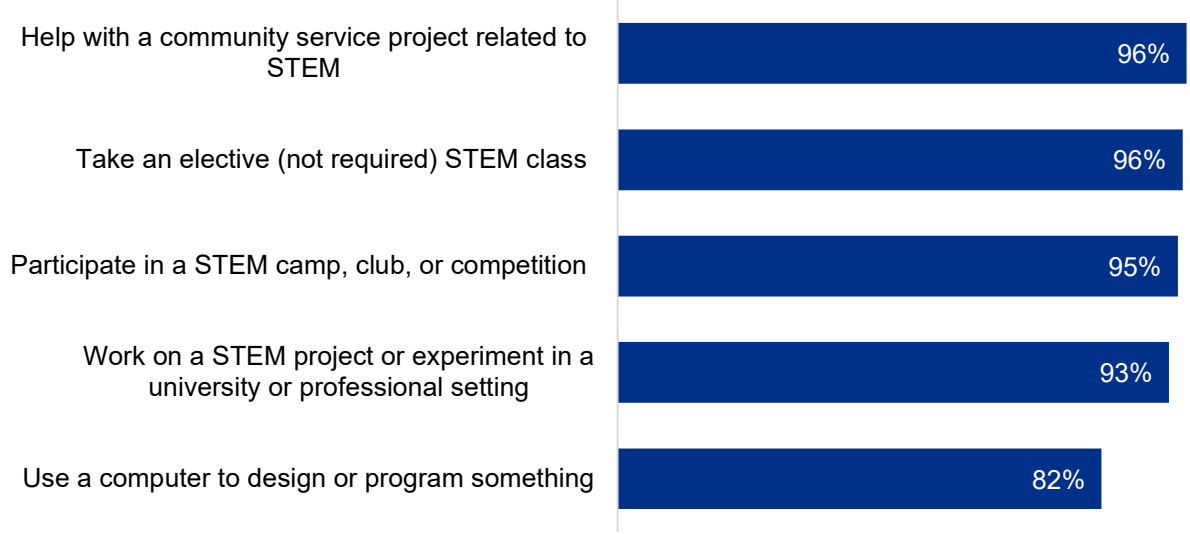
Response	Strongly Disagree	Disagree	Agree	Strongly Agree	Agree overall
I am/They are more confident in STEM knowledge, skills, and abilities	2%	6%	35%	58%	93%

Due to rounding, totals may not equal 100%.
Participant Survey; (n = 268)

5.2 INTEREST IN STEM-RELATED ACTIVITIES

Evaluation results show that participating in JSHS positively influenced students' likelihood of continued engagement in STEM. Participants were asked about their interest in continuing to engage in STEM activities after their JSHS experience. The vast majority of students said they more likely to take a non-required STEM class (96%) or to work on a STEM project or experiment in a university or professional setting (93%). Furthermore, most JSHS students reported a higher inclination to participate in informal STEM-related activities, including helping on a community service project (96% reported they were "more likely" or "much more likely"), and participating in a STEM camp, club, or competition (95%) (Figure 4).

Figure 4. Most students reported an increase in their interest in participating in other kinds of STEM-related activities.

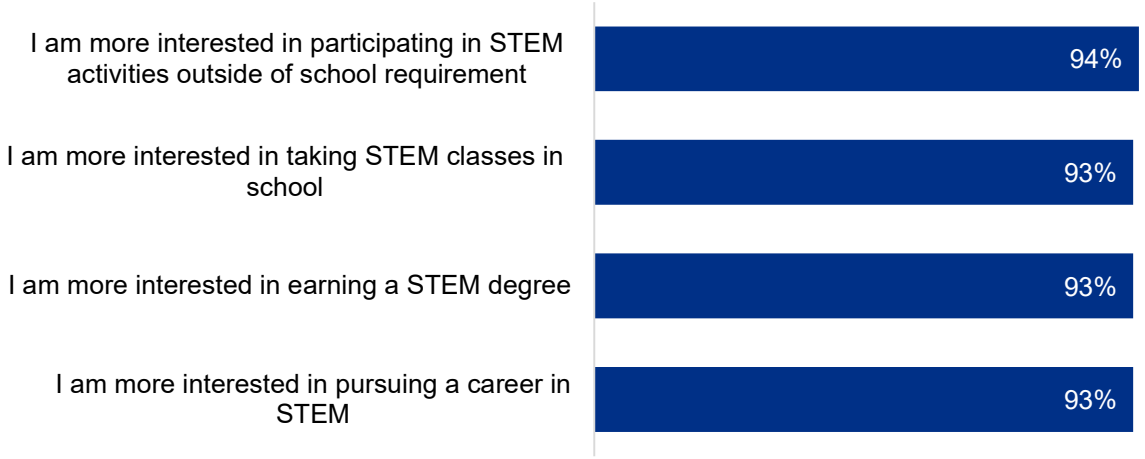


Participant Survey (n = 271)
Responses include those who reported "more likely" and "much more likely."

5.3 INTEREST IN PURSUING STEM EDUCATION AND CAREERS

JSHS had a positive influence on students' interest in STEM education and careers. As Figure 5 shows, more than nine out of 10 JSHS students reported that the program had influenced their plans to take STEM classes in school, earn a STEM degree, and pursue a STEM career.

Figure 5. Most students reported an increase in their interest in participating in other kinds of STEM-related activities.



Participant Survey (n = 269)
Responses include those who reported "Agree" or "Strongly Agree"

Several students commented about how JSHS confirmed their interest in pursuing a career in STEM.

“ *[JSHS helped] decide my future career.* -JSHS Student

“ *I've known for a long time that I want to go into anatomical pathology, but I know for sure that I'm interested in doing lab work after looking at some of those projects I was kind of in between. But now it's kind of solidified. That's the route that I want to take and I want to work in the lab.* -JSHS Student

Through their experiences in competitions, participants reported that they appreciated the opportunity to have growth-focused conversations with judges and get their feedback.

“ *I really appreciated the judges as well. They helped point me toward the right direction for my project and helped me to understand how to make it better and improve my research. The whole experience makes me want to go into college with my research and study even more for my love for science.* - JSHS Student

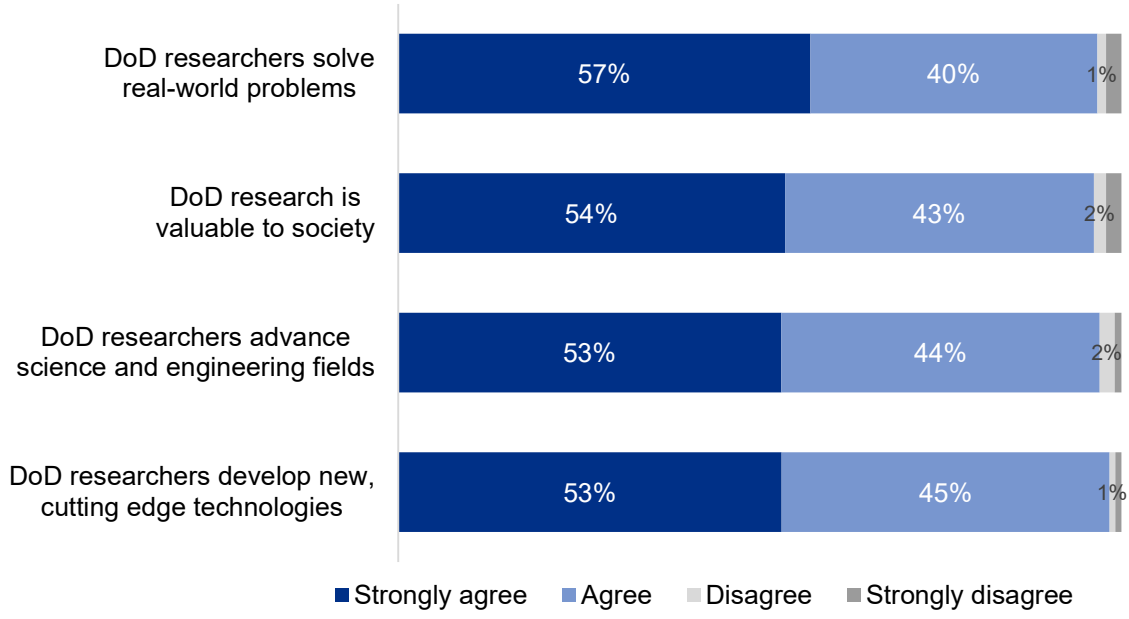
6 PERCEPTIONS OF DOD

JSHS is instrumental in educating students about the significance of Department of Defense (DoD) research in addressing real-world issues. According to evaluation results, most JSHS students recognize the value of DoD research, acknowledging its role in advancing science and engineering, developing innovative technologies, and solving practical problems. These findings underscore the potential of JSHS to provide theoretical knowledge and foster an appreciation for the real-world impact of DoD research. In addition, participation in JSHS encourages students' interest in pursuing STEM careers within the DoD, including the Office of the Secretary of Defense, Departments of the Army, Navy, and Air Force.

6.1 UNDERSTANDING OF DOD RESEARCH

Students gained a greater appreciation of and interest in DoD STEM, as well as Army, Navy, and Air and Space Force STEM research and careers through their participation in JSHS. On the survey, students were asked how much they agree or disagree with statements about DoD researchers and research. Almost all students agreed or strongly agreed that DoD researchers solve real-world problems; that DoD research is valuable to society; that DoD researchers develop new, cutting-edge technologies; and that DoD researchers advance science and engineering fields (Figure 6).

Figure 6. JSHS Students understand that DoD research is important and the different components of that research.

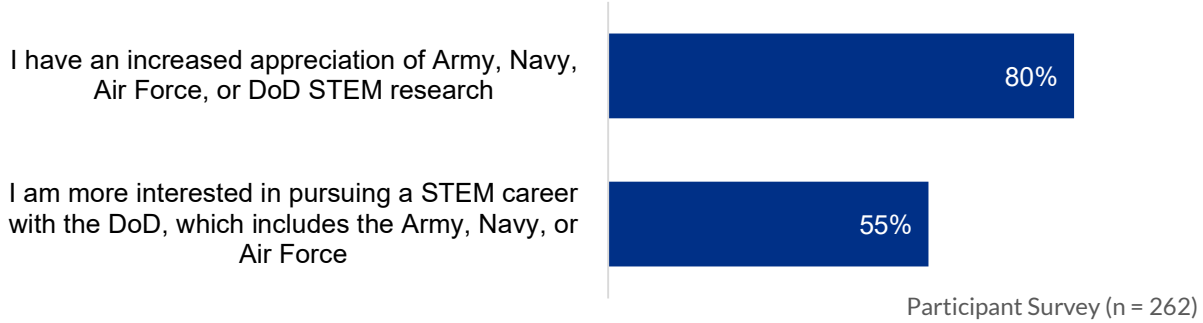


Participant Survey (n = 242)
For each category, 2% of respondents chose "Strongly disagree."

6.2 INTEREST IN DOD STEM, ARMY, NAVY, AND AIR AND SPACE FORCE STEM RESEARCH AND CAREERS

Participating in JSHS cultivates students' appreciation for and interest in DoD STEM, as well as Army, Navy, and Air Force STEM research and careers. As Figure 7 shows, a substantial portion of students reported that they had a greater appreciation of DoD STEM research (80%) and over half (55%) were more interested in pursuing a STEM career with the DoD. These findings speak to the JSHS's goal of cultivating the pathway of STEM researchers, and more specifically, expanding the opportunity for individuals who may do STEM work within the DoD.

Figure 7. Participating in JSHS Cultivates Students' Appreciation for and Interest in DoD STEM Research and Careers



Participant Survey (n = 262)
Responses include those who reported "Agree" or "Strongly Agree"

Several students commented about how JSHS increased their knowledge about career paths in STEM and exposed them to a what a career in DoD research could be.

"*It has opened up new opportunities with the Department of Defense.* -JSHS Student

"*Something that would be specific to JSHS that I haven't seen at other competitions I've never been exposed to [are] the speakers and the roundtable discussion with people who showed me an aspect of research that's more related to military organizations. At other science fairs it's more of an academic focus or industry and that was something new that I experienced here.* -JSHS Student

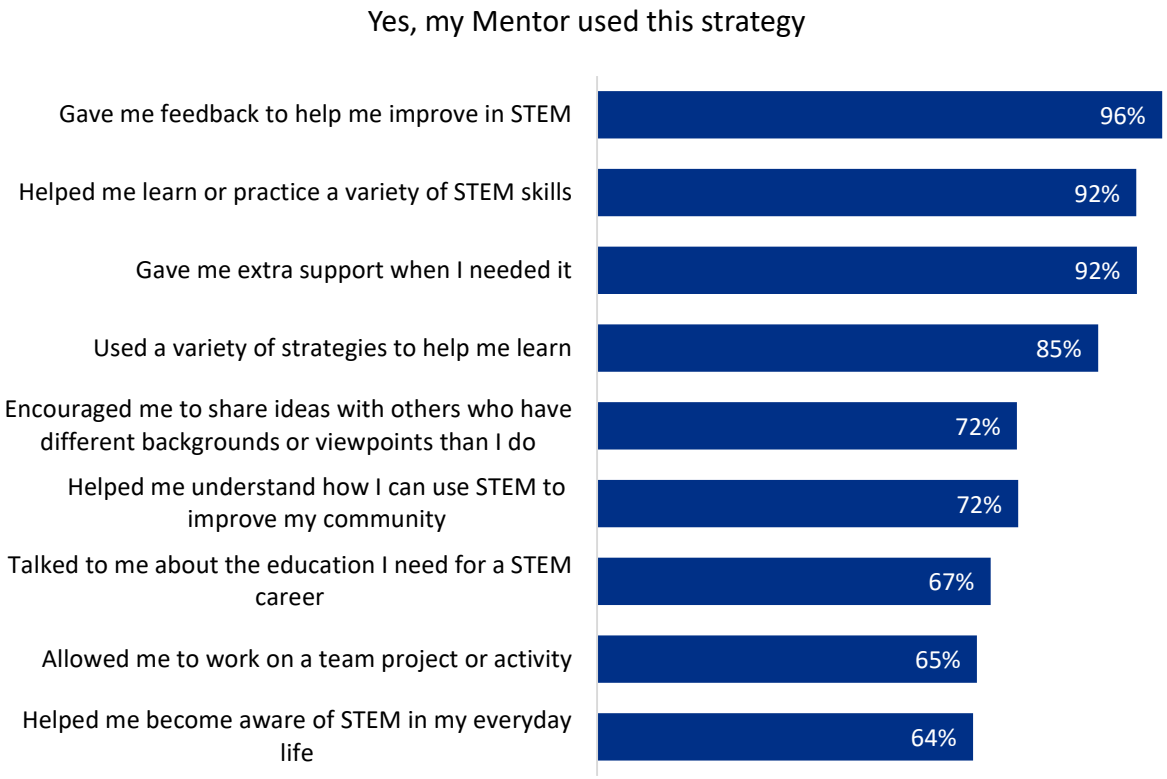
7 IMPACT OF MENTORS ON PROGRAM PARTICIPANTS

For many JSHS students, mentors—who could be their high school teachers, club leaders, or others—played an important role. Students reported positive experiences working with their mentors and suggest mentors had a strong impact on them. (JSHS mentors were not surveyed.)

The survey asked students about a range of strategies their mentors may have employed in JSHS. For example, over 90% of students reported that mentors helped them in three key areas: giving them feedback to help them improve their STEM projects, providing extra support when they

needed it, and helping them to practice a variety of STEM skills. Students were less likely to report that mentors helped them become aware of STEM in their everyday life (64%) (Figure 8).

Figure 8. Students reported that mentors used a number of strategies to support them.



Participant Survey (n = 186)

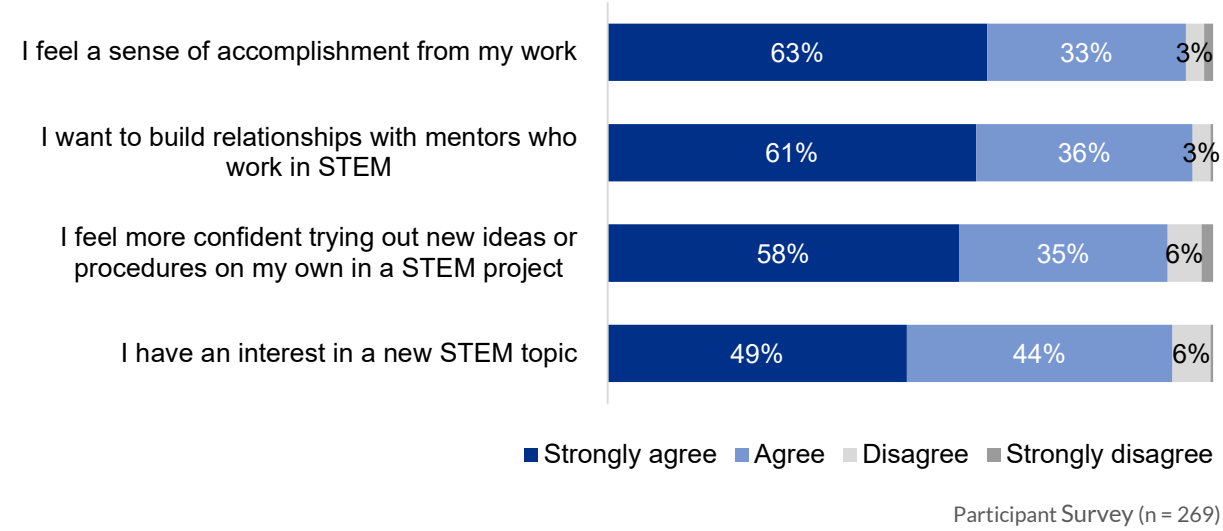
8 OVERALL EXPERIENCE

JSHS received positive feedback from participants who expressed significant satisfaction in acquiring new STEM skills, engaging in research, and networking with STEM professionals. About a quarter of respondents wanted the judging process to be improved, with more opportunities to discuss improvements to their projects, ask judges questions, and have clarity on scoring ratings.

8.1 OVERALL IMPRESSIONS

Students had positive overall experiences with JSHS. As noted in the above sections, students developed their STEM skills and knowledge while gaining valuable real-world experience. Figure 9 shows that overall, more than 90% of students "agreed" or "strongly agreed" that they have an interest in a new STEM topic (96%), want to build relationships with mentors who work in STEM (97%), feel more confident trying out new ideas or procedures (93%), and feel a sense of accomplishment from their work in AEOP (96%).

Figure 9. Students agreed that as a result of their JSHS experience, they possessed a sense of personal accomplishment in their project work and wanted to build relationships with mentors who work in STEM fields.



Participant Survey (n = 269)

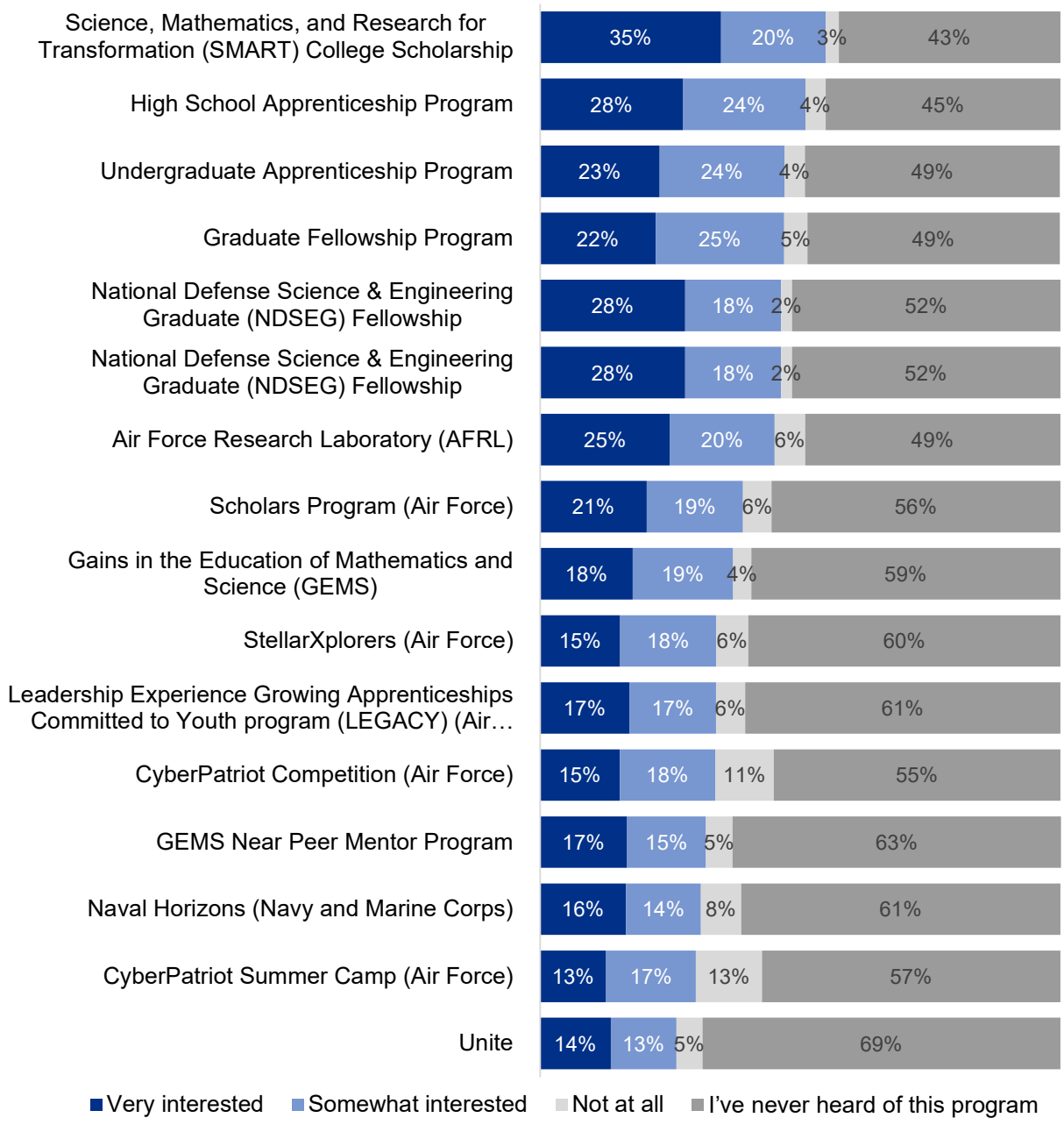
Through their experiences in competitions, participants reported that they appreciated the opportunity to have growth-focused conversations with judges and get their feedback.

> *"I really appreciated the judges as well. They helped point me toward the right direction for my project and helped me to understand how to make it better and improve my research. The whole experience makes me want to go into college with my research and study even more for my love for science.* - JSHS Student

8.2 FUTURE INTEREST IN JSHS AND OTHER DOD STEM PROGRAMS

Students were interested in participating in JSHS and other DoD STEM programs, but there is room for greater awareness of these opportunities. Between 26% to 55% of students indicated they were somewhat or very interested in participating in another program within AEOP or a similar DoD, Navy, or Air and Space Force STEM-focused initiative in the future (see Figure 10). This enthusiasm serves as a strong foundation for expanding participation within AEOP or other DoD, Navy, or Air and Space Force STEM-focused programs. While the current level of interest is high, there is a potential to increase student familiarity with the breadth of programs available. Approximately one-half to two-thirds of students indicated they were not familiar with each of the programs, highlighting a valuable opportunity for enhanced outreach. This indicates a pathway for JSHS to amplify its efforts in disseminating information about its diverse and enriching opportunities, ensuring that students can take full advantage of the programs that foster their growth in STEM fields.

Figure 10. Students expressed interest in AEOP and other DoD, Navy, Air and Space Force STEM programs, with opportunities for increased awareness.



Participant Survey (n = 190-204)

8.3 PROGRAM SATISFACTION

The survey asked students open-ended questions about the perceived benefits of JSHS and any additional comments about their JSHS experience.

Just over half of students reported that they enjoyed the program, attributing their experiences to several areas. Students stated that they gained confidence in their knowledge and skills in conducting research, enjoyed learning with their peers, and developed their interest and knowledge about STEM-related careers. Students also appreciated the program's focus on college preparation and skill building. One participant shared, "*In the research I submitted to JSHS, I was able to massively sharpen my computer science skills*." Finally, students were able to find clear connections between their research and solving problems in communities for real-world learning.

Students grew personally, feeling a sense of accomplishment in their work while also growing in their confidence to use their knowledge through trying new ideas and procedures.

"*I had a great experience overall since I was able to not only able to conduct my own research, but I also gained invaluable experience on how to present it.* -JSHS Student

"*[JSHS] increased confidence in my STEM abilities.* -JSHS Student

Table 6. Reasons students gave for their satisfaction with JSHS

Theme	Quote
Gained confidence as a STEM researcher	*I thoroughly enjoyed this experience! The people who helped put this on were very nice, and I feel much more confident as a future STEM researcher now that I have attended this event.*
Bonded with peers	*It was really fun getting to know others' projects and what they have done for their project. It really opened my eyes to see that there are a lot of people who have the same interests as me when it comes to science. I really appreciated the judges as well; they helped point me toward the right direction for my project and helped me to understand how to make it better and improve my research. The whole experience makes me want to go into college with my research and study even more for my love for science.*
Developed STEM Skills	*Before this project, I had very little experience with 3D modeling, but as a part of my project for this year, I needed to make a tracking mount that follows the stars. This involved creating a 3D model from scratch, 3D printing the parts, assembling everything, and then finding solutions to the problems that became apparent. This whole process really helped by spatial thinking, and I feel I can visualize how things work better as a result.*
Developed 21st Skills	*In my opinion the most valuable part of my research experience was learning how to dynamically identify and solve the problems I encountered. I also found it valuable to learn how to convey the importance of my research and convince others of the same passion.*

Theme	Quote
College preparation and skill building (public speaking, writing papers, etc.)	*I learned a lot about communicating clearly orally with others through the numerous presentation practice and opportunities. Speaking about my research used to make me nervous, but with practice, such as for the preliminary video, the online presenting information session, the online judging session, and in-person symposium, I was able to grow more comfortable presenting in front of people I didn't know. I liked the numerous opportunities to practice and present.*
Connected research to real-world problems	*I definitely saw my project and own experiences on a much higher level of importance and impact in my own community, where the use of nicotine and vapes are common but never truly acknowledged.*
Overall experience	*My experience with JSHS has been excellent so far. I have probably learned the most in my life from all the amazing judges and their speeches. I was also able to make great friends, and could do social networking. Also, I achieved probably the greatest accomplishment of my life.*

8.4 PARTICIPANTS' SUGGESTIONS FOR IMPROVEMENT

The participant surveys included a question, *What are two ways [this program] could be improved?* A high-level summary of key themes is included below.

About one in 10 respondents wanted the judging process to be improved; one of the ways suggested was to provide more time for judges to spend with participants. Students wanted more opportunity to discuss improvements to their projects, ask judges questions, and have clarity on scoring ratings.

About one in 10 participants also wanted more access to recorded presentations from their peers which would allow them to learn from each other and prepare for upcoming competitions. About 5% of participants wanted program guidelines to be revisited. For example, one participant reported that they wanted JSHS to give "*students a little more freedom on what can and can't be used in their designs*." Students also wanted group requirements to be changed to allow for more people to present together.

9 RECOMMENDATIONS

This report distills findings across the JSHS student participant surveys as they align with AEOP's overarching research questions. As stated in the limitations, data collected for this evaluation are not necessarily representative of the entire program; however, based on the results presented above, we offer the following recommendations:

Programmatic Considerations

Continue to offer relevant research experiences connecting with communities. Student feedback indicated that they appreciated conducting research that connected their work to their communities and the world beyond their classes.

Offer more opportunities for participants to engage with judges. Students indicated they wanted an opportunity to ask judges questions, receive more feedback, and engage with judges beyond the current time allocation. Students felt they would benefit from more feedback from judges.

Consider providing more opportunities for peers to learn from each other. Students wanted more opportunities to learn about the types of projects their peers were working on and better prepare for upcoming competitions.

Consider ways to support students in increasing their collaboration and team-building skills. The student surveys indicated participants were engaging in research and that collaboration was often a part of that process. However, students' self-assessment of their skills in working with teams was relatively lower than other 21st Century skills. Bolstering students' experiences related to leadership and/or team-based problem-solving practices could be an opportunity for development.

Evaluation Considerations

Continue to examine ways to increase response rates. The low response rate makes it difficult to know how generalizable the findings are across JSHS.