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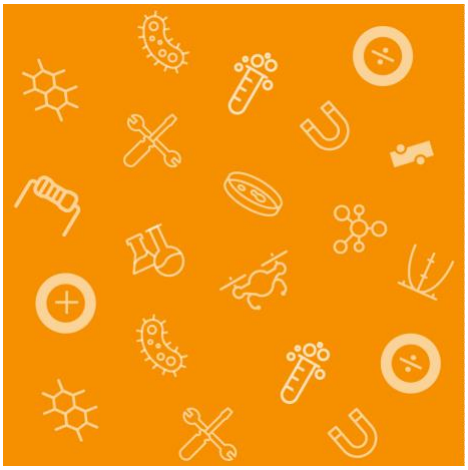

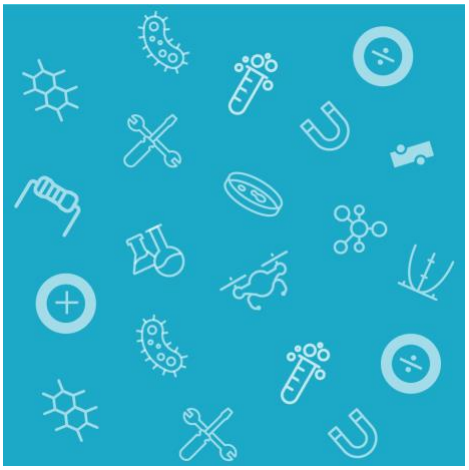

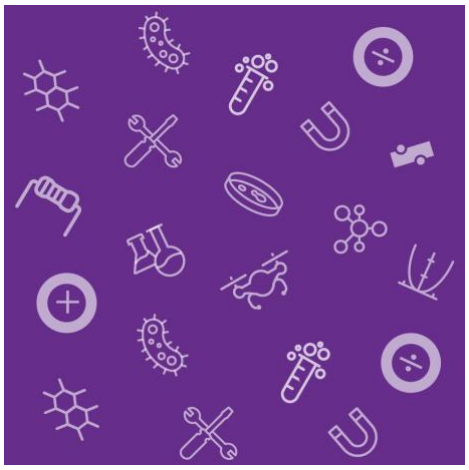


ARMY EDUCATIONAL OUTREACH PROGRAM

JSHS

2019 Annual Program Evaluation Report
Executive Summary

April 2020

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ARMY EDUCATIONAL OUTREACH PROGRAM

1 | AEOP Consortium Contacts

U.S. Army Contacts

Matthew Willis, Ph.D.
Director for Laboratory Management
Office of the Deputy Assistant Secretary
of the Army for Research and Technology
matthew.p.willis.civ@mail.mil

Jack Meyer
Army Educational Outreach Program (AEOP) Director
Office of the Deputy Assistant Secretary of the Army
for Research and Technology
jack.m.meyer2.ctr@mail.mil

AEOP Cooperative Agreement Manager

Christina Weber
AEOP Cooperative Agreement Manager
U.S. Army Combat Capabilities Development
Command (CCDC)
christina.l.weber.civ@mail.mil

Battelle Memorial Institute – Lead Organization

David Burns
Project Director, AEOP CA
Director of STEM Innovation Networks
burnsd@battelle.org

JSHS Program Administrators

Sue Whitsett
NSTA Director of AEOP
National Science Teaching Association (NSTA)
swhitsett@nsta.org

Evaluation Team Contacts – NC State University

Carla C. Johnson, Ed.D.
Evaluation Director, AEOP CA
carlacjohnson@ncsu.edu

Toni A. Sondergeld, Ph.D.
Assistant Director, AEOP CA
tonisondergeld@metriks.com

Janet B. Walton, Ph.D.
Assistant Director, AEOP CA
jwalton2@ncsu.edu

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2 | Executive Summary

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

This report documents the evaluation of the FY19 JSHS program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The assessment strategy for JSHS included questionnaires for R-JSHS and N-JSHS participants and mentors, focus groups with N-JSHS students, a focus group with N-JSHS mentors, and an annual program report compiled by NSTA.

Regional symposia were held at 47 university campus sites nationwide in FY19. The top five students in each region received an invitation to participate and compete at N-JSHS, an all-expense-paid trip hosted by the Services. Of these five, the top two students were invited to present their research as part of the national competition; the third-place student was invited to display a poster of his/her research in a competitive poster session; and the fourth and fifth place students were invited to attend as student delegates with the option to showcase their research in a non-competitive poster session. In 2019, 221 students competed at N-JSHS, 93 as oral presenters and 128 as poster presenters.

All JSHS programs are designed to meet the following objectives:

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

JSHS 2019 Fast Facts	
Description	STEM Competition - Nationwide (incl. DoDEA schools), research symposium that includes 47 regional events and one national event
Participant Population	9th-12th grade students
Number of Applicants	4,493
Number of Regional Student Participants	2,651
Number of National Student Participants	224
Number/Percentage U2 Participants*	1,216 / 41%
Placement Rate	N/A
Number of Adults (Mentors, Regional Directors, Volunteers – incl. Teachers and S&Es)	2,636
Number of Army and DoD S&Es	252
Number of Army/DoD Research Laboratories	43
Number of K-12 Teachers	715
Number of K-12 Schools	810
Number of K-12 Schools – Title I	111
Number of DoDEA Students	114
Number of DoDEA Teachers	32
Number College/University Personnel	705
Number of Colleges/Universities	204
Number of HBCU/MSIs	17
Number of Other Collaborating Organizations	144
Total Cost	$1,943,752
CCDC Cost	$30,924
IPA Cost	$1,912,829
Total Travel	$402,055
CCDC Travel	$30,924
IPA Travel	$4,646
Participant Travel	$366,485
Total Awards	$428,800
Student Awards/Stipends	$403,500
Adult/Teacher/Mentor Awards	$25,300
Cost Per Student	$733

* U2 calculation based upon Cvent participation data that reflects enrollment of n=2,970

Summary of Findings

The FY19 evaluation of JSHS collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in the following table.

2019 JSHS Evaluation Findings	
Priority #1: *Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base*	
There was a slight increase in JSHS applicants in FY19 compared to FY18, however a substantial downward trend in participation over a multi-year period continues.	In FY 19, R-JSHS sites received applications from 4,493 students, a 5% increase as compared to FY18 when 4,279 students applied. This represents a slight reversal in the downward trend in applications since 2015 (8,663 applicants in FY17; 8,947 in FY16; and 9,347 in FY15).
	In FY19, 2,651 students competed in regional competitions. This is a 16% decrease in participation as compared to FY18 (3,069 participants) and continues the downward trend in participation (5,577 participants in FY 17; 5,620 in FY16; and 5,829 in FY15).
Collection of required demographic data for JSHS improved for 2019.	In FY19, Cvent reflected enrollment of 2,970 students while site reports reflected enrollment of 2,651 students.
JSHS continues a trend of enrolling a majority of female participants.	Slightly more than half (59%) of FY19 R-JSHS students were female and 40% were male, a distribution similar to FY18 when 58% of R-JSHS participants were female and 40% were male.
The ethnic/racial diversity of JSHS remains relatively constant compared to previous program years , with White and Asian being the most frequently reported races or ethnicities.	Half (50%) of R-JSHS students identified themselves as White (compared to 57% in FY18), with another 27% identifying themselves as Asian (20% in FY18). The proportion of Hispanic or Latino students in R-JSHS increased slightly (7% in FY19, 5% in FY18), and the proportion of Black or African American students decreased slightly (5% in FY19, 6% in FY18).
Students reported that they actively engaged in STEM practices in JSHS but that this engagement was not significantly more frequent than in their typical school experiences.	Students reported engaging in a wide variety of STEM practices in their R-JSHS experiences and indicated that they performed each STEM Practice more often (weekly or every day) during JSHS than in school. For example, students engaged in the following more frequently in JSHS than in school: designing and carrying out an investigation (40% in JSHS compared to 33% in school); interacting with STEM researchers (29% in JSHS compared to 23% in school); and designing their own research based on their own questions (37% in JSHS compared to 32% in school).
	There was no significant difference in engagement in STEM practices by U2 status or by any individual demographic component of U2 status.

Students reported gains in their STEM knowledge and STEM competencies (skills in science and engineering practices) as a result of participating in JSHS.	A majority (70% or more) of R-JSHS students reported medium or large gains in all areas of STEM knowledge due to their participation in JSHS.
	More than half of students (58%-80%) reported medium or large gains in all STEM competencies. Three-quarters or more of students reported medium to large gains in multiple STEM competencies, including using knowledge and creativity to suggest a solution to a problem (75%), supporting an explanation with STEM knowledge or data from experiments (75%), defending an argument based upon findings from an experiment or other data, and presenting an argument that uses data and/or findings from an experiment (78%).
	There was no significant difference in gains in STEM knowledge or STEM competencies by U2 status or by any individual demographic component of U2 status.
Students reported gains in their 21st Century skills as a result of participating in JSHS; FARMS students reported larger gains than their peers.	More than half of students (52%-85%) reported at least medium gains in all 21st Century skills except for creating media products (34%) and leading/guiding others in a team/group (49%). Areas with largest reported 21st Century skills gains (medium to high) included solving problems (77%); evaluating others' evidence, arguments, and beliefs (78%); incorporating feedback on personal work (78%); and communicating clearly with others (85%).
	There was no significant difference in gains in 21st Century skills by overall U2 status, however FARMS students reported larger gains than their peers (small effect size).
Students reported gains in their STEM identities as a result of participating in JSHS; FARMS students and students who attended suburban schools reported larger gains than their peers.	More than 70% of students reported medium to large gains across all areas of STEM identity. Areas of the greatest reported medium/large gains were confidence to try out new ideas or procedures on STEM projects (78%), the desire to build relationships with mentors who work in STEM (79%), and being better prepared for more challenging STEM activities (80%).
	There was no significant difference in gains in STEM identity by overall U2 status, however FARMS students and those who attended suburban schools reported larger gains than their peers (small effect sizes).
Priority #2: *Support and empower educators with unique Army research and technology resources.*	
Most JSHS students had worked with mentors, and these mentors were primarily teachers or STEM researchers.	Most R-JSHS students reported their mentor was either a teacher (40%) or STEM researcher (38%). More than half of students indicated their mentor was available at least half of the time (61%).
Students most frequently worked with their mentors to design their projects, however many students also reported	More than three-quarters of students reported having some degree of participation in designing their projects. Specifically, 39% independently designed their entire project, while 22% reported working with their mentor to design their project, 16% designed their project with their mentor and

designing their projects on their own.	members of a research team, and 7% were given a choice among various projects suggested by their mentors.
Most mentors used a variety of effective mentoring strategies with their students, however few discussed AEOPs other than JSHS with their students.	Most responding mentors (55%-83%) reported using strategies associated with establishing the relevance of learning activities to students, supporting the diverse needs of learners, supporting students' development of collaboration and interpersonal skills, and supporting students' engagement in "authentic" STEM activities.
	Although about two-thirds (67%) of mentors discussed JSHS with students and slightly over a quarter (26%) discussed Unite, few mentors (3%-18%) reported speaking with students about other AEOPs specifically or about AEOPs generally.
Students reported high levels of satisfaction with JSHS program components, and were somewhat more satisfied with the judging and feedback from judges as compared to FY18.	Most R-JSHS (54%-85%) students were somewhat or very much satisfied with nearly all JSHS features that they had experienced. Students were most satisfied with oral presentations (85%), judging (69%), and speakers. Nearly half (46%) of R-JSHS students had not experienced team-building activities.
	Qualitative data from both R-JSHS and N-JSHS students suggest that students particularly valued the research experience they gained, the opportunity to present their research and learn about others' research, the feedback they received, and connecting with like-minded peers.
	Few R-JSHS students expressed dissatisfaction with any R-JSHS features on the questionnaire, although 8% expressed dissatisfaction with the judging process and with feedback from judges, a decrease from the 11% who expressed dissatisfaction with these features in FY18. Over three-quarters of N-JSHS questionnaire respondents made positive comments about regional judging and over half made positive comments about the national judging.
R-JSHS and N-JSHS students made a number of suggestions for program improvement	N-JSHS students made the following suggestions for improvements to the regional judging process: • Providing more judges or more female judges • Ensuring that judges are knowledgeable about the categories they judge • Ensuring that judges ask relevant and meaningful questions • Providing more detailed feedback from judges • Allowing more time for questions, both from judges and from the audience • Providing participants with the judging rubrics in advance • Instructing judges to consider the type of mentorship students received
	N-JSHS students made the following suggestions for improvements to the national judging process: • Providing more judges (particularly for poster judging) • Providing more time for judging (particularly for poster judging) • Providing more judge feedback

	• Ensuring that judges are knowledgeable about the categories they judge • Ensuring that judges ask relevant and meaningful questions • Providing more specific categories for projects and separating categories (e.g., separating mathematics from computer science, and behavioral science from medical science) • Ensuring consistency in judging • Improving judges' attentiveness or communication with presenters
	R-JSHS students recommended program improvements focusing on event logistics such as providing more time for social interaction; more activities, trips, or tours; and different or better speakers. Those suggesting overall program improvements suggested providing clearer guidelines and deadlines for presenters and clearer registration or application procedures.
	N-JSHS students recommended program improvements to the organization, scheduling, and communication associated with the national event. Students also suggested more diverse, interactive, or interesting speakers; improvements to poster judging (e.g., provide chairs, provide more judges, provide more time); more or better tours; and more food choices.
Mentors reported high levels of satisfaction with JSHS, and suggested various program improvements.	More than half of mentors (60%-92%) reported being somewhat or very much satisfied with all program features they experienced. Over a third (35%) had not experienced support for instruction or mentorship and had not experienced research abstract preparation.
	Qualitative data from mentors indicates that mentors particularly value the opportunity for students to experience authentic research, present their research, connect with like-minded peers, and receive feedback on their projects. Mentors also valued the opportunity to connect with other educators, network with researchers, and the information they gained from tours and judges' feedback on students' projects.
	Mentors suggested that JSHS could be improved by improving event logistics and scheduling, improving judging (e.g., judges from a wider variety of disciplines, more written feedback), having more or better speakers or tours, and providing more social interaction time for students.
	Mentors participating in a focus group suggested ways to broaden the reach of JSHS, stressing the need to provide separate categories for unmentored projects. Mentors also noted that paying teachers for their time could broaden participation, and suggested providing scholarships for students to attend N-JSHS as observers and funding an effort in which scientists would come to schools to train teachers in research.
Priority #3: *Develop and implement a cohesive, coordinated and sustainable STEM education outreach infrastructure across the Army*	

Students' primary source of Information about AEOP is communication through their schools, and they are motivated to participate by their interest in STEM and desire to learn. Mentors learned about AEOP primarily through personal or professional contacts.	Two-thirds (66%) of students learned about AEOP from someone who works at the school or university they attend, 34% from school or university newsletters, emails, or websites; 30% from past participants of the program; and 22% from friends.
	The top two factors motivating students to participate in JSHS were interest in STEM (81%) and the desire to learn something new (75%). Other motivators included having fun (61%), a desire to expand laboratory or research skills (59%), and teacher encouragement (58%)
	The most common ways mentors learned about AEOP were from being a past JSHS participant (30%), from a colleague (24%), or from a JSHS site host or director (22%).
Most students had not heard of most AEOPs other than JSHS although many expressed interest in participating in other AEOPs in the future. Program participation and personally conveyed information were the most impactful resources for both mentors and students to learn about other AEOPs.	Few R-JSHS students (3%-7%) and few N-JSHS students (1%-8%) indicated that they were "not at all" interested in participating in other AEOPs. However, the majority of R-JSHS students (58%-73%) had not heard of AEOPs other than JSHS. Likewise, most N-JSHS students (53%-83%) had not heard of AEOPs with the exception of the SMART scholarship (35% had not heard of this).
	Between 22% and 38% of R-JSHS students expressed at least some future interest in participating in all programs other than JSHS (88% were interested in future participation). Between 21% and 59% of N-JSHS students indicated being at least somewhat interested in all programs other than Unite (16%), and nearly all expressed interest in participating in JSHS in the future (92%).
	Resources that more than half of students reported as having at least a little impact on their awareness of AEOPs were JSHS program staff or site coordinators (67%), presentations or information shared at the competition (64%), and invited speakers (60%). Nearly half (46%) had not received AEOP information from their mentors and another 13% indicated that AEOP information from mentors was not helpful.
	Mentors reported that the most useful resources of AEOP information were JSHS program staff of site coordinator (75%), presentations or information shared at the JSHS competitions (71%), and invited speakers or "career" events (50%).
JSHS participants learned about STEM careers both generally and within the DoD, and had positive perceptions of DoD research and researchers.	A large majority (82%) of R-JSHS students reported learning about at least one STEM job/career during JSHS, and 27% expressed they had learned about five or more. Less than half (46%) of R-JSHS students reported having heard of at least one DoD STEM job/career, and only 7% having learned about five or more during JSHS.
	Nearly all N-JSHS participants (91%) reported learning about one or more STEM jobs/careers in general, and nearly all (94%) indicated they learned about one or more DoD STEM job/career. Additionally, approximately half or more of N-JSHS students reported they learned about five or more STEM jobs/careers in general (58%) and DoD STEM jobs/careers (48%).

	N-JSHS students noted that their exposure to DoD STEM career opportunities was primarily at the N-JSHS event rather than at regional competitions.
	Of the R-JSHS students who had opinions about DoD research and researchers, more than three-quarters selected "strongly agree" or "agree" for each item about which they were asked, including that DoD researchers solve real-world problems (81%) and develop new cutting edge technologies (80%).
R-JSHS students reported being more likely to engage in STEM activities outside of required school courses in the future; FARMS and minority students were more likely to report intentions to engage in STEM in the future than their peers.	Most R-JSHS students (51%-68%) reported they were more likely or much more likely to participate in STEM activities after JSHS. STEM activities in which two-thirds or more of respondents reported increased likelihood of participation were helping with a community service project related to STEM (66%), talking with friends or family about STEM (68%), and working on a STEM project/experiment in a university or professional setting (69%)
	While there were no differences in likelihood of future engagement in STEM by overall U2 status, FARMS students and minority students reported significantly higher likelihood of participating in STEM activities in the future (small effect sizes).
Most JSHS participants had educational aspirations beyond earning an undergraduate degree after participating in JSHS.	Nearly all R-JSHS students (98%) reported planning to earn a Bachelor's degree, at a minimum, and 80% indicated they intend to earn a master's degree or higher, while 63% reported plans to earn a terminal degree. All N-JSHS participants (100%) reported that they plan to at least earn a Bachelor's degree, and 80% indicated planning to earn at least a master's degree, while 65% reported that they plan to earn a terminal degree.
Both R-JSHS and N-JSHS students reported positive impacts from their JSHS participation, although many reported that JSHS had not impacted their knowledge of other AEOPs and DoD STEM careers; FARMS students, ELL students, and students attending suburban schools reported larger impacts than their peers.	Close to half or more of R-JSHS students (43%-83%) agreed that JSHS contributed to or was primarily responsible for their growth in all areas of program impact. Items for which two-thirds or more of participants reported impact were appreciation of DoD research (65%); interest in participating in STEM activities outside of school requirements (74%); and confidence in STEM knowledge, skills, and abilities (83%).
	Nearly half of R-JSHS students (46%) reported that JSHS had not increased their interest in pursuing a STEM career with the DoD. A third (33%) of R-JSHS students reported that JSHS had not impacted their interest in participating in other AEOPs, their awareness of other AEOPs, and their awareness of DoD STEM research and careers.
	There was no significant difference in impact of JSHS by overall U2 status, however FARMS students, ELL students, and students attending suburban schools reported larger impacts than their peers (small effect sizes).
	Over half of N-JSHS students (51%-92%) reported that JSHS had impacted them in each area about which they were asked. Items for which N-JSHS participants were most likely to indicate that JSHS had an impact were awareness of Army/DoD STEM researcher and careers (92%); appreciation

	of Army/DoD STEM research (89%); awareness of other AEOPs (82%); and confidence in STEM knowledge, skills, and abilities (81%).

Recommendations for FY20 Program Improvement/Growth

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. 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 findings indicate that JSHS experienced success as in previous years. Notable successes for the year include continual impacts on STEM skills, STEM knowledge, STEM identity, and 21st Century skills. While these successes are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY20 and beyond:

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

As in the previous four years, JSHS participation continued to decrease in FY19, declining 16% from FY18 (2,592 compared to 3,069 participants). Previous year participation numbers were 5,577 in FY17, 5,620 in FY16, and 5,829 in FY15. As in FY17 and FY18, we again suggest considering three strategies for addressing enrollment concerns: 1) work with regions to expand their recruitment efforts beyond the local area utilizing websites, social media, and other marketing efforts of the consortium; 2) grow capacity for stronger regions to accept more participants; 3) asking FY18 alumni to recruit new participants for the program.

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

Findings in FY19 indicated slightly more than half of JSHS mentors reported using some of the effective mentoring strategies including attending to different learning styles and highlighting individuals from underserved backgrounds in STEM careers. All other strategies were utilized by more than 60% of mentors, an improvement from FY18. However, it is recommended that JSHS utilize the mentoring strategies toolkit that has been developed for use in the AEOP in FY20.

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

As in FY18, JSHS participants in FY19 reported (58% to 73% depending on program) not having any knowledge of the other AEOPs. Few mentors reported speaking with their students about other AEOPs (3-18% depending on program). This finding has been prevalent across evaluations from FY15 to present without improvement despite some efforts to encourage regional sites to promote AEOPs. Due to the significance and importance of making participants aware of the other AEOPs and resources in the pipeline, we strongly encourage NSTA to implement a plan of how to better grow mentor and participant awareness of other AEOPs in FY20.

To view the rest of the report:

JSHS Evaluation Report Narrative Part 2
JSHS Evaluation Report Appendices Part 3